US Army Corps
of Engineers
New York District

Repair McGuire Airfield Hazardous Cargo Loading Area

PN: PTFL141025

JB McGuire-Dix-Lakehurst, New Jersey

Design Bid Build
RTA- Specification

May 2026

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SECTION 01 11 00

SUMMARY OF WORK
02/24, CHG 1: 05/25

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-260-01 Airfield And Heliport Planning And Design

1.2 COMMENCEMENT, PROSECUTION AND COMPLETION OF WORK

a. The Contractor must be required to (i) commence work under this contract within five (5) calendar days after the date the Contractor receives the Notice to Proceed, (ii) prosecute the work diligently, and (iii) complete the entire work ready for use, not later than 720 calendar days after the date the Contractor receives the notice to proceed. The time stated for completion must include final cleanup of the premises.

b. The Contractor must furnish all labor, materials, equipment, and services for the following work: design and construction as indicated in the solicitation package.

c. All work must be in accordance with the drawings and specifications or instructions attached hereto and made a part thereof, or to be furnished hereafter by the Contracting Officer and subject, in every detail, to his supervision, direction, and instructions.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

1.3.1 Project Description

The work includes but not limited to the construction of a new concrete Hazardous Cargo Loading Area (Referred to herein as Hazardous Cargo Pad in accordance with UFC 3-260-01 terminology), de-icing pad, and associated 50 foot wide asphalt paved shoulders compliant with UFC 3-260-01 paragraph 6-12 and Figure 6-26. Per UFC 3-260- 01 paragraph 6-12 associated work/features include:

a. New concrete access taxiway and associated 25’ wide asphalt paved shoulders connecting the new Hazardous Cargo Pad to existing concrete Hot Cargo Access Taxiway (Pavement Feature T61A2) which abuts Taxiway Lima constructed in 2015.

b. Aircraft Tie-Down and Grounding Points

c. Utilities: Telephone service, apron lighting, airfield lighting and water/fire hydrant(s).

d. Vehicular Access Road - Paved roadway to the hazardous cargo pad for access by trucks and other vehicles.

e. Vehicular Staging Area - Paved area adjacent to the hazardous cargo pad for staging vehicles and equipment.

f. Hazardous Cargo pad with deicing capabilities and drainage systems.

1.3.2 Location

The work is located at the parallet to TAXIWAY MIKE at the TAXIWAY LIMA crossing, approximately as indicated. The exact location will be shown by the Contracting Officer https://www.google.com/maps/place/40%C2%B001'17.7%22N+74%C2%B035'48.9%22W/@40.021595,-/maps/plac e/40%C2%B001'17.7%22N+74%C2%B035'48.9%22W/@40.021595,-74.5976985,399m/data=!3m2!1e3!4b

1.4 DFARS 236.204, DISCLOSURE OF THE MAGNITUDE OF CONSTRUCTION PROJECTS

This project is estimated between $10,000,000.00 and $25,000,000.00

1.5 EXISTING WORK

In addition to FAR 52.236-9 Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements:

a. Remove or alter existing work in such a manner as to prevent injury or damage to any portions of the existing work which remain.

b. Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as approved by the Contracting Officer. At the completion of operations, existing work must be in a condition equal to or better than that which existed before new work started.

1.6 AUTHORIZED CONSTRUCTION AREA AND TRESPASSING

Do not inflict damage upon land and properties outside the authorized construction area by unwarranted entry upon, passage through, damage to, or disposal of, material on such land or property. The Contractor may make a separate agreement with any other party, regarding the use of, or right to, land or facilities outside the contract area. If such an agreement is made, it must be in writing and a copy must be provided to the Contracting Officer. The Contractor must hold and save the Government, its officers, and agents free from liability arising from trespassing or damage occasioned by his operations.

1.7 Base Civil Engineering Work Clearance Request, AF Form 103

In accordance with JB MDL Regulations, prior to commencing construction work, or whenever the ground surface is to be disturbed deeper than three inches or when erecting structures or operating equipment near overhead lines, the Contractor performing work is responsible for calling the CALL-BEFORE-YOU-DIG 800 number and contact DPW at 609-562-6021 and having in their possession at all times while digging, an approved AF Form 103.

1.7.1 AF Form 103

The AF Form 103 shall be completed and processed by the Contractor, through the applicable McGuire JB MDL Civil Engineering Offices noted on the form, prior to the actual start of excavation or the erection

operation, and will remain valid for 30 days. The written request shall include details and methods to be used for the excavation.

The Contractor shall contact the applicable McGuire JB MDL Civil Engineer's office in writing a minimum of five working days prior to each expiration date and notify them of the need to revalidate the form.

1.8 LOCATION OF UNDERGROUND UTILITIES

Obtain digging permits prior to start of excavation, and comply with Installation requirements for locating and marking underground utilities. McGuire AFB JB MDL will be responsible for locating and providing mark-outs of existing underground utilities in the project area. Due to the various areas on the base this contract impacts, the utility mark-outs will be done in phases as determined by the contractor's project work plan. The contractor must coordinate all area mark-outs with the Corps of Engineers field representative 15 days prior to the start of work in any particular area.

Identify and mark all other utilities not managed and located by the local utility companies. Scan the construction site with Ground Penetrating Radar (GPR), electromagnetic, or sonic equipment, and mark the surface of the ground or paved surface where existing underground utilities are discovered. Verify the elevations of existing piping, utilities,and any type of underground or encased obstruction not indicated, or specified to be removed, that is indicated or discovered during scanning, in locations to be traversed by piping, ducts, and other work to be conducted or installed. Verify elevations before installing new work closer than nearest manhole or other structure at which an adjustment in grade can be made.

1.8.1 Notification Prior to Excavation

Notify the Contracting Officer at least 15 days prior to starting excavation work.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

BY ORDER OF THE COMMANDER
305TH AIR MOBILITY WING (AMC)

305TH AIR MOBILITY WING
INSTRUCTION

13-213

20 JANUARY 2022

Nuclear, Space, Missle, Command and Control

AIRFIELD DRIVING

COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

ACCESSIBILITY: Publications and forms are available for downloading or ordering on the e-Publishing website at **www.e-Publishing.af.mil**.

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OPR: 305 OSS/OSA

Certified by: 305 AMW/CC
(Col Scott M. Wiederholt)

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Pages: 76

This instruction implements Air Force Policy Directive 13-2, *Air Traffic, Airfield, Airspace, and Range Management*. It establishes the Airfield Driver Training Program in accordance with DAFI 13-213, *Airfield Driving*, and contains requirements and procedures for safe vehicle and self-propelled equipment operation and control on the airfield, ramp, taxiways, and runways. This instruction provides general guidance for operating vehicles and self-propelled equipment on the airfield and is not intended as a comprehensive, definitive document that applies to all airfield driving situations. Units that have unique requirements and equipment are strongly encouraged to supplement this instruction with unit or section operating instructions. This instruction does not take priority over more restrictive technical orders or technical data. This instruction applies to all wings, base, base tenant organizations, and base-sponsored contractors authorized to operate vehicles and self-propelled equipment on the airfield.

Ensure that all records created as a result of processes prescribed in this publication are maintained In Accordance With (IAW) Air Force Instruction 33-322, *Records Management and Information Governance Program*, and disposed of IAW with the Air Force Records Information Management System (AFRIMS) located at **https://www.my.af.mil/gcss-af61a/afrims/afrims/**. Refer recommended changes and questions about this publication to the Office of Primary Responsibility (OPR) using the AF Form 847, *Recommendation for Change of Publication*; route AF Form 847s from the field through the appropriate functional's chain of command.

SUMMARY OF CHANGES

This document has been substantially revised and must be completely reviewed. This version incorporates changes directed by the revised governing instruction DAFI 13-213 AMCSUP1, *Airfield Driving.* Major changes include: 108 Air National Guard program management, driver training requirements, vehicle call sign changes, an updated airfield diagram, and the addition of Cargo Processing Area.

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Chapter 1

GENERAL INFORMATION

1.1. Concept.

1.1.1. 305 OSS/OSAA, Airfield Management (AM) is the OPR for the Airfield Driving Program (ADP). The Wing Airfield Driving Program Manager (WADPM) trains and certifies each primary and alternate Unit Airfield Driving Program Manager (UADPM) as well as develops the training program that the UADPM utilizes when training unit personnel. The UADPM trains and certifies, at Unit Commander's discretion, any additional unit airfield driving trainers as well as unit personnel required to operate a vehicle and self-propelled equipment on the flight line to fulfill mission requirements.

1.1.2. **ALL** personnel driving on McGuire Field **MUST** be trained and certified. Vehicle and self-propelled equipment operators must have an AF Form 483, Certificate of Competency in their possession at all times. This requirement applies to all military, commercial, or privately owned vehicles (POVs). This requirement is non-waiverable.

1.1.2.1. Due to operational requirements and location in relation to aircraft movement areas, personnel operating in the area defined as the "Cargo Processing Area", are exempt from airfield driving requirements outlined in this regulation. See **Attachment 12** for the Cargo Processing Area boundaries.

1.1.3. The host unit administers airfield driver training for TDY military and civilian personnel performing unit specific duties. OPRs, designated points of contact, and project officers will contact the appropriate host ADPM to coordinate airfield driving training. Airfield Management (AM) will provide guidance and training for non-unit specific TDY military and civilian personnel.

1.2. Responsibilities.

1.2.1. 305th Air Mobility Wing Commander (305 AMW/CC).

1.2.1.1. Designates personnel and agencies to support the ADP.

1.2.1.2. May reinstate airfield driving privileges in writing to perform mission essential duties following suspension/revocation of an individual's civilian driver's license and/or base driving privileges. Authority may be delegated in writing to a G-series ordered commander in the appropriate chain of command.

1.2.1.3. Approves Publication of the Airfield Driving Instruction (ADI).

1.2.1.4. Requests an Air Force Runway Safety Action Team (AFRSAT) through the Air Mobility Command (AMC) A3AP for Airfield Operations (AO) if there are recurring occurrences of runway incursions. See AFMAN 13-204 v1, for additional information.

1.2.1.5. Reviews runway incursion incidents and Controlled Movement Area Violation (CMAV) incidents and corrective actions taken.

1.2.2. 305th Operations Group Commander (305 OG/CC).

1.2.2.1. Reviews CMAVs and corrective actions taken.

1.2.2.2. Convenes a Runway Incursion Prevention Working Group (RIPWG) no later than 30 calendar days following the occurrence of a third runway incursion (within a six-month period).

1.2.2.2.1. The RIPWG will include OSS/CC, AOF/CC, Airfield Manager (AFM), WADPM, ATCT Chief Controller, Wing Safety, 87 Security Forces Squadron, Unit Commanders and/or UADPMs, and other organizational leadership as determined locally. RIPWG shall convene to conduct the following:

1.2.2.2.1.1. Analyze each runway incursion and corrective actions taken.

1.2.2.2.1.2. Evaluate the airfield driving operating procedures/standards and airfield configuration (to include signs, marking, and lighting) to determine if corrective actions are needed.

1.2.2.2.1.3. Develop strategies to prevent the reoccurrence of runway incursions. Examples include but are not limited to:

1.2.2.2.1.3.1. Increases or improve local training or testing materials.

1.2.2.2.1.3.2. Implement mandatory briefings to all airfield drivers, aircrew and ATC personnel, as applicable.

1.2.2.2.1.3.3. Limit runway crossings and/or limit crossings to certain taxiways/road intersections.

1.2.2.2.1.3.4. Increase penalty for CMAVs.

1.2.2.2.1.3.5. Alter the shape and/or increase the size of the Controlled Movement Area (CMA).

1.2.2.2.1.3.6. Determine if additional signage, markings, and lighting are needed in high-risk areas. Examples of additional signs, markings, and lighting include the following:

1.2.2.2.1.3.6.1. Installing “Stop, Do Not Enter, Contact Air Traffic Control Tower” signs/markings at runway hold lines and roads leading to the runway.

1.2.2.2.1.3.6.2. Increasing visibility of runway hold position markings by increasing the width of the yellow stripes from six to 12 inches. **Note**: This option requires coordination with Civil Engineer and Wing Safety and a work order request to change for uniform implementation across the entire airfield.

1.2.2.2.1.3.6.3. Painting runway hold position signs on pavement prior to the runway hold position markings. (See FAA AC 150/5340-1, *Standards for Airport Markings*) **Note:** This option requires coordination with Civil Engineer and Wing Safety and a work order request to change for uniform implementation across the entire airfield.

1.2.2.2.1.3.6.4. Painting FAA enhanced taxiway centerline marking prior to the runway hold position markings. **Note**: This option requires coordination with Civil Engineer and Wing Safety and a work order request to change for uniform implementation across the entire airfield.

1.2.2.2.1.3.6.5. Installing runway guard lights (RGLs), if applicable.

1.2.2.2.1.3.6.6. Installing runway status lights (normally associated with a Category II/Airport Surveillance Detection Equipment).

1.2.2.2.1.3.6.7. Procuring vehicle-tracking devices to include Global Position System (GPS), ground radar, or video surveillance. **Note:** Coordinate with AMC A3AP for AO prior to the procurement and/or use of new systems/technology.

1.2.2.2.1.3.6.8. Installing additional FM radio repeaters for Air Traffic Control and the base station/ramp net.

1.2.2.2.1.3.6.9. Installing Location Signs.

1.2.2.2.1.3.6.10. Coordinate with AMC A3AP for AO prior to implementing new procedures and /or purchasing airfield support systems such as signs, marking and lighting.

1.2.2.2.1.3.6.11. When required, ensure an airfield waiver is processed and approved.

1.2.2.2.2. Provide a summary of the RIPWG's analysis and recommendations during the next Airfield Operations Board (AOB).

1.2.2.2.3. Publish minutes of the RIPWG and provide an informational copy to AMC A3AP for AO within 30 calendar days.

1.2.3. Unit Commander or equivalent.

1.2.3.1. Appoints a primary and alternate UADPM in writing (normally the Vehicle Control Officer [VCO] or Vehicle Control Noncommissioned Officer [VCNCO]) to manage training and testing requirements of unit personnel who are required to operate a vehicle and self-propelled equipment on the airfield. Forward a copy of the appointment letter to the WADPM.

1.2.3.1.1. UADPMs must be at least SSgt or above, or civilian equivalent. UADPMs must possess an AF Form 483 with the same level of access as the personnel he/she is training (i.e. UADPMs with members who require CMA access, must also have CMA access).

1.2.3.1.2. Ensures a replacement UADPM is appointed in writing and trained by the WADPM at least 30 calendar days prior to releasing the current UADPM.

1.2.3.1.3. Ensures UADPMs can satisfactorily manage the number of airfield drivers within their organization. Large organizations should consider having more than one UADPM to provide effective program management and quality training, thus reducing the potential for airfield driving violations and runway incursions. Conversely, small organizations (e.g. normally a flight level or smaller) can combine and or consolidate their ADP with a unit.

1.2.3.2. Appoints unit airfield driving trainers in writing to conduct and document practical day and night (as applicable) airfield familiarization training and the practical driving test as outlined in this ADI. Trainers must have completed the Air Force Training Course. Forward a copy of the appointment letter to the WADPM. **Note:** This letter may be

consolidated with the UADPM appointment letter. (See **Attachment 2** for an example appointment letter.)

1.2.3.3. Certifies personnel are qualified to drive on the airfield. Authority may be delegated in writing to UADPMs.

1.2.3.4. Ensures unit personnel complete the required training and testing requirements outlined in DAFI 13-213 Air Mobility Command Supplement and this ADI prior to obtaining an Air Force (AF) Form 483 to operate a vehicle and self-propelled equipment on the airfield.

1.2.3.5. Limits the number of personnel authorized to drive on the airfield to the absolute minimum necessary to accomplish the mission.

1.2.3.6. Suspends a unit member's airfield driving authorization upon suspension or revocation of their civilian driver's license, and/or base driving privileges. Notify the WADPM and UADPM of the individuals' suspension/revocation. **Note:** Process request for reinstatement of airfield driving authorization.

1.2.3.6.1. Prior to reinstatement, a review of individual's Driving Record via Air Force Justice Information System (AFJIS) or AF Form 1313 (located at Security Forces) will be conducted to determine their civilian driver's license status before permitting them to operate a vehicle or self-propelled equipment equipment on the airfield.

1.2.3.7. Ensures UADPMs and designated trainers give a practical day and night (as applicable) airfield familiarization training and practical driving test to all new vehicle and self-propelled equipment operators before they are allowed to drive vehicles and self-propelled equipment on the airfield.

1.2.3.8. Ensures unit airfield drivers limit their access on or across the runway to mission essential duties only.

1.2.3.9. Participates in the RIPWG.

1.2.3.10. Ensures that out-processing with the UADPM is part of the squadron out-processing checklist. This will ensure proper tracking of personnel assigned and authorized to drive on the airfield within the AMC Airfield Driving database.

1.2.4. McGuire Field Airfield Operations Flight Commander (AOF/CC).

1.2.4.1. Appoint the WADPM in writing.

1.2.4.2. Will ensure the ADP is managed IAW DAFI 13-213 AMCSUP and this ADI.

1.2.4.3. Will concur/non-concur with 305th Air Mobility Wing (AMW) Safety, and the WADPM as a team to assign all runway incursions an operational category (e.g., Operational Error, Pilot Deviation and Vehicle/Pedestrian) for trend analysis. The AOF/CC will ensure these classifications are annotated in the recommendation section of the AF Form 457, USAF Hazard Report or narrative section of the AF Form 651, *Hazardous Air Traffic Report* (HATR).

1.2.4.4. Participates in the RIPWG.

1.2.4.5. Will notify MAJCOM within 24 hours in the event of a CMAV and Runway Incursions.

1.2.5. McGuire Field WADPM.

1.2.5.1. Provides overall ADP management and oversight for airfield drivers at McGuire Field.

1.2.5.1.1. The 108th Operations Group (OG)/Airfield Management assists in providing management and oversight for all 108th Air National Guard (ANG) airfield driving programs.

1.2.5.2. Develops an ADI to establish the Wing ADP.

1.2.5.3. Maintain a WADPM continuity binder or electronic equivalent in the TAB format below.

1.2.5.3.1. Tab A: ADPM appointment letter.

1.2.5.3.2. Tab B: Department of Air Force Instruction 13-213 and Wing/Base Supplement.

1.2.5.3.3. Tab C: Annual Inspection Results.

1.2.5.3.4. Tab D: Unit Airfield Driving Program Manager Training Documentation.

1.2.5.3.5. Tab E: Current list of unit assigned airfield drivers. At a minimum, the list of airfield drivers include the individual's full name, rank, unit, Air Force Form 483 certificate number, restrictions (i.e. daytime or ramp only) and refresher training due date.

1.2.5.3.6. Tab F: United States Air Force Airfield Driving computer based training (CBT), Training Curriculum, Test/Answer Key.

1.2.5.3.7. Tab G: Unit airfield driving requirements as applicable.

1.2.5.3.8. Tab H: Airfield Violations/Corrective actions.

1.2.5.3.9. Tab I: References (i.e., AFMAN 24-306, Chapter 12, AFMAN 91-203, *Air Force Consolidated Occupational Safety Instruction*, AFI 21-101, etc.)

1.2.5.3.10. Tab J: Miscellaneous documents, WADPM emails, meeting minutes, etc. **Note:** References may be paper or electronic copy. If any of the above information is maintained elsewhere, use DD Form 2861, Cross Reference to identify location.

1.2.5.4. Conducts a review of the ADI to include procedural guidance, training/testing materials, diagrams, figures, and any other supportive information for currency and accuracy at least annually. Use a Memorandum for Record (MFR), log, or electronic equivalent to document ADI program reviews and maintain a file copy in accordance with Air Force Records Disposition Schedule (RDS), Table 13-06, Rule 4.00.

1.2.5.5. Ensures all locally developed training curriculum and training materials, to include *PowerPoint* slides, videos, appropriate CBTs, checklist(s) and lesson plan(s) used in training airfield drivers are loaded/maintained on the Airfield Driving Training Program (ADTP) website for members to use and process.

1.2.5.6. Ensures required elements of DAFI 13-213 AMCSUP1 **Attachment 4** are created in Step 2 of the ADTP website.

1.2.5.7. Trains and certifies UADPMs using UADPM Training Checklist (**Attachment 3**).

1.2.5.8. Conducts quality control measures to monitor the effectiveness of unit airfield driver training programs. At a minimum, the WADPM will:

1.2.5.8.1. Ensure daily spot checks are completed to enforce and monitor compliance with airfield driving procedures. At a minimum, a spot check will include a check of the driver's AF Form 483 for accuracy/currency, the availability/currency of AF Visual Aids (e.g., AFVA 11-240, *Airports Signs and Markings*, AFVA 13-221, *Control Tower Light Signals*, AFVA 13-222, *Runway/Controlled Movement Area Procedures*), and the availability/currency of the local airfield diagram.

1.2.5.8.1.1. Report violations detected during spot checks to the AFM, AOF/CC, individual's Unit Commander and ADPM.

1.2.5.8.1.2. Report and document results of spot checks (unit/office symbol) in the "status of airfield driving" section of the AOB.

1.2.5.8.2. Monitors radios for proper radio terminology/phraseology and discipline.

1.2.5.8.3. Conducts semi-annual review of unit test for compliance.

1.2.5.8.4. Inspect/validate each Unit Airfield Driving Program at least annually for compliance with DAFI 13-213 and this instruction, to include a copy of the Unit ADPM MICT SAC.

1.2.5.8.4.1. Provides a written memorandum documenting inspection results to the unit's commander.

1.2.5.8.4.2. Brief inspection results to the 305 OSS/CC, UADPM's Unit Commander and briefed at the next quarterly AOB.

1.2.5.8.4.3. Use MICT/SAC or paper equivalent to conduct and document the inspection of the unit ADP.

1.2.5.8.4.4. Inspection ratings will be graded as Satisfactory or Unsatisfactory.

1.2.5.8.4.5. The 108th OG/Airfield Management will conduct annual inspections for all 108th ANG airfield driving programs. Results will be provided to the McGuire Field WADPM.

1.2.5.8.5. Unsatisfactory inspection results will require a follow-up inspection 30 calendar days after the initial inspection.

1.2.5.8.6. Provides an annual inspection schedule to the UADPM's for planning purposes.

1.2.5.9. Ensures all CMAVs are briefed at the quarterly AOB.

1.2.5.10. Notifies the 305th Air Mobility Wing Safety (305th AMW/SE) of all CMAVs in a timely manner.

1.2.5.11. Revokes/suspends airfield driving privileges as necessary. In the event of an airfield driving revocation/suspension, informs the member's Unit Commander and UADPM.

1.2.5.12. Validates the need for airfield access of non-base assigned individuals such as contractors working on the airfield, commercial delivery vehicle drivers, and POV drivers

assigned to the base who have immediate and temporary need to drive on the airfield and do not have access to a Government Owned Vehicles (GOV).

1.2.5.12.1. Once the need is validated, individuals are trained, and information is annotated on McGuire Airfield Driving Briefing for contractors and TDY personnel Letter. An AF Form 483 is issued authorizing limited airfield access.

1.2.5.12.2. AF Form 483 will be issued for the expected duration of the contract based on contract completion date in the contract.

1.2.5.13. Conducts semi-annual meetings with UADPMs.

1.2.5.14. Use a MFR or electronic equivalent to document semi-annual meeting minutes. Maintain a file copy of the current calendar year in Tab J of the WADPM Continuity Binder or electronic equivalent. (See **Para 1.2.6.2**)

1.2.5.15. Utilizes the ADTP mass email function to educate, inform and update personnel on airfield changes and trends. Other approaches (base paper, commander's access channel (TV), e-mail advisories, unit briefings) may also be used.

1.2.5.16. Coordinates on unit airfield driving lesson plans and tests

1.2.5.17. Ensures UADPMs provide appropriate training to TDY personnel and non-base assigned contractors based on type, location, time and duration of work. See **Chapter 3** for additional information.

1.2.5.18. Establish a list of all AF Form 483 driving restriction codes in the ADTP for use by the certifying official. (**Attachment 12**)

1.2.5.19. Participates in the RIPWG.

1.2.5.20. Provides UADPM a standardized spreadsheet or electronic equivalent to monitor and track unit personnel authorized to drive on the airfield. At a minimum, the list of airfield drivers will include the individual's full name, rank, unit, AF Form 483 certificate number, restrictions (e.g. daytime or ramp only), and refresher training due date. **Note:** A sample spreadsheet is available for download at the HQ AFFSA Airfield Operations *SharePoint* website. The ADTP Personnel list meets this requirement when exported to *Excel*.

1.2.5.21. WADPM/UADPMs will utilize the ADTP reports function to monitor and track the personnel list.

1.2.6. Unit ADPM.

1.2.6.1. All UADPMs will complete the following training prior to taking over UADPM duties:

1.2.6.1.1. Must be trained and certified to drive on the airfield by the current WADPM or designated representative.

1.2.6.1.2. Must attend UADPM and ADTP database training with the WADPM or a designated representative. **Note:** No UADPM will be transferred to another unit to become an UADPM or trainer until a new appointment letter is on file with the WADPM from both units.

1.2.6.2. Administers the Unit Airfield Driver's Training Program IAW DAFI 13-213 and this ADI.

1.2.6.2.1. Conduct and document random spot checks of not less than 10% of their assigned drivers per quarter for enforcement and compliance with this ADI using **Attachment 9** of this regulation.

1.2.6.2.2. Report spot check results to the WADPM quarterly.

1.2.6.2.3. Notifies Unit Commander and WADPM in writing after suspending an individual's airfield driving privileges.

1.2.6.3. Validates unit personnel complete airfield driver training and certification prior to issuance of an AF Form 483 (See **Attachment 4**).

1.2.6.3.1. Ensures unit personnel who are not trained and certified to drive at night AF Form 483 indicates restricted access (e.g. "*AUTHORIZED DAYLIGHT HOURS ONLY*"). If the individual later requires driving on the airfield at night, ensure the practical airfield familiarization training and practical driving test is conducted and documented prior to updating the AF Form 483.

1.2.6.3.2. Identifies, documents, and tracks personnel requiring access to the CMA, non-CMA, or restricted airfield driving as applicable (e.g. Ramp only, Daylight Hours only, etc.).

1.2.6.3.3. Ensures designated airfield driving trainers conduct and document practical day and night (as applicable) airfield familiarization training and practical driving test on unit personnel prior to issuance of an AF Form 483.

1.2.6.4. Ensure processing in/out with UADPM is added to unit's in/out processing checklist.

1.2.6.5. Attends WADPM semi-annual meeting and/or briefing regarding airfield driving.

1.2.6.5.1. All 108th ANG UADPMs will attend the semi-annual meetings held by the McGuire Field WADPM.

1.2.6.6. Participates in the RIPWG.

1.2.6.7. Trains unit airfield driver trainers how to conduct and document training on newly assigned unit airfield drivers. Ensure trainers are trained on the use of the ADTP database.

1.2.6.8. May develop a classroom standardized curriculum for unit trainers to use to train personnel.

1.2.6.9. Develops Night Vision Device (NVD) and Mission Oriented Protective Posture (MOPP) gear training plans and Letter of Procedures (LOP) if applicable and submits the plan to the WADPM for approval.

1.2.6.10. Will develop and administer a practical driving test or "check ride" IAW **Para 2.3.4** of this regulation. The "check ride" documentation will be maintained in TAB F of the ADP Continuity Binder or electronic equivalent.

1.2.6.11. The UADPM will ensure the following is completed prior to members being progressed to Step 4 in the ADTP process:

1.2.6.11.1. Personnel have a valid state driver's license.

1.2.6.11.2. Personnel are qualified to drive the vehicle or self-propelled equipment they will be operating on the airfield. **Note:** Military and Department of Defense (DoD) Civilians will have all vehicle or self-propelled equipment qualifications on their government drivers licenses.

1.2.6.11.3. All color vision requirements listed in **paragraph 2.1.2** of this regulation are completed.

1.2.6.11.4. Designated airfield driving trainers conduct and document all airfield driving training and testing on unit personnel using **Attachment 4** prior to issuance of an AF Form 483.

1.2.6.11.5. A closed book 25 question unit test will be administered via the (ADTP) website. Passing grade for the test is 80% (corrected to 100%).

1.2.6.11.6. Personnel that require CMA access receive the appropriate training prior to placing the "CMA" restriction on their AF Form 483 and individuals not receiving night orientation/training check rides will have their AF Form 483's restricted to daylight operations only. **Note:** Even if an individual normally only works "dayshifts," keep in mind that in the winter months it will be dark for periods during the hours of 1630-0730L.

1.2.6.11.7. The UADPM will review all airfield driving test failures with the trainee and provide additional training as required.

1.2.6.12. Ensures TDY and contractor personnel that are hosted by the unit receive applicable local airfield driving training using DAFI 13-213 AMCSUP1, this regulation and **Attachment 5**. **Note:** The sponsoring unit will conduct training and certification for contractors. All contractors must be trained at least 2 weeks prior to construction start date to the maximum extent possible.

1.2.6.13. The UADPM will review ADTP database at least weekly.

1.2.6.13.1. Ensure all personnel are completing training in a reasonable amount of time and personnel in the system still have a need to drive on the airfield. Personnel who do not complete all training and certification within 30 calendar days (120 calendar days for Traditional Reservist and Guardsmen) will be evaluated for removal from the system and or returned to Step 2.

1.2.6.13.2. Ensure all personnel are assigned the appropriate "Restrictions" within the ADTP (e.g. CMA, Non-CMA Ramp only, Daylight Hours only, etc.).

1.2.6.13.3. Individuals whose duty requirements (as determined by their Squadron Commander) would not require them to ever enter the CMA will have their AF Form 483 annotated with "Non-CMA". **Note:** While normal day-to-day operations may not require entering the CMA, other circumstances that may require entering the CMA should be considered (i.e. blown tires, aircraft tow teams for disabled aircraft, etc.).

1.2.6.13.4. Provides annual refresher training for assigned unit personnel. Annual refresher training for airfield driving will be documented on reverse side of AF Form

483 automatically via the ADTP website. Members are required to re-print AF Form 483 after refresher training is complete.

1.2.6.13.5. Ensures deploying personnel maintain a current AF Form 483 for airfield driving through their entire deployment.

1.2.6.13.6. Ensure personnel out processing the unit are removed from Unit's ADTP profile.

1.2.6.14. Maintains an ADP Continuity Binder in the TAB format outlined in **paragraph 1.2.5.3.1**.

1.2.6.15. Ensures personnel who need to use their POV for airfield access, comply with **paragraph 6.2** to obtain an airfield cone/placard. **Note:** All airfield cones/placards will be returned to Airfield Management when individuals Permanent Change of Station (PCS), separate, or no longer require access to the airfield.

1.2.6.16. Maintains a list of all unit personnel issued an airfield cone or placard.

1.2.6.17. Will maintain a current list of permanent party, TDY and contractors that are issued AF Form 483.

1.2.6.18. Annually validates the number of personnel authorized to drive on the airfield to include justification for individuals required to enter or cross the CMA. Forward results to the WADPM.

1.2.6.19. Use the MICT/SAC to conduct and document a self- assessment of the unit's airfield driving program at least annually. Provide a copy of the checklist to the Wing ADPM upon request for functional oversight.

1.2.7. Airfield Management (AM), 305 OSS/OSAA.

1.2.7.1. The AFM, DAFM, WADPM, or Non-Commissioned Officer In Charge (NCOIC), Airfield Management Operations will sign off the airfield driving requirement on pre-deployment checklists to ensure deploying personnel are fully trained and possess a valid AF Form 483 for airfield driving.

1.2.7.2. Imposes and publishes restricted driving routes as required.

1.2.7.3. Routinely monitors radios for proper radio terminology/phraseology and discipline. Immediately respond to and correct improper radio usage when notified by the Air Traffic Control Tower (ATCT) or through the monitoring of radio frequencies. Document corrective actions on an AF Form 3616, Daily Record of Facility Operation or electronic equivalent.

1.2.7.4. Conducts random spot checks per day for enforcement and compliance with the ADI in conjunction with periodic airfield checks. AM will:

1.2.7.4.1. Use **Attachment 9** to document spot checks.

1.2.7.4.2. Report violations detected during spot checks to the AFM and WADPM.

1.2.7.4.3. Notify the WADPM when POV's are parked on the airfield without the proper placard/cone.

1.2.7.4.4. Escort individuals off the airfield who do not have a current AF Form 483 on their person. Note: If another member is available to drive they may remain on the airfield.

1.2.7.5. Responds to reported or suspected airfield driving violations. At a minimum, AM personnel will:

1.2.7.5.1. Escort individuals off the airfield.

1.2.7.5.2. Confiscate individuals AF Form 483.

1.2.7.5.3. Request a written statement from individuals and forwards to the WADPM, AFM, and AOF/CC.

1.2.7.6. Participate in the RIPWG.

1.2.8. Air Traffic Control Tower (ATCT).

1.2.8.1. Controls all aircraft, vehicle, and approved pedestrian traffic on the CMA by two-way radio communications or, in the event of lost communications, by light gun signals. If use of light gun signals is unsuccessful when controlling vehicle or pedestrian traffic, contact AM to have vehicle and/or pedestrian traffic escorted off the CMA.

1.2.8.2. Provides ATCT light gun signals when requested for training purposes. **Note:** Request for light gun signals will be contingent on ATC priorities and work load. ATC will not give light gun signals while aircraft operations are within the local area.

1.2.8.3. Reports known CMA violations and problems with vehicle or self-propelled equipment operator radio communications to AM. Assists AM in identifying and locating unauthorized personnel and vehicles on or near the CMA, and help with preventing CMA violations to the maximum extent.

1.2.8.4. Report any visual blind spots to AM. Visual blind spots at McGuire Airfield are Alpha Row, Bravo Row, X-Ray Row, Romeo Spot 1, and both parking spots located North and South of Big Beige.

1.2.8.5. Participates in the RIPWG.

1.2.9. 305th AMW Safety (SEF).

1.2.9.1. Coordinates on local directives and/or operating instructions that establish vehicle traffic flow patterns and vehicle parking plans on the airfield.

1.2.9.2. Coordinates on lesson plans and tests for vehicle and self-propelled equipment operations on the airfield.

1.2.9.3. Participates with the WADPM in investigating airfield driving incidents, HATRs, CMA violations. Provide a copy of all Class E CMA violation report submittals (initial, status, final) to AOF/CC for review/concurrence as outlined in AFMAN 91-223, *Aviation Safety Investigations and Reports*.

1.2.9.4. Reviews CMAVs for trends.

1.2.9.5. Participates in the RIPWG.

1.2.9.6. Ensures the AFM is notified of any ground mishaps on the airfield.

1.2.10. 87th Security Forces Squadron (SFS).

1.2.10.1. Monitors airfield vehicle and self-propelled equipment operations for ADI compliance.

1.2.10.2. Enforces all traffic rules and directives on the airfield.

1.2.10.3. Ensures unauthorized vehicles are prohibited from operating on the airfield and informs AM of violations.

1.2.10.4. Detains all unauthorized POVs driving on the airfield and notifies AM.

1.2.10.5. Assists in escorting violators (as needed) to AM.

1.2.10.6. Will issue either DD Form 1408, *Armed Forces Traffic Ticket* or citation via the Central Violations Bureau (CVB) to vehicle owners:

1.2.10.6.1. That do not properly display POV placards/cones while within the airfield environment.

1.2.10.6.2. That improperly park their vehicles or self-propelled equipment on the airfield.

1.2.10.7. Provides assistance when requested by AM or the ATCT to apprehend airfield driving violators and remove unauthorized persons from the airfield.

1.2.10.8. Complies with all procedures outlined for entry into the CMA.

1.2.10.9. Participates in the RIPWIG.

1.2.10.10. Coordinate with the WADPM to establish a designated response location in support of In-flight/Ground emergencies and or other emergency situations.

1.2.11. 87th ABW Medical Group.

1.2.11.1. Conduct necessary color vision testing to determine if individuals can distinguish between red, green, white, yellow and blue (Unit ADPMs can use the Officer and Enlisted Classification Directory for Air Force Specialty Codes to check vision requirements).

1.2.11.2. Coordinate with the WADPM to establish a designated response location in support of In-flight/Ground emergencies and or other emergency situations.

Chapter 2

TRAINING & CERTIFICATION

2.1. Procedures for Obtainig an Airfield Driving Certificate of Competency (AF Form 483).

2.1.1. The WADPM or a designated Airfield Management representative are the only individuals authorized to issue/sign AF Form 483 for personnel operating on McGuire Field. Individuals operating a vehicle on Maxfield Field (Naval Support Activity Lakehurst) will be trained/licensed IAW Lakehurst Facility Manual and Lakehurst Air Operations Manual. Lakehurst Airfield Drivers Training can be coordinated with NAS Lakehurst airfield driving program managers via telephone at 723-323-4995.

2.1.2. Color Vision Requirements.

2.1.2.1. Prospective airfield drivers will complete a color vision test to ensure they are able to distinguish between color red, green, white, yellow, and blue.

2.1.2.2. Military personnel driving on the CMA must have a color vision test completed by the 87th Medical Group Optometry office.

2.1.2.3. All civilian personnel will have a color vision exam accomplished during the pre-employment phase of the hiring process. If the civilian member fails the color vision test, he/she will be referred to optometry to determine the level of deficiency. Members unable to be color-vision certified will not be issued CMA access on their AF Form 483.

2.1.2.4. Vehicle or self-propelled equipment operators who do not pass the color vision test **will not** be authorized to operate within the CMA and will have "NON-CMA" restriction placed on their AF Form 483.

2.1.2.5. **EXCEPTION TO TESTING:** Career fields requiring a color vision before entry do not need to retest.

2.2. Training Criteria.

2.2.1. Operators will possess a valid state driver's license.

2.2.2. Personnel will be qualified to drive the vehicle or self-propelled equipment they will be operating on the airfield. **Note:** Military and DoD Civilians will have all vehicle or self-propelled equipment qualifications on their Government Drivers licenses.

2.2.3. Base assigned personnel will complete the following:

2.2.3.1. Log onto the ADTP website to start airfield drivers training. **https://webapp.amc.af.mil/ADTP/Pages/System/Login.aspx** **Note:** Personnel without Common Access Card (CAC) access will receive the *PowerPoint* presentation from the UADPM.

2.2.3.2. All base assigned (military, DoD Civilian, Contractor, etc.) personnel operating a vehicle or self-propelled equipment on the airfield must complete all training items outlined in this ADI, AFI 13- 213 AMCSUP1 and Step 2 of the ADTP website. Ensure in Step 2, member checks **ALL** boxes (both black letter items, which is AFI driven and gray letter items, which are McGuire Airfield specific) before the Trainer or UADPM certifies them. If they only check black letter items and Trainer or UADPM signs after them, they

will remain stuck in Step 2. If this occurs, member must be decertified on tasks in order to check all boxes.

2.2.3.2.1. **Attachment 4** will be used to document training.

2.2.3.2.2. All training documentation will be maintained by the Unit ADPM.

2.2.3.3. Completion of the USAF Airfield Driving CBT (accessible on the myLearning website [**https://lms-jets.cce.af.mil/moodle**]), is required for all wing and/or base assigned airfield drivers prior to issuance of an AF Form 483.

2.2.3.4. Review this instruction, AFMAN 24-306, *Manual for Wheeled Vehicle Driver* **Chapter 25** and AFMAN 91-203. AFI 21-101, *Aircraft and Equipment Maintenance Management*.

2.2.3.5. Complete classroom training as determined by UADPM.

2.2.3.6. Practical day and night airfield familiarization training. At a minimum, the practical airfield drivers training involves taking the individual out on the airfield to show them how to get to and from their work areas. Use Step 2 in the ADTP website and **Attachment 4** to document completion of training.

2.2.3.7. Individuals that do not complete a nighttime airfield orientation will be issued an AF Form 483 restriction indicating operation approval for "Daylight Hours Only".

2.2.4. Night Vision Devices (NVD) Training

2.2.4.1. NVD instructors must:

2.2.4.1.1. Be an E-4 or above.

2.2.4.1.2. Have completed either the Air Force Train the Trainer Course or graduated from any Air Force Education and Training Command (AETC) Instructor course.

2.2.4.1.3. Be appointed by their commander.

2.2.4.1.4. Phase 3 trainers must hold phase 3 qualifications for six months.

2.2.4.2. Current McGuire Field NVD training times are opportune meaning whenever a window is free for NVD Ops, aircrew will take advantage of that window.

2.2.4.3. The primary location for NVD training will be located on the X-Ray Row followed by Romeo Row and Victor Row.

2.2.4.4. NVD training shall be broken into the following three phases.

2.2.4.4.1. Phase 1 Classroom training

2.2.4.4.1.1. Trainees will learn how to use the NVDs in a NVD environment

2.2.4.4.1.2. Component, Function and operation of NVDs

2.2.4.4.1.3. NVD Vehicle Preparations

2.2.4.4.2. Phase 2 Basic vehicle operations

2.2.4.4.2.1. Inspect vehicle

2.2.4.4.2.2. NVD vehicle preparations

2.2.4.4.2.3. Operate vehicle while on NVDs

2.2.4.4.3. Phase 3 training will be AFSC specific and may be conducted on the main ramp.

2.2.4.5. UADPM will annotate NVD driving qualifications on the drivers AF Form 483 by choosing the correct restriction in the ADTP website

2.2.4.6. NVD drivers must complete an approved annual NVD refresher class that will include supervised NVD driving by a NVD trainer.

2.2.4.7. UADPMs will document all refresher training in the ADTP website.

2.2.5. TDY and Short-Term Contractors.

2.2.5.1. Must review the contractor/TDY *PowerPoint* slides developed by AM and complete all training items outlined in **Attachment 5**. Contractor must also provide a copy of their state side driver's license to go along with their **Attachment 5**.

2.2.5.2. All contractors/TDY personnel should have an airfield orientation that shows the individual the route they will take to and from their work area. **Note**: At a minimum, the UADPM will use an airfield diagram to show the contractor the route they will use to access to their work site.

2.3. Testing.

2.3.1. Trainees will take and pass the following tests:

2.3.1.1. General knowledge unit test developed and administered by the UADPM on the ADTP web site. UADPMs will enable the unit test located in Step 3 of the ADTP.

2.3.1.1.1. UADPMs will set the passing score on the unit test to 80% within the ADTP training site. Once the test has been reviewed, advance the trainee to the next step. Add a comment in the trainees block stating *score* received and that "*all missed test questions have been reviewed with the trainee*."

2.3.1.1.2. Unit test will be enabled for no more than 72 hours. All members will have one hour to finish the test once started. **Note:** If the electronic test remains idle for more than five minutes, the system will automatically cancel the test.

2.3.1.2. Trainees will take a 25-question closed book wing test developed by the WADPM and AMC through the ADTP web site. This test will initially be enabled by the UADPM. Subsequent test (if the member fails) will be administered IAW DAFI 13-213 AMCSUP1. Results will be recorded and maintained in the ADTP web site. At a minimum this test will include:

2.3.1.2.1. Five communication questions with a minimum passing score of 100%. At a minimum, include the following areas: basic communication principles, phonetic alphabet, standard aviation phraseology, escort phraseology/rules, and a simulation of radio communications between a vehicle operator and ATCT. (For example, initial radio contact, crossing active runway, hold short instructions, etc.) Runway Incursion Prevention Test must be at least five questions with a minimum passing score of 100%.

2.3.1.2.2. General Knowledge Test. Develop a written general knowledge test on the ADI with at least 10 questions and a passing score of 80%, (corrected to 100%).

2.3.1.3. Airfield Diagram/Layout Test. Test consists of a blank diagram of the airfield consisting of all taxiways, runways, and other prominent features properly labeled. The test will be proctored by the Unit ADPM with a minimum passing score of 100%. Unit ADPMs maintain member's actual diagram test on file for sampling during unit annual inspection visits or unit spot checks.

2.3.1.4. Practical Driving Test. At a minimum, the individual must:

2.3.1.4.1. Drive the vehicle during the check-ride.

2.3.1.4.2. Demonstrates the ability to operate a vehicle in all areas required for the duty position and/or work areas without assistance.

2.3.1.4.3. Identify the location of runways and all CMAs.

2.3.1.4.4. Demonstrate the ability to contact ATCT prior to entry on the runway and other CMAs (*for Runway/CMA drivers only*).

2.3.2. Test Failure. Individuals must wait a minimum of 24 hours to retest for all test failures. UADPM will document all actions in the ADTP website. Note: The ADTP site will only enable failed sections of the Step 4 test.

2.3.2.1. Unit test failures.

2.3.2.1.1. First Failure: UADPM will review test results with the individual to review missed questions and to explain why they missed that question.

2.3.2.1.2. Second Failure: UADPM will complete a thorough test review with the member. The member will then be sent back to Step 2 to re-accomplish all training. Additionally, the UADPM will assign a new trainer to the member for remedial training.

2.3.2.1.3. Third Failure: UADPM will notify Unit Commanders and provide recommendations for further actions. Note: After the third failure, member must wait at least 60 calendar days before trying to re-accomplish the unit test. Member must re-accomplish step 2 in ADTP prior to retaking the unit test.

2.3.2.2. Wing test failures.

2.3.2.2.1. First Failure: The UADPM will complete a thorough test review with the member. Once the UADPM is confident that the member is ready to retest, the UADPM will coordinate with the WADPM prior to re-enabling the Wing test. Must wait 24 hrs.

2.3.2.2.2. Second Failure: WADPM or designated AM representative will send the member back to Step 2. The UADPM will assign a new trainer to the member for remedial training. Once the member has passed the unit test, the UADPM will coordinate with the WADPM to re-enabling the wing test. In addition, A memorandum, signed by the UADPM and Unit Commander, must be emailed or hand delivered to the WADPM.

2.3.2.2.3. Third Failure: Member <u>will not</u> receive a license. **Note:** Wing test are enabled by the UADPM. Member's Wing test is not automatically enabled. After member passes Wing Test, WADPM will pass member in ADTP to receive their AF Form 483. Unit WADPM passes the member in Step 4, their account will sit in Step 4

with a status of "Passed." If UADPM is unavailable, member should contact WADPM via email to enable test.

2.3.3. All test results will be documented in the "Add Comment" section of the ADTP website.

2.4. Annual Refresher Training/Testing Requirements.

2.4.1. Airfield drivers will complete the following annual training:

2.4.1.1. A review of the ADI

2.4.1.2. Light Gun signal Training *PowerPoint* slides.

2.4.1.3. Federal Aviation Administration (FAA) Communications Best Practices *PowerPoint* slides.

2.4.1.4. FAA Signs, Markings, Lighting *PowerPoint* slides.

2.4.1.5. Introduction to Runway Safety *PowerPoint* slides.

2.4.1.6. A 25 multiple choice test through the ADTP web site. Minimum passing score is 80%. However, the test will consist of at least five runway incursion prevention questions with a minimum passing score of 100%. Reference **para 2.3.2** for test failures.

2.4.2. The WADPM may add more requirements for specialized and/or additional unit training at any time; the requirements listed here are the minimum training requirements.

2.4.3. The UADPM will get approval from Wing Safety and the WADPM for any additional/specialized refresher training.

2.4.4. The UADPM ensures all refresher training is complete prior to enabling the refresher test.

2.4.5. Drivers can print their license through the ADTP web site after training and testing is complete. If a driver is unable to print an issued license, contact the UADPM.

2.4.6. If annual refresher training is not accomplished prior to the last day of the expiration month, WADPM will send the member back to Step 2. If member received AF Form 483 on the last day of the month, member must complete the refresher training BEFORE the date of expiration. If the member has a placard and their AF Form 483 expires, the placard is no longer valid. **Note:** No written refresher documentation will be annotated on the AF Form 483 unless the member is TDY. All documentation must be entered into ADTP unless MAJCOM sends a message stating ADTP is unserviceable for more than one week.

2.5. Manual Testing Procedures.

2.5.1. In the event that ADTP is down for maintenance or for some unforeseen measures, Manual test will proceed as follows:

2.5.1.1. Train on all items listed below. Use the **Attachment 4** to document training.

2.5.1.2. The UADPM will issue the unit test once all of the above task are complete. All terms stated in **paragraph 2.3** apply when scoring the test.

2.5.1.3. After Unit Testing is complete and member pass, member will proceed over to Airfield Management to take the Wing Test. All terms stated in **paragraph 2.3** apply when scoring the test.

2.5.1.4. After member passes Wing Test, the WADPM will issue the member a written AF Form 483 until ADTP returns to service. Once the ADTP is returned to service, the UADPM will create a license for the member, signed by the WADPM, and the written AF Form 483 will become void.

Chapter 3

TDY PERSONNEL AND CONTRACTORS.

3.1. TDY Personnel.

3.1.1. TDY personnel that have a current home station AF Form 483 will:

3.1.1.1. Complete a local airfield orientation that will include where the member will be working and any designated routes that the member will be required to take.

3.1.1.2. Complete a local airfield diagram test. Test consists of a blank diagram of the airfield consisting of all taxiways, runways, and other prominent features must be labeled. Minimum passing score is 100%.

3.1.1.3. A new AF Form 483 for McGuire Field may be issued after receiving a local briefing, or the home station AF Form 483 may be used. If using a home station AF Form 483, ADPMs will annotate training on the reverse side of the form. "McGuire Field Authorized" will be stamped on the reverse side of the AF Form 483.

3.1.2. Any individual assigned on a TDY basis who does not have home station AF Form 483 will be required to complete all certification/training requirements listed on the airfield driver training website and **Chapter 2** of this ADI or depending on circumstance will not receive certification/training.

3.2. Contractors.

3.2.1. Short-term contractors are personnel hired for a specific contract for the duration of one year or less.

3.2.1.1. The UADPM will ensure all short term contractors:

3.2.1.1.1. Receive an airfield driver briefing that will cover all items in **Attachment 5**. Use the documentation box loaded on the "ADTP TDY/Misc personnel" page to certify use of this attachment by the creator of this profile.

3.2.1.2. The UADPM will create a "Miscellaneous Application" within the ADTP website. **Note:** Ensure the expiration date of the license extends past the contract completion date.

3.2.2. Long-term contractors are personnel that will utilize the airfield for the duration of a year or more (i.e. OTC, Evergreen, ATA, Boeing, SAIC).

3.2.2.1. Host agency will provide training.

3.2.2.2. These individuals must complete the same training as all base assigned personnel. Refer to Chapter two for training requirements. **Note:** 87 CEG ADPM will conduct driving training for airfield contractors on projects being tracked and being overseen by 787 CES Project Managers or 87 CES contract services (mowers, rubber removal and restriping, Ameresco, oil water separator cleaning/MX, environmental, etc.). Groups larger than 20 may be trained by the WADPM. WADPM will only train groups of less than 20 if the 87 CEG ADPM is on a case-by-case basis. WADPM requires 1 weeks' notice. 87 CEG ADPM will reserve adequate space for training, as well as create licenses for all trained, to be signed by the WADPM or designated AM representative.

3.3. Training Documentation.

3.3.1. Documentation will be either electronically or paper and placed in tab D of the continuity binder.

3.3.2. Documentation will be maintained IAW Air Force RDS, Table 13-01, Rule 01.00.

Chapter 4

REPORTING VIOLATIONS AND FOLLOW-UP ACTIONS

4.1. Reporting Procedures:

4.1.1. When made aware of, or upon noticing an airfield driving violation/ runway incursion, CMAV or NVD-related accident, ATCT or any agency/person noticing the violation will:

4.1.1.1. Direct violators to hold their position outside the CMA and wait for an AM representative to escort them off the airfield. If unable to contact the driver either by radio or in person, notify the Emergency Communication Center (ECC). If 87 SFS locates the driver, they will initiate a challenge on the vehicle or self-propelled equipment. If it is determined to be only an airfield violation, 87 SFS will escort the driver to AM to complete an Airfield Driving Violation Report. The driver will fill out the form. If the driver is unauthorized to drive on the airfield or another security issue is witnessed, 87 SFS will transport the driver to the ECC and conduct an investigation.

4.1.1.2. Notify AM either via the following landlines: 609-754-2712/2713 or via the Tower Net.

4.1.1.2.1. If ATCT personnel notice a violation, they will notify AM and inform them of the violator's current location and whether the violation had an adverse impact on flight operations. ATCT will also document the event in daily logs and tracking forms.

4.1.1.2.2. Runway Incursion: Any occurrence involving an aircraft, vehicle or self-propelled equipment, person or object that enters any portion of the landing area. A runway incursion is a serious violation and action will be taken to eliminate the potential for reoccurrence. AF Form 651, *Hazardous Air Traffic Report*, must be completed and submitted within 24 hours (see also AFI 91-202, *US Air Force Mishap Prevention Program*) if the incursion involved an aircraft having to take evasive actions (go around, aborted takeoff, etc.). An AF Form 457, *USAF Hazard Report*, must be completed and submitted within 24 hours for all other runway incursions. Completed forms will be submitted to 305 AMW/SE **Note:** A written follow-up is due within 72 hours.

4.1.2. When made aware of or upon noticing an airfield driving violation/runway incursion, CMAV or NVD-related accident, AM will:

4.1.2.1. Immediately respond to the incident and escort the violating individual back to AM.

4.1.2.2. Confiscate the driver's AF Form 483. If member does not posess a a valid AF Form 483 (verified in the ADTP), Unit ADPM will be notified.

4.1.2.3. Interview the driver to determine the cause of the event, the intended actions and the driver's previous training.

4.1.2.4. Contact the ATCT to determine if the violation had an adverse impact on flight operations, if not contacted already.

4.1.2.5. Determine the type of violation that occurred based on the above information.

4.1.2.5.1. CMAV: Any occurrence involving an aircraft, vehicle, person or object entering any portion of the CMA without the approval of ATCT. For CMAV an AF Form 457, *USAF Hazard Report*, must be completed and submitted to 305 AMW/SE within 24 hours.

4.1.2.5.2. Both the AF Form 651 and 457 must have the following information in the narrative section:

4.1.2.5.2.1. Individual's information (e.g., rank, job title, organization, and TDY or base assigned status).

4.1.2.5.2.2. Individual's experience working on or near the airfield and date trained.

4.1.2.5.2.3. If individual was authorized on the airfield and/or CMA.

4.1.2.5.2.4. If individual completed all training required to operate a vehicle or self-propelled equipment on the airfield.

4.1.2.5.2.5. Approximate location where the CMAV occurred (e.g., runway/taxiway intersection, distance from threshold or overrun etc.).

4.1.2.6. Notify 305 AMW/SE, DAFM, and AFM. If after duty hours, notifications may be delayed until the next duty day at the discretion of the AM Supervisor.

4.1.3. When made aware, or upon noticing an airfield driving violation/ runway incursion, CMAV or NVD-related accident the WADPM will:

4.1.3.1. Notify AMC/A3AP, 305 OSS/CC, Unit Commander of the driver involved in the incident, operator, Primary/Alternate UADPM, and 305 AMW/SE via e-mail within 24 hours of the incident. If the incident occurs on a weekend, notification will be sent on the first duty day after the incident.

4.1.3.2. Maintain a copy of the AF Form 651/457, actions taken, results and supporting documentation IAW Air Force RDS, Table 91-04, Rule 08.00. Documentation may also be maintained in the ADTP.

4.1.3.3. Suspend the members profile in ADTP within 24 hours. Only the WADPM can reinstate status in the suspended member's profile.

4.1.3.4. Work with the AOF/CC and Wing Safety to assign all runway incursions an operational category (e.g., Operational Error, Pilot Deviation and Vehicle/pedestrian) for trend analysis.

4.1.3.5. Brief all CMAV events at the AOB. The following items will be included in the brief:

4.1.3.5.1. Provide a detailed description of each incident to include (What, When, Where, How, type vehicle/aircraft involved and action taken to prevent a reoccurrence).

4.1.3.5.2. Highlight any trends (e.g. annual/biannual chart showing upward or downward incident rate as applicable).

4.1.3.6. If a runway incursion or a CMAV occurs conduct an inspection with the 305 AMW/SE of the member's Unit ADP. Emphasis will be placed on how the unit trained the

individual, their compliance with the ADI and the ability to utilize the ADTP. The results will be reported to the Unit Commander.

4.1.4. When made aware of or upon noticing an airfield driving violation, runway incursion. CMAV or NVD-related accident the AOF/CC will:

4.1.4.1. Work with 305 AMW Flight Safety to assign all runway incursions an operational category (e.g., operational error, pilot deviation, or vehicle/pedestrian) for trend analysis. The AOF/CC will ensure these classifications are annotated in the recommendation section of the AF Form 457 or narrative section of the AF Form 651.

4.1.4.2. Ensure HATRs are briefed at the AOB.

4.2. Airfield Violations.

4.2.1. Gross or repeated violation of safety or airfield driving rules, or an overall demonstrated lack of ability on the part of the certificate holder may result in a suspension of airfield driving privileges, surrender of the certificate, or revocation of the certificate.

4.2.2. Unit Commanders, ADPMs and AM personnel are authorized to revoke or confiscate the AF Form 483 from any individual violating the provisions of this instruction without debate.

4.2.3. **Suspension** . Any supervisor in the driver's chain of command may recommend suspension of a driver's certificate. All suspensions will be reported to the UADPM and the WADPM. Failure to complete annual refresher training (or lack of documentation) is cause for competency card suspension.

4.2.4. **Surrender** . All certificate holders will surrender their AF Form 483 upon request by the UADPM and/or AM personnel. Surrendered certificates will be forwarded to WADPM and will be held until reinstatement/retesting. The following information will be obtained for all airfield driving offenses:

4.2.4.1. Name/Rank of the individual, unit, duty phone, Unit Commander, and UADPM.

4.2.4.2. Details of the incident/violation (including date, time, location, nature and any other pertinent facts). **Note:** If AM/87 SFS personnel stop a vehicle or self-propelled equipment operator, member needs to cooperate or members AF Form 483 will be suspended at the WADPM discretion.

4.2.5. **Revocation** . AF Form 483 may be revoked by the UADPM, WADPM or designated representative. Once revoked, another certificate will not be reissued without the explicit approval of the WADPM. **Note:** Violations are based on the duration of the member's tour at McGuire Field. Violations occurring on Maxfield Field will be addressed IAW Lakehurst Facility Manual and Lakehurst Airfield Operations Manual.

4.2.6. Violations of this ADI will carry the following penalties:

4.2.6.1. Runway Incursions: A runway incursion is a CMAV event that involves the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft. For the purpose of this instruction, the protected area is the same as the CMA. Runway Incursions are further classified into three operational categories (Operational Error, Pilot Deviation, and Vehicle/Pedestrian).

4.2.6.1.1. First Violation: Will result in an automatic 6-month suspension of airfield driving privileges.

4.2.6.1.2. Second Violation: Will result in a permanent revoking of airfield driving privileges.

4.2.6.2. CMAVs that don't involve the runway:

4.2.6.2.1. First Violation: 30 calendar day suspension of airfield driving privileges.

4.2.6.2.2. Second Violation: 1 calendar year suspension of airfield driving privileges.

4.2.6.2.3. Third Violation: Permanent suspension of airfield driving privileges.

4.2.6.3. Violations other than CMA offenses:

4.2.6.3.1. Driving in front of/cutting off an aircraft:

4.2.6.3.1.1. First Violation: 10 calendar day driving suspension. UADPM will be notified.

4.2.6.3.1.2. Second Violation: 30 calendar day driving suspension. Unit Commander will be notified

4.2.6.3.1.3. Third Violation: Permanent suspension of airfield driving privileges. Unit Commander will be notified

4.2.6.3.2. Unsafe Speed violations:

4.2.6.3.2.1. First Violation: 10 calendar day driving suspension. UADPM will be notified.

4.2.6.3.2.2. Second Violation: 30 calendar day driving suspension. Unit Commander will be notified.

4.2.6.3.2.3. Third Violation: Permanent suspension of airfield driving privileges. Unit Commander will be notified.

4.2.6.3.3. Unsafe speed violations within vicinity of an aircraft:

4.2.6.3.3.1. First Violation: 30 calendar day suspension of airfield driving privileges. 4.2.6.3.3.2. Second Violation: 1-year suspension of airfield driving privileges. 4.2.6.3.3.3. Third Violation: Permanent suspension of airfield driving privileges.

4.2.6.3.4. Grossly incorrect phraseology/lack of situational awareness.

4.2.6.3.4.1. First Violation: Warning.

4.2.6.3.4.2. Second Violation: 10 calendar day driving suspension. UADPM will be notified.

4.2.6.3.4.3. Third Violation: 30 calendar day driving suspension. Unit Commander will be notified in writing.

4.2.6.3.5. Improper/Non-display of POV cones/placards: see **paragraph 6.2.2**.

4.2.6.3.6. All other violation of this ADI will be handled on a case by case basis by the WADPM.

4.2.7. Multiple infractions of this ADI within in 12-month period may result in more severe repercussions as assessed by the WADPM.

4.2.8. Suspension/revocation of civilian driver's license automatically results in suspension of airfield driving privileges. UADPM must notify WADPM if this situation occurs.

4.2.9. Individuals who do not complete annual refresher training by the last day of the expiration month will have their driving privileges suspended until all initial training is re-accomplished. **Note:** Personnel that were unable to complete refresher training (e.g. deployed, TDY, etc.) must complete it prior to driving on the airfield. If a member loses driving privileges for reasons other than airfield driving violations (reckless driving, DUI, etc) and they have an AF Form 483 and POV Placard or Cone, the AF Form 483 is automatically suspended for the duration of the suspension term and the UADPM must suspended the POV Placard or cone.

4.3. Reinstatement Procedures.

4.3.1. Unit Commanders will:

4.3.1.1. Provide a MFR with their recommendation for suspension, revocation, and reinstatement of airfield driving privileges to the WADPM. Please use **Attachment 7** for a memorandum template.

4.3.1.2. Ensure that, prior to seeking reinstatement of airfield driving privileges, the individual concerned receives refresher training on proper ground vehicle operations on the airfield and re-accomplishes all tests. **Note:** All refresher training must be documented and maintained by the UADPM. Documentation must be maintained for a minimum of one year.

Chapter 5

OPERATING PROCEDURES AND STANDARDS

5.1. Vehicle and Self-propelled Equipment Operations on McGuire Airfield.

5.1.1. All vehicle and self-propelled equipment operators must have a current state driver's license, an AF Form 483 digitally signed by the WADPM or designated representative via ADTP, and a local airfield diagram in their possession before driving on the airfield. No one will enter the airfield without AF Form 483 and will pay attention to the sign shown in **Figure 5.1** below.

5.1.2. Only those vehicle and self-propelled equipment operators with a mission requirement will operate on McGuire Field. Operators must utilize the most direct route while operating on the airfield. The airfield will not be utilized for convenience purposes to transit from one location to another.

5.1.2.1. Units sponsoring TDY personnel or non-base assigned contractors are responsible for providing training or an escort for personnel that require access to the airfield

Figure 5.1. Airfield Access Point.

5.1.3. **Airfield Vehicles:**

5.1.3.1. Vehicles will use Light Emitting Diodes (LED)/rotating beacon lights and/or emergency flashers when driving in the CMA.

5.1.3.2. Vehicles operating in the CMA on a daily basis should have a permanent radio mounted in the vehicle to communicate with the ATCT. A hand-held radio should only be used as a backup or when communication is required outside the vehicle. If radio failure occurs while inside the CMA, immediately exit and inform AM of the situation via telephone who will notify ATCT.

5.1.3.3. All GOVs that operate within the CMA will maintain an Air Force Visual Aid (AFVA)/decals card and an airfield diagram. **Note:** Decals will be in plain view of the

driver, clipped to either the inside of the sun visor on the driver's side or affixed to the dashboard.

5.1.3.3.1. AFVA 11-240. (**Figure 5.2**) **Note:** The FAA Form 5280-7, *Airfield Visual Aid Safety Placard* is the FAA equivalent to AFVA 11-240, either of which is authorized for use. **Note:** Decals may be ordered from AF e-Publishing for the AFVA 11-240 or FAA Form 5280-7 products at http://www.faa.gov/runwaysafety/order/order.cfm.

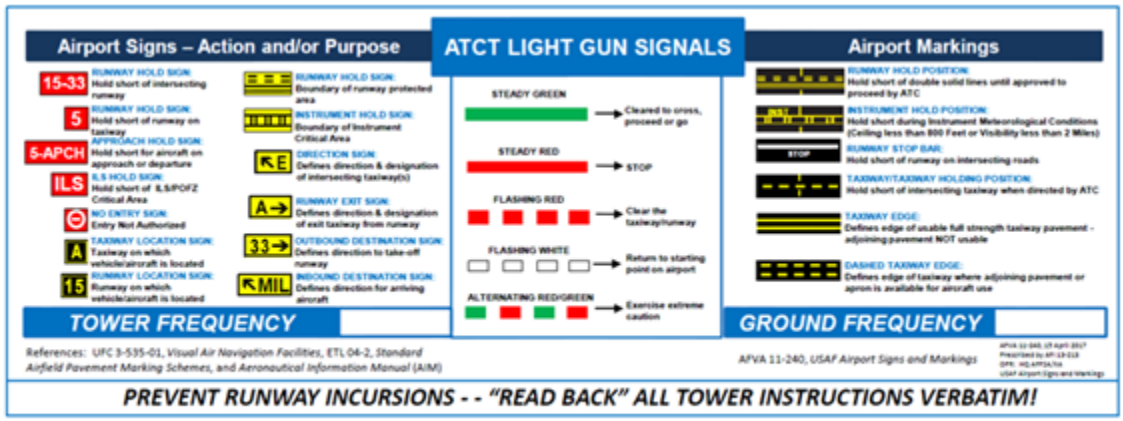
5.1.3.3.2. AFVA 13-221, *Control Tower Light Signals* (optional if vehicle has an AFVA 11-240, see **Figure 5.2**)

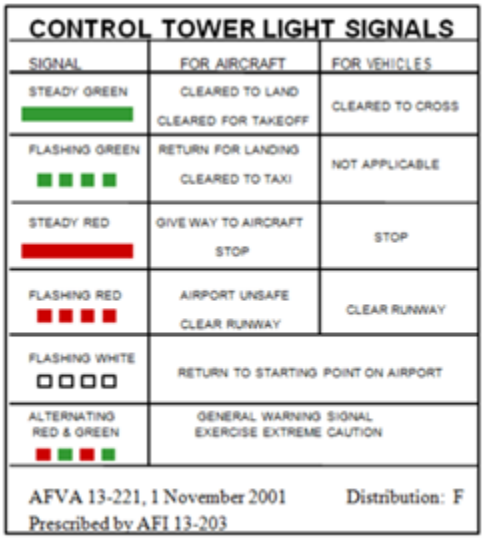
5.1.3.3.3. AFVA 13-222. (see **Figure 5.2**)

5.1.3.3.4. A current locally developed airfield diagram (**Attachment 11**) (provided by WADPM).

5.1.3.4. Hot spots are challenged operating areas with greatest susceptibility for a CMA violation or runway incursion to occur. **The intersection of Runway 36 Approach Zone, Taxiway Hotel, and the runways has been identified as a CMA violation hotspot.**

Figure 5.2. Airfield Driving Air Force Visual Aids.





5.2. CMA Vehicle Operations.

5.2.1. The CMAs at McGuire consists of:

5.2.1.1. Runway 18/36 and 100’ from the runway edge on either side of the runway. The CMA is designated by Visual Flight Rules (VFR) hold lines (see **Figure 5.3**) located on intersecting taxiways on taxiway Hotel and North West Lima Runway Guard Lights (RGL) also known as wig-wag lights are provided and stop sign (see **Figure 5.3**) are located on vehicle access roads. While in the infield area, personnel must ensure they remain outside a 100’ from the runway edge or be granted approval from ATCT prior to entering. There are no markings that depict this boundary; however, personnel can use the Distance Remaining Markers (DRMs) which are located 60 feet from the runway edge as a guide.

Figure 5.3. Runway and CMA hold positions.

5.2.1.2. Runway 06/24 and 100’ from the runway edge on either side of the runway, to include the overruns. The CMA is designated by VFR hold lines and RGLs located on intersecting taxiways (see **Figure 5.3**) and stop bars located on vehicle access roads. While in the infield area, personnel must ensure they remain outside a 100’ from the runway edge or be granted approval from ATCT prior to entering. There are no markings that depict this boundary; however, personnel can use the DRMs, which are located 60 feet from the runway edge as a guide (see **Figure 5.4**).

Figure 5.4. Runway VFR hold sign and DRM.

5.2.1.3. Taxiway Alpha has the only Instrument Hold Line and sign on the airfield (see **Figure 5.5**).

Figure 5.5. Instrument Hold Line and Mandatory Sign.

5.2.1.4. Taxiway Hotel starting 787 feet from the edge of Taxiway Quebec (southernmost entrance to the 108th Air National Guard [ANG] ramp) to include Taxiways Tango, Victor, and Zulu. The CMA is designated by a taxiway hold line represented by one single solid line and one dashed line that runs across the width of the taxiway. (see **Figure 5.7**). This marking will be located at every Hotel CMA entrance point. At the northernmost entrance of the Hotel CMA a "Stop! Controlled Movement Area" (see **Figure 5.7**) sign is located on the left hand side of the taxiway at the CMA entrance.

5.2.1.5. Runway 36 Approach (APCH) Zone starts at the intersection of Taxiways Hotel and Zulu and extends through Taxiway Alpha. It also extends from Taxiway Alpha down Taxiway Golf to the north eastern edge of Taxiway Bravo. The 36 APCH area is more restrictive than the Hotel CMAs. This area is designated by a hold line (see **Figure 5.6**) painted at each CMA entrance as well as "36 APCH" signs located on the left hand side of the taxiway at the CMA entrance. Vehicles utilizing Alpha shall hold between the INST and VFR hold lines when transiting from Runway 24 to the 36 APCH zone until granted permission by ATCT.

Figure 5.6. Runway 36 Approach Hold-Sign.

5.2.2. Runway crossings and CMA access will be limited to an absolute minimum and to performing mission essential duties.

5.2.3. All personnel that will be operating within the CMA will conduct an operational test of the radio before entering the airfield with the ATCT.

5.2.4. Prior to entering the CMA at McGuire Field, all vehicle operators and pedestrians will:

5.2.4.1. Establish two-way radio communication and request access from "McGuire Ground". Note: Vehicle operators and/or pedestrians may be escorted into the CMA by another vehicle and/or pedestrian that has two-way radio contact with the ATCT.

Figure 5.7. Taxiway Hotel CMA Boundary Marking and Signage.

5.2.4.2. Vehicle drivers and/or pedestrians must read back all ATC instructions verbatim. If transactions are garbled, member must hold short behind the hold line and ask ATC to repeat the last transmission.

5.2.5. Once authorized into the CMA, vehicle operators and/or pedestrians will monitor the Tower Net and maintain two-way radio communications with "McGuire Ground" until outside the CMA.

5.2.6. Vehicle drivers and/or pedestrians operating in the CMA must use a distinct call sign (e.g., Airfield 1, Chief 1, Sweeper 1, TA 1, etc.) coordinated by the WADPM to avoid duplication, or that might cause confusion due to similarities, (e.g. Airfield 1, Airfield Lighting, Airfield Sweeper, etc.). (See **Attachment 8** for McGuire Airfield Vehicle Call-signs.)

5.2.7. Use of unconditional instructions (blanket approval) is not authorized when entering the runway for the purpose of an airfield inspection, check, or any other airfield operation. (See FAA Joint Order (JO) 7110.65, *Air Traffic Control* for additional information.)

5.2.8. In the event of vehicle/ATCT radio failure, one of the following should apply:

5.2.8.1. ATCT will flash the runway edge lights on and off to alert vehicle operators/pedestrians on the runway that there is a problem and/or emergency that requires them to immediately exit the runway.

5.2.8.2. A vehicle operator, after vacating the runway, should turn the vehicle toward the ATCT and start flashing the vehicle headlights and wait for the controller to signal with the light gun. All vehicle operators are required to know and comply with the following signals:

5.2.8.2.1. Steady Green Light: —Cleared to cross, —Proceed, —Go

5.2.8.2.2. Steady Red Light: —STOP! Vehicle will not be moved.

5.2.8.2.3. Flashing Red Light: —Clear active taxiway/runway

5.2.8.2.4. Flashing White Light: —Return to starting point.

5.2.8.2.5. Red and Green Light: —General warning. Exercise extreme caution. During alerts and emergency conditions all non-essential personnel will withdraw to AM or their work control center until the emergency is terminated. The withdrawal of contractors will be at the discretion of AM.

5.2.8.3. All vehicle operators/pedestrians must exit the runway immediately. Contact AM immediately and advise off the runway and include any pertinent information that might affect safe runway operations by any means available. If not able to communicate with ATCT or AM via radio, use other means of communication such as a cellular phone (when available). **Note:** Cellular phone usage is **prohibited** while driving on the airfield. Vehicles will park before using cellular phones. Report incidents to AM immediately.

5.3. Radio Phraseology and Discipline.

5.3.1. The words “clear” or “clearance” should not be used by personnel operating vehicles on the airfield. **Exception:** Vehicle operators may reply “Loud and Clear” in response to an ATCT request for radio transmission quality or clarity.

5.3.2. Personnel in the CMA will acknowledge each radio communication with ATCT by using the appropriate call sign.

5.3.3. Radio Techniques:

5.3.3.1. Listen before transmitting. If someone else is talking, the keying of another transmitter will be ineffective and will probably override/block out the other receiver, causing the other vehicle operator to repeat his or her call.

5.3.3.2. Think before keying the transmitter. You must know exactly what you need to say before you say it.

5.3.3.3. The microphone should be very close to your lips and, after pressing the "microphone button", a slight pause may be necessary to ensure the first word is transmitted clearly. Speak in a normal, conversational tone.

5.3.3.4. When releasing the microphone button, wait a few seconds before calling again. The controller may be looking for you on the airfield, transmitting on a different frequency, or scanning the runway to enable your request.

5.3.3.5. Be alert to the sounds or the lack of sounds in the receiver. Check your volume, recheck your frequency, and make sure that your microphone is not stuck in the transmit position. Frequency blockage can, and has, occurred for extended periods due to unintentional transmitter operation. This type of interference is commonly referred to as a "stuck mike," and controllers may refer to it in this manner when attempting to correct the problem.

5.3.3.6. Be sure that you are within the performance range of your radio equipment and the ground station equipment. Communication blind spots at McGuire Field are located on Victor Row and X-Ray Row.

5.3.3.7. Use caution when using a vehicle mounted/handheld radio and operating a vehicle at the same time. When possible, only use the radio when the vehicle is safely parked.

5.3.4. Phraseology.

5.3.4.1. Prior to proceeding into a CMA, vehicle operators must advise the controller of three things: **WHO** you are, **WHERE** you are, and **WHAT** your intentions are. Vehicle operators/pedestrians **WILL** read back and adhere to all instructions from ATC.

5.3.4.2. A typical runway crossing transmission sequence is as follows:

Table 5.1. Sample Runway Crossing Phraseology.

VEHICLE OPERATOR:	"McGuire Ground Airfield one"
ATCT	"Airfield one, McGuire Ground."
VEHICLE OPERATOR:	"McGuire Ground, Airfield One, located at the intersection of runway one-eight and taxiway Hotel. Request to cross runway one-eight from taxiway Hotel to taxiway Kilo."
ATCT:	"Airfield One, Proceed across runway one-eight at taxiway Hotel report when off." Or "Airfield One, Hold Short of runway one-eight"

5.3.4.3. Always read back instructions verbatim before taking any action and allow time for correction, if misinterpreted. If you are unsure what the controller has transmitted, or if you do not understand an instruction, you MUST ask the controller to repeat it. Good communications only occur when each party knows and understands what the other is saying.

Table 5.2. Sample Read back Instructions.

VEHICLE OPERATOR:	"Ground Airfield One understands approved to cross runway one-eight at taxiway Hotel. Will report when off." Or "Ground Airfield One, Holding Short of runway one-eight at taxiway Hotel."
VEHICLE OPERATOR:	"McGuire Ground , Airfield one crossing complete, off runway one-eight at taxiway Kilo."
ATCT:	"Airfield one, Roger."

5.3.4.4. If vehicle operators are issued hold short instructions, they are required to provide a read back to the ATCT.

Table 5.3. Sample Hold Short Instructions.

ATCT:	Airfield One, McGuire Ground proceed on taxiway Hotel CMA hold short of Runway three-six approach area."
VEHICLE OPERATOR:	"McGuire Ground, Airfield One proceeding on the Hotel CMA will hold short of Runway three-six approach area."

Table 5.4. Common Use Phrases.

What Is Said:	What It Means:
Acknowledge	Let me know you have received and understand this message.
Advise Intentions	Let me know what you plan to do.
Affirmative	Yes.
Correction	An error has been made in the transmission, and the correct version follows.

Go Ahead	Proceed with your message only. Note: Use of this phrase does not authorize requestor to ―Go Ahead‖ with, or carry out, their request.
Hold/Hold Short	Phrase used during ground operations to keep a vehicle or aircraft within a specified area or at a specified point while awaiting further clearance from air traffic control.
How do you hear me?	Question relating to the quality of the transmission or to determine how well the transmission is being received.
Immediately or without delay, Expedite	Phrase used by ATC when such action compliance is required to avoid an imminent situation.
Negative	"No" or "permission not granted" or "that is not correct."
Out	The radio conversation is ended, and no response is expected.
Over	My radio transmission is ended, and I expect a response.
Read Back	Repeat my message to me.
Roger	I have received all of your last transmission.
Stand By	Means the controller or pilot must pause for a few seconds, usually to attend to other duties of a higher priority. Also means to wait as in "stand by for clearance." The
Unable	Indicates inability to comply with a specific instruction, request, or clearance.

Verify	Request confirmation of information.
Wilco	I have received your message, understand it, and will comply with it.

5.3.4.5. Phonetic Aviation Alphabet. Because some letters have similar sounds, like B and P, the international aviation industry uses the following words to reduce confusion.

Table 5.5. Phonetic Aviation Alphabet.

A	ALPHA	N	NOVEMBER
B	BRAVO	O	OSCAR
C	CHARLIE	P	PAPA
D	DELTA	Q	QUEBEC
E	ECHO	R	ROMEO
F	FOX-TROT	S	SIERRA
G	GOLF	T	TANGO
H	HOTEL	U	UNIFORM
I	INDIA	V	VICTOR
J	JULIET	W	WHISKEY
K	KILO	X	X-RAY
L	LIMA	Y	YANKEE
M	MIKE	Z	ZULU

5.4. Airfield Signs, Markings and Lighting.

5.4.1. Signs are standard and meet all criteria required by the AF and FAA.

5.4.1.1. Informational/guidance signs are signs that have a black inscription on a yellow background (directional signs) or a yellow inscription on a black background (location signs). (see **Figures 5.8**)

Figure 5.8. Directional and Location Signs.

5.4.1.2. Mandatory Signs are signs that have a white inscription on a red background. (see **Figures 5.9**) All pedestrian/vehicle operators WILL STOP and request access to area from McGuire Ground prior to passing a mandatory sign.

Figure 5.9. Mandatory Signs.

5.4.2. Lighting are standard and meet all criteria required by the AF and FAA.

5.4.2.1. Taxiway lighting system is a configuration of lights that define the lateral (side to side) limits and direction of a taxi route.

5.4.2.1.1. Taxiway edge lights are aviation blue in color located within 10 feet of the full strength pavement.

5.4.2.1.2. Taxiway entrance and exit lights are found where taxiways intersect runways or aprons. They consist of two taxiway edge lights spaced 5 feet apart. One is in line with the taxiway edge lights, the second is located 5 feet out perpendicular to the side of the runway or apron.

5.4.2.2. Runway edge lights are a line of white lights paralleling each side of the runway that outline the lateral limits of the runway. (see **Figure 5.10**)

Figure 5.10. Runway Edge Lighting.

5.5. Foreign Object Damage (FOD) Prevention.

5.5.1. FOD checks will be conducted at all airfield access points, when a vehicle and self-propelled equipment re-enters a paved surface within the airfield environment, when exiting construction sites, and when entering the airfield from the Cargo Processing Area.

5.5.2. At a minimum, a FOD check will consist of the following:

5.5.2.1. Inspection of vehicle tires (pull forward to conduct a Roll-Over FOD check to inspect the rest of the tire). Remove foreign materials (e.g., rocks, gravel, etc.) as applicable.

5.5.2.2. A visual check to ensure all external vehicle components are secured. Secure any/all items loaded on payload vehicles, including all tie down device loose ends such as chains, ropes, packaging or other item that may become dislodged during movement while on the airfield.

5.5.2.3. A thorough walk around of the vehicle to check for damaged, loose, or worn parts.

5.5.3. If large concentrations of FOD are found on the airfield, contact Airfield Management Operations at 609-754-2712/2714.

5.6. Vehicle Driving Lanes.

5.6.1. Vehicle Driving lanes are designed to keep airfield drivers operating adjacent to aircraft parking aprons moving in an orderly fashion. The driving lanes will be utilized to the maximum extent possible to cut down on vehicle traffic operating in proximity to taxiing or parked aircraft to help eliminate the possibility of an incident or accident occurring. **Note:** IAW AFMAN 91-203, vehicles shall not be driven diagonally across the parking ramp, but at 90-degree angles to the driving lanes.

5.6.2. Certain driving lanes at McGuire do not provide adequate wingtip clearance for taxiing aircraft, and in some instances, provide no wingtip clearance at all for aircraft taxiing adjacent to them. (**See Attachment 11**) Driving lanes that do not provide sufficient wingtip clearance are located:

5.6.2.1. On the front side of Romeo Row, spots 5–9.

5.6.2.2. At the Northeast corner of building 1837 (3-Bay) behind Foxtrot Row.

5.6.2.3. Adjacent to the transient apron (closest to the buildings) along Alpha and Bravo Rows.

5.6.2.4. On Taxiway Lima from the road behind Petroleum-Oil-Lubricants (POL) to the ATCT access road.

5.6.3. Vehicle and self-propelled equipment operators in the driving lanes listed in paragraphs **5.7.2.1**-**5.7.2.4** will exercise extreme situational awareness. If an aircraft is approaching you from either direction while at these locations in the driving lanes, take the following actions:

5.6.3.1. If an aircraft and your vehicle are traveling towards each other on the front side of Romeo Row or in the driving lanes adjacent to Alpha and Bravo Row, turn around and exit the driving lane at the closest point to your location. Wait until the aircraft passes or shuts down in the parking spot, then proceed. If the aircraft is approaching from the rear, exit the driving lane. **Note:** A good rule of thumb is to have your vehicle even with the building edges along Alpha and Bravo Row, or in an open parking spot in the middle of Romeo Row where you are exiting.

5.6.3.2. If an aircraft is approaching you from the back side of Foxtrot Row adjacent to 3-Bay, either turn around heading away from the approaching aircraft or exit the driving towards the 3-Bay to an area where you are even with the building.

5.6.3.3. If you are on Taxiway Lima between the POL parking lot and the ATCT access road and an aircraft and your vehicle are traveling towards each other, assess whether the aircraft is a safe enough distance away to continue (without speeding). If you determine that, there is not enough distance between the vehicle and the aircraft to continue, turn around and exit at your point of origin (ATCT access road or the road behind POL) until the aircraft passes. As a last resort, exit the taxiway into the grass area at a distance of 200' from the taxiway centerline until the aircraft passes. Upon re-entering the taxiway, stop and conduct a FOD check of the vehicle tires.

5.6.3.4. If you are driving on the apron side of hangars 3333, 3336, and building 3335 at the Guard Ramp, and an aircraft is taxiing at the front side of Zulu Row, you must position your vehicle outside of the yellow dash wingtip clearance lines. Wait until the aircraft passes or shuts down in the parking spot, then proceed.

5.6.3.5. While operating on the ANG apron, operators will drive to the right and within' 5' of taxi lines.

5.7. Vehicle Speed Limits.

5.7.1. Vehicles operating within 50 feet of an aircraft: 5 mph.

5.7.2. Special purpose vehicles (tractors, tugs forklifts, etc.): 10 mph.

5.7.3. General purpose vehicles: 15 mph.

5.7.4. Ramp access lane / infield access lane: 15 mph.

5.7.5. Aircraft parking areas: 15 mph. (108 ANG Alert vehicle speed limit is variable but safety permit)

5.7.6. Taxiways: 25 mph is the maximum speed for any vehicle operating on taxiways.

5.7.7. Runways: 35 mph is the maximum speed for any vehicle operating on the runways.

5.7.8. 10 mph is the maximum speed limit for any vehicle operating vicinity of building 1839.

5.7.9. Personnel driving with NVDs on airfield not in vicinity of aircraft will not exceed 15 mph

5.7.10. Personnel driving with NVDs on aprons with aircraft will not exceed: 5 mph

5.7.11. Towing: No more than four type B1, B4, B5 and similar small stands may be towed as follows: two sets of two in tandem on a double hitch or two in tandem on a single hitch. Type B3, J7 and similar large stands will be towed singularly on a center mounted hitch. Four-wheeled units will not be towed behind two wheel units. Large pieces of AGE, when towed in tandem, will not block the driver's vision of the last item being towed.

5.7.11.1. Vehicles towing aircraft and two or more maintenance stands: 5 mph.

5.7.11.2. Vehicles towing a maintenance stand: 10 mph.

5.7.11.3. Vehicles towing AGE (compressors, ground power units, oxygen carts, etc.): 15 mph.

5.7.12. Exceptions:

5.7.12.1. Snow and ice on paved surfaces reduce speed to 10 mph maximum. Operate mission essential vehicles only on the airfield.

5.7.12.2. Snow and ice removal vehicles will operate at a speed commensurate with safety and operational requirements during snow and ice control operations.

5.7.12.3. Reduced visibility - reduce speed to 10 mph maximum.

5.7.12.4. Emergency vehicles responding to an emergency may operate at any prudent speed commensurate with safety.

5.7.12.5. AM emergency response vehicle speed limits will be as required, commensurate with safety, when responding to an emergency, asked to expedite by the ATCT when operating on the runway, or as necessary when determining the Runway Condition Reading (RCR).

5.8. Vehicle Parking/Chocking.

5.8.1. Vehicle operators will not leave vehicles unattended on the airfield unless: **Note**: Vehicles defined as unattended are those that do not have an operator at the wheel or an operator within a reasonable response time in the event the vehicle needs to be moved.

5.8.1.1. The ignition is turned off.

5.8.1.2. The key is left in the ignition.

5.8.1.3. The door remains unlocked.

5.8.1.4. The transmission lever is placed in PARK (automatic transmission) or the lowest gear (manual transmission) to take the vehicle away from the nearest aircraft (e.g., headed toward an aircraft, use reverse; headed from an aircraft, use lowest forward gear).

5.8.1.5. The parking brake is set.

5.8.1.6. One rear wheel fore and aft on all powered vehicles and all equipment mounted on wheels that do not have an integral braking system are chocked. One chock will be placed between the tandem wheels of dual (tandem) axle vehicles. All wheeled AGE and maintenance equipment will utilize brakes or be chocked. EXCEPTION: Alert and emergency vehicles responding to an alert or emergency are exempt from this requirement.

5.8.1.7. The hazard/flashing lights and/or rotating beacon are left on.

5.8.2. All vehicles will remain at least 25 feet to front, outboard of the engines and 200 feet to rear of any aircraft, except as authorized for operations such as loading or unloading, servicing, fueling, deicing or towing. Spotters will be used when a vehicle within 25 feet of an aircraft.

5.8.2.1. Spotters. Spotters will be used when a vehicle is operated within 25 feet of an aircraft. Vehicles are to operate under the direction of a spotter posted in front of the vehicle and slightly to the driver's left to allow the driver an unobstructed view of the spotter while looking forward. During backing operations, an additional spotter must be posted to coordinate the vehicles rear clearance with the forward spotter. When the aircraft is being serviced, loaded, or off-loaded, position a spotter in a location to prevent vehicle from contacting aircraft. The spotters and driver(s) will meet to review the standard hand signals to be used prior to the operation. **Note:** There will be no exceptions to the spotter

requirement unless procedurally directed by T.O., AFOSH Standard or AFI. In all cases, safety will not be compromised.

5.8.2.2. Pre-positioned Chocks. Wheel chocks will be pre-positioned to prevent the vehicle from striking the aircraft when backing within 25 feet. Pre-positioned chocks and spotters are mandatory for any vehicle within a 10-foot safety zone around the aircraft, regardless of direction of travel. The chocks will be pre- positioned to prevent the vehicle from striking the aircraft. The chocks will remain in place, or repositioned accordingly until the vehicle departs the 10-foot safety distance requirement.

5.8.3. All vehicles in the aircraft parking area will park to the front left or right of the aircraft they are servicing. Vehicles will be located clear of the wingtips, clearly visible from the aircraft cockpit.

5.8.4. Do not park a vehicle where it can interfere with the taxi operations of an aircraft on the airfield.

5.8.5. When passengers are loading and unloading aft of the aircraft wings, the vehicle will park 20 feet from the passenger steps with the front of the vehicle pointed towards the rear of the aircraft. After the vehicle is properly positioned, turn the front wheels away from the aircraft and chock the vehicle.

5.8.6. Vehicles that are authorized on the airfield but are not directly supporting airfield operations will be parked in designated parking lots on the airfield with a placard/cone displayed IAW **para. 5.1.3.3** of this ADI.

5.9. Fixed and Mobile Obstacles.

5.9.1. A fixed or mobile obstacle is anything posing a threat to aircraft movements, e.g., fire bottles, maintenance stands, vehicles, AGE, etc.

5.9.2. Obstacles must remain at least 1,000 feet from runway centerlines, 200 feet from taxiway centerlines, 3,000 feet from runway ends and 1,500 feet either side of runway end centerline.

5.9.3. On taxi lanes, refer to the yellow dashed double lines alongside all taxi lanes and remain behind those lines for proper wingtip clearances for moving aircraft. Where the yellow dashed double lines do not exist, follow the following apron taxi lane clearance criteria:

5.9.3.1. Main Parking Ramp, Alpha, Bravo, Romeo and Victor rows:

5.9.3.1.1. Primary peripheral taxi lane: 173 feet

5.9.3.1.2. Secondary peripheral taxi lane:

5.9.3.1.3. Main Parking Ramp/Romeo Row: 153 feet

5.9.3.1.4. Alpha, Bravo/Victor Rows: 148 feet.

5.9.3.1.5. Interior taxi lane clearances:

5.9.3.1.6. Main Parking Ramp/Romeo Row: 230 feet.

5.9.3.1.7. Alpha, Bravo/Victor rows are 220 feet.

5.9.3.2. ANG apron:

5.9.3.2.1. Primary peripheral taxi lane: 154 feet

5.9.3.2.2. Secondary peripheral taxi lane: 134 feet

5.9.3.2.3. Interior taxi lane: 191 feet.

5.9.3.3. Navy and Marine aprons:

5.9.3.3.1. Primary peripheral taxi lane: 155 feet

5.9.3.3.2. Secondary peripheral taxi lane: 135 feet

5.9.3.3.3. Interior taxi lane: 193 feet

5.9.4. Equipment may be pre-positioned on parking ramps or hardstands not more than three hours before aircraft arrival or three hours after aircraft departure IAW Unified Facilities Criteria (UFC) 3-260-01. Examples of such equipment are AGE, electrical carts, forklifts, tow-bar trailers, fire extinguisher carts, material-handling equipment, airfield maintenance stands, and portable floodlights.

5.10. In-Ground Fuel Pits. Driving over fueling pits is "prohibited" due to the high potential for damage to the pit covers and equipment. During snow removal operations only the absolute minimum amount of equipment will be authorized to drive over the pits, utilizing extreme caution and operating at a speed commensurate with safety and operational requirements.

5.11. Jet Blast Areas.

5.11.1. Spot four on rows India through Kilo are authorized to perform full power engine runs.

5.11.2. At a minimum, aircraft operators will:

5.11.2.1. Have a spotter at the front of the aircraft that will prevent vehicles from driving behind the aircraft while aircraft engines are stepped to power.

5.11.2.2. Have the aircraft position and strobe lights on.

5.11.3. Drivers will not drive behind aircraft during an engine runs. Drivers should use extreme caution when approaching the engine run up areas and exit the Main Ramp taxi lane prior to Lima and Hotel rows.

5.12. Restricted Visibility.

5.12.1. Airfield Management will inform all required work centers when implementing the restrictions listed below.

5.12.1.1. When visibility is less than 300 feet, explosive loaded and refueling vehicles will not be operated on the airfield unless granted approval by the 305 AMW/CC. General purpose vehicles and POVs will reduce their speed to 10 mph. All other vehicles will not exceed 5 mph.

5.12.1.2. When visibility is less than 100 feet, POVs and airfield vehicles will not be operated on the airfield. EXCEPTION: Emergency response and Airfield Management vehicles are always exempt. 305 AMW/CC approval is required for any POV that requires access to the airfield. **Note:** The above guidelines are IAW AFMAN 91-203.

5.12.2. Flashing lights will be used on all vehicles temporarily parked on the aircraft parking ramps during periods of low visibility.

5.13. Night Operations & Daytime Running Lights.

5.13.1. Vehicle operators will have emergency flashers and/or rotating beacon on during night time operations so the vehicle location can be easily identified. Rotating beacon is optional on parking aprons but mandatory on taxiways and runways.

5.13.2. Vehicle operators will ensure vehicle headlights do not point towards taxing aircraft or tow operations. If an aircraft is taxiing towards a vehicle, the operator will pull off to a safe location and turn off the head lights. Lights will remain off until the aircraft has passed and cannot be affected by the vehicle lights. **Note:** Vehicles with daytime running lights will follow the steps above with the ignition off and the parking brake set.

5.14. Disabled Vehicles.

5.14.1. When a vehicle has a malfunction that prevents operation under its own power, every means will be used to alert taxiing aircraft in the vicinity. At a minimum, the ground vehicle operator will:

5.14.1.1. Leave the vehicle parking lights or emergency flashers on.

5.14.1.2. If the vehicle has two-way radio capability, make the following transmission: "All parties BREAK, BREAK-This is (call sign) with an emergency for Airfield Management, Tower, and Maintenance Operations Center". State the nature of the problem and report your position on the airfield.

5.14.1.3. Operators of other radio-equipped vehicles (e.g. Security Forces, Civil Engineer, Transportation, etc.) must make every effort to assist getting the disabled vehicle off of the airfield, especially if the vehicle is located on parking aprons, taxiways, or runway. Notify Airfield Management immediately so they can issue airfield restrictions if needed. Vehicle will be recovered IAW AFJMAN21-306 **Chapter 22** Vehicle Recovery.

5.14.1.4. If a vehicle is not equipped with a two-way radio, stay with the vehicle and continue attempts to alert any taxiing aircraft or other vehicles in the vicinity.

5.14.1.5. In the event of a disabled vehicle in the CMA, the vehicle operator will immediately notify AM by telephone or any means possible (i.e. runner, flag down other vehicle) to coordinate expeditious removal of the disabled vehicle from the CMA.

5.14.1.5.1. The vehicle operator will ensure the disabled vehicle is not left unattended in the CMA.

5.14.1.5.2. The disabled vehicle will be removed using any method in the quickest and safest way possible.

5.15. Vehicle Escorts and Convoys.

5.15.1. When a non-qualified airfield driver requires access on the airfield, host unit will provide an escort that is authorized/certified to drive on the airfield. AM will at no time provide an airfield escort. Note: Airfield escorts are not a substitute for required training and certification. Personnel assigned to the base that have a mission need to operate a vehicle on the airfield are required to be trained and certified.

5.15.1.1. The host unit will ensure personnel have a valid AF Form 483 to operate the vehicle on the airfield. The 483 will have the proper restrictions for the area of work (i.e. CMA, Main Ramp Alpha Ramp).

5.15.1.2. Full time contractors that work directly for the base are authorized to escort personnel on the airfield provided that have all required documentation. **Note:** Non base assigned contractors with 483s and line badges will not escort personnel onto the airfield.

5.15.1.3. If a POV cone is required, ensure compliance with **paragraph 6.2**. **Note:** If business conducted on the airfield involves activities within 200' of the taxiway centerlines, 100' of the runway, CMAs, on aircraft parking aprons or within 145' of any apron, escorts must notify AM prior for approval. All commercial vehicles or contractors driving a POV must report to Airfield Management with their escort prior to entering the airfield for a Restricted Area or Unrestricted Area cone (No Exceptions).

5.15.2. All airfield convoys with more than three vehicles will also have two escorts. One will be a lead vehicle and the other will be a follow vehicle. For convoys of three or less vehicles one escort may be used as long as that escort can maintain a visual acuity on all vehicles.

5.15.2.1. Both escort vehicles will maintain two-way communication with ATC while in the CMAs.

5.15.2.2. The lead vehicle will make the initial radio call to request permission into the CMA. Once in CMA, lead vehicle will be the only vehicle talking to ATCT. No vehicle will break the formation and make their own call-sign unless lead vehicles notifies ATCT to amend formation status.

5.15.2.3. Once all vehicles have exited the CMA the Follow vehicle will contact ATC to report out.

5.16. Vehicles equipped with supplemental traction devices.

5.16.1. Vehicles equipped with tire chains may be used on airfield pavements after obtaining approval from the AFM, 305 AMW/SE and CE. The requesting agency will conduct a risk assessment with the above agencies when evaluating the need for tire chains to minimize the pavement damage and FOD.

5.16.2. Only non-sparking material chains will be used on the airfield.

5.16.2.1. Chains will be inspected before and after their use.

5.16.2.2. If links are missing the user will inform AM as soon as possible with the following information:

5.16.2.2.1. Name.

5.16.2.2.2. Squadron/Company.

5.16.2.2.3. Route vehicle took to work area.

5.16.3. Vehicles with studded tires are not authorized on the airfield.

5.17. Night Vision Device (NVD) Operations.

5.17.1. NVD operations may be conducted in the designated ground operations area and on Romeo Row, Victor Row, and X-ray Row. Personnel performing NVD training can request

taxiway lights be turned off while performing NVD ground operations. **Note:** ATCT does not have the capability to control the parking ramp lights.

5.17.2. During NVD operations non-participating vehicular movement is strictly prohibited on Romeo Row, Victor Row, and X-Ray Row. Units will coordinate with AM and Command Post (CP) if vehicular movement is required within these areas. All other areas of the airfield are under normal operating procedures IAW this document during NVD operations.

5.17.3. Vehicle NVD training will not take place on any CMA.

5.17.4. Aircraft and vehicular NVD operations will not be performed on the same ramp unless pre-coordinated with AM 72 hours in advance.

5.17.5. Request for NVD operations on any other ramp will be pre-coordinated through AM 72 hours in advance.

5.17.6. Vehicles operating with lights-out during periods of reduced airfield lighting must use hazard warning flashers or mount an Infrared Red (IR) strobe on the vehicle's roof so the ATCT and aircrews can observe the vehicle on the airfield.

5.17.7. A safety observer with two-way radio communication with ATCT will be in each vehicle performing NVD training.

5.17.8. The NVD driver will identifying and avoiding all obstacles on the left hand side of the vehicle. The driver will also avoid obstacles identified by the assistant driver from the right side of the vehicle.

5.17.9. The Assistant NVD driver will:

5.17.9.1. Identify and relay all obstacles on the right side of the vehicle to the driver.

5.17.9.2. Make and relay all radio calls to the driver, to ground personnel and ATCT.

5.17.10. Emergency vehicles must contact the ATCT as soon as possible and ensure that NVD operations have been suspended upon emergency response.

5.17.11. The WADPM shall notify UADPMs of any day/time changes on NVD operations when necessary.

5.18. Bicycles, Motorcycles, Mopeds/Scooters, Similar Utility Vehicles.

5.18.1. Bicycles, motorcycles and mopeds/scooters will only be operated on the airfield access roads and parking lots to travel to and from work centers, at no time will they be operated on the airfield aprons or in the vicinity of an aircraft.

5.18.2. Operators must have a current AF Form 483, OSAA Form 7 on file with Airfield Management, see **Attachment 6**, and POV Placard IAW **para. 6.3**.

5.18.3. All operators must meet applicable safety requirements (i.e., reflectors worn, helmets, etc.).

5.18.4. For night operations, bicycles must have an operable front white light turned on (visible for 500 or more feet), rear and side reflectors.

5.18.5. Golf carts and Gator type utility vehicles are authorized on all ramps and access roads. These vehicles are prohibited in the CMA.

5.19. Pedestrian Movement.

5.19.1. Pedestrians are authorized on the airfield for official business in support of the flying mission.

5.19.2. Walk facing oncoming traffic.

5.19.3. Do not sit or recline on the ramp in such a manner that interferes with normal ground vehicle and aircraft operations.

5.19.4. Do not enter the CMA without two-way radio contact and approval from the ATCT.

5.19.5. During the hours of darkness and low visibility, all airfield pedestrians are required to wear reflective gear (i.e. belt, vest).

5.20. Emergency Response procedures.

5.20.1. Emergency vehicles responding to time critical emergencies are not required to stop prior to entering the airfield, regardless of where they enter.

5.20.2. Emergency vehicles responding to an emergency may operate at any prudent speed commensurate with safety.

5.20.3. Primary/initial emergency response vehicles.

5.20.3.1. 87 CES/CEF will preposition at the approach end of the active runway the aircraft will be landing.

5.20.3.2. AM will standby at the approach end of the runway to conduct a FOD sweep following the taxi route of the emergency aircraft.

5.20.3.3. All emergency vehicles must have ATCT approval to enter the CMA. **Note:** Chief 1 may take responsibility for all fire/crash vehicles.

5.20.3.4. ATCT personnel shall ensure responding emergency vehicles are given priority and will hold all other ground traffic that may interfere with the emergency response.

5.20.4. Follow-on/secondary response vehicles.

5.20.4.1. Secondary response vehicles listed below should preposition on either Alpha Row (Runway 06/24 responses) or Romeo parking Row (Runway 18/36 responses) and wait to be called forward by either the Fire Chief or the incident/on-scene commander.

5.20.4.1.1. Flight Medicine/Ambulance Services.

5.20.4.1.2. 87th Security Forces.

5.20.4.1.3. 87th Civil Engineering.

5.20.4.1.4. Emergency Management.

5.20.4.1.5. EOD.

5.20.4.1.6. Vehicle Operations.

5.20.4.1.7. Joint Base Safety.

5.20.4.2. All secondary support vehicles are required to request approval from ATCT prior to entering the CMA.

5.21. Lightning procedures.

5.21.1. JB-MDL Ground Operations will be conducted IAW 305 AMWI 15-101 Table A5.1. JB-MDL Ground Operations Weather Sensitivities and AFMAN 91-203 Chapter 3, Weather Safety.

5.21.2. Lightning Observed within 10 nautical miles.

5.21.2.1. Increase awareness of storms; begin re-planning ground operations. Personnel should rethink ground operations.

5.21.3. Lightning Observed within five nautical miles.

5.21.3.1. Implement alternate ground operations plan. All ground operations and transportation must cease.

Chapter 6

PRIVATELY OWNED (POV) AND GOVERNMENT LEASED VEHICLES PASSES

6.1. Procedures.

6.1.1. Any vehicle operating on the McGuire Field airfield must have a direct mission- related purpose. The airfield will not be used for convenience or as a shortcut to move from one part of the base to another. Member must have AF Form 483, local airfield diagram, updated OSAA Form 7 completed and information placed in the POV/Cone tracking log and POV cone or placard without escort.

6.1.2. Personnel whose duties require a permanent placard will complete OSAA Form 7 Request for Issue of Airfield Cone/Placard (**Attachment 6**). Form must be endorsed by Unit Commander or designated representative (designated representative must have a Memorandum for Record on file with WADPM). Project Managers (787 CEG DoD Civilian) can sign in place of the Unit Commander but they must meet all of the Airfield Driving qualifications outlined in this ADI and meet all 87 SFS airfield access requirements to include the restricted area. Once completed, forward the form to AM for review and to ensure AF guidance is met. All vehicles that the member will be operating on the airfield must be annotated on the OSAA Form 7. Maintain all vehicle documents in accordance with Air Force RDS, Table 13-01, Rule 01.00.

6.1.3. Personnel are only authorized one POV Cone/Placard.

6.1.4. If approved, the AFM, WADPM or designated AM representative will issue a permanent POV placard/cone to the requestor. Permanent POV placards/cone are valid for two current calendar years and must be revalidated biannually (once every two years) in the month of July. If the request is disapproved, the WADPM will notify the requestor's UADPM.

6.1.5. Temporary POV cones are issued at the AM counter. Individual will complete the POV sign out log. Cones are a controlled item and must be returned to Airfield Management within 24 hours. **Note:** Temporary POV that will operate long than one month can request an extended cone thru the WADPM.

6.1.6. The Wing Commander, all Unit Commanders, Joint Base Safety Staff, and the 305 OSS/OSA Staff members will have a RED placard. They will have this placard until they are relieved of duty, PSC, PCA, separate, retire, etc.

6.2. 24 Hour POV Cones.

6.2.1. There are two categories of cones which can be issued:

6.2.1.1. Unrestricted Access Cones: A pre-determined colored cone issued to personnel approved by AM for access to all areas of the McGuire Airfield, to include restricted areas.

6.2.1.2. Limited Access Cones: A pre-determined colored cone issued to personnel who require access to all areas of the McGuire Airfield, not including the restricted areas (i.e. Radar, Airfield and Weather Systems (RAWS) Maintenance). **Note:** Issuance of restricted area cone will be limited to personnel who either have a restricted area badge OR have an escort who has a restricted area badge.

6.2.2. Drivers will clearly display the cone on the passenger's side dashboard prior to entering the flight line. If dashboard is too small to display cone, please contact the WADPM for an alternative resolution.

6.2.3. Once complete with Airfield Driving operations, the operator will return the cone to AM.

6.3. Long Term POV Placards.

6.3.1. Placards allow access to vehicle parking areas at work centers located within the airfield perimeter fence.

6.3.2. Placards will be displayed anytime the vehicle is operated or parked on the airfield. The placard MUST be hung on the rearview mirror (If rearview mirror is not available or placard will not fit on the rearview mirror, display the placard on the driver's side dashboard), or hanging on right handle bar, mirror or visor (as long as the tint doesn't block the view of the placard) of a motorcycle – always visible. The credentials for motorcycles also apply to bicycles, motorcycles and mopeds/scooters. Unicycles are exempt. See **Figure 6.2** on how to display your placard. If placards are not clearly visible, the following actions may be taken:

6.3.2.1. First offense: Escorted off the airfield by AM and receive a 1 week suspension and must have Memo signed by Unit Commander to get the placard back. AM may contact 87 SFS for assistance for escort and violation reporting.

6.3.2.2. Second offense: Escorted off the airfield by AM and receive a 6 month suspension and must have Memo signed by Unit Commander to get the placard back. AM may contact 87 SFS for assistance for escort and violation reporting.

6.3.2.3. Third offense: Escorted off the airfield by AM, and loss of issued placard permanently. **Note:** (POV placard is a privilege, not mandatory.) AM personnel will not scrap or brush snow off a vehicle windshield to view a placard/cone. After snow settles, driver must to remove snow from front windshield so that AM and 87 SFS can see the placard/cone.

6.3.3. Placards should be secured and not visible when the vehicle is off of the airfield. Placards left unsecured will be confiscated by SFS and returned to AM. Under certain circumstances, depending on the violation, vehicles may be towed at the owner's expense. (See Joint Installation Defense Plan 2015, Tab C, Appendix 8, 3.2.1).

6.4. Disposition of POV Placard.

6.4.1. All airfield cones/placards will be returned to AM when access is no longer required to the airfield, upon, PCS, separation, or retirement.

6.5. Lost/Damaged POV Cone/Placard.

6.5.1. Personnel who lose their assigned POV Cone/Placard will submit an MFR endorsed by the UADPM. In addition, the following actions will be taken:

6.5.1.1. First offense: Warning & reissue of POV Cone/Placard.

6.5.1.2. Second offense: Termination of POV Cone/Placard privilege.

6.5.2. Damaged POV Cones/Placards will be returned to AM immediately along with a Memorandum for Record endorsed by the Unit Commander.

Figure 6.1. POV Cone.

Figure 6.2. POV Placard.

SCOTT M. WIEDERHOLT, Col, USAF
Commander, 305th Air Mobility Wing

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

US Air Force Publications

AFPD 13-2, Air Traffic Control, Airspace, Airfield, and Range Management, 3 January 2019
AFMAN 13-204, Vol 1 & 2, Airfield Operations Standardization and Evaluations, 29 June 2020

DAFI 13-213, Airfield Driving, 04 February 2020

AFMAN 13-204v1, Management of Airfield Operations, 22 July 2020

AFI 21-101, Aircraft and Equipment Maintenance Management, 15 January 2020

AFI 24-301, Vehicle Operations, 16 March 2017

AFMAN 24-306, Manual for Wheeled Vehicle Driver, 29 July 2020

AFI 31-218, Air Force Motor Vehicle Traffic Supervision, 14 July 2017 AFI 33-360, Publications and Forms Management, 01 December 2016

AFI 33-322, Records Management and Information Governance Program, 23 March 2020

AFI 91-202, The US Air Force Mishap Program, 11 March 2020

AFMAN 91-223, Aviation Safety Investigations and Reports, IC 1, 14 September 2018

AFI 48-123, Medical Examinations and Standards, IC1, 05 November 2013

Air Force Enlisted Classification Directory (AFECD), 31 October 2019

Air Force Officer Classification Directory (AFOCD), 31 October 2019

AFI 21-101 JBMDL SUP, Aircraft Equipment and Maintenance Management 18 January 2018

UFC 3-260-01, Airfield and Heliport Planning and Design, 17 November 2008

Federal Aviation Administration (FAA) Advisory Circulars (AC) and Joint Orders (JO).

FAA Advisory Circular 150/5340-1M, Standards for Airport Markings, 10 May 2019

FAA Joint Order 7110.65, Air Traffic Control, 20 June 2019

Adopted forms

AF Form 457, *USAF Hazard Report*

AF Form 483, *Certificate of Competency*

AF Form 651, *Hazardous Air Traffic Report (HATR)*

AF Form 847, *Recommendation for Change of Publication*

AF Form 3616, *Daily Record of Facility Operation*

OSAA FORM 7, *Request for issue of Airfield Cone/Placard*

Abbreviations and Acronyms

ADI—Airfield Driving Instruction

ADP—Airfield Driving Program

ADPM—Airfield Driving Program Manager

ADTP—Airfield Driving Training Program

AF—Air Force

AFI—Air Force Instruction

AFMAN—Air Force Manual

AFM—Airfield Manager

AFSC—Air Force Specialty Code

AFVA—Airfield Visual Aid

AM—Airfield Management

AMC—Air Mobility Command

AO—Airfield Operations

AOB—Airfield Operations Board

AOF/CC—Airfield Operations Flight Commander

ATC—Air Traffic Control

ATCT—Air Traffic Control Tower

BDOC—Base Defense Operations Center

CBT—Computer Based Training

CMA—Controlled Movement Area

CMAV—Controlled Movement Area Violation

DAFM—Deputy Airfield Manager

DOD—Department of Defense

ECP—Entry Control Point

FAA—Federal Aviation Administration

FOD—Foreign Object Damage

GOV—Government Owned Vehicle

HATR—Hazardous Air Traffic Report

MAFBI—McGuire Air Force Base Instruction

MAJCOM—Major Command

MFR—Memorandum for Record

OG—Operations Group

OPR—Office of Primary Responsibility

NVD—Night Vision Device

POL—Petroleum Oil Lubricant

POV—Privately Owned Vehicle

RDS—Records Disposition Schedule

RIPWG—Runway Incursion Prevention Working Group

RWY—Runway

SE—Safety

SFS—Security Forces Squadron

TDY—Temporary Duty

UADPM—Unit Airfield Driving Program Manager

WADPM—Wing Airfield Driving Program Manager

Terms

Acknowledge—Let me know that you have received my message

Advise Intentions—Tell me what you plan to do

Airfield—An area prepared for the accommodation (including any buildings, installations, and equipment) of landing and take-off of aircraft

Airfield Driving Instruction (ADI)—Formerly known as the flight line driving instruction. Establishes local operations, procedures and training standards for driving a vehicle on the airfield. Also called ADI

Airfield Driving Program Manager (ADPM)—An individual appointment by the Unit C ommander to administer the organization's airfield driving program

Airfield Facilities—Includes: runways, taxiways, parking and servicing areas, ATC facilities, Airfield Management, navigational aids, aircraft fire suppression and rescue services and airfield

Airfield Management—A function that conducts airfield inspections and checks for safety and compliance with planning and design criteria. Plans, organizes and directs airfield activities to include airfield construction/repairs, airfield driving program, ice/snow removal operations, Bird/Wildlife control, etc. Procures, maintains, and produces information on safe operation of aircraft through the national and international airspace system such as Flight Information Publications, aeronautical charts and maps, Notice to Airmen (NOTAM), local airfield and navigational aid status, and weather information. Process domestic and international flight plans.

Airfield Manager (AFM)—Works directly for the AOF/CC and manages airfield management facilities to ensure effective support to the base flying mission and transient aircrews.

Airfield Operations Flight Commander (AOF/CC)—Responsible for the overall operation/services provided by the airfield operations flight in support of the wing flying mission and in compliance with USAF and FAA guidelines.

Approach Zone—3,000 x 3,000 ft. measured along the extended runway centerline beginning at the runway end and 3,000 ft. centered on and measured at right angles to the extended runway centerline.(MAFB approach zone includes taxiways Zulu, Alpha and portions of Golf.)

Clear—ATC term used between pilots and air traffic controllers, not authorized for use by personnel operating motor vehicles on the airfield.

Controlled Areas—Controlled areas are legally defined areas containing Protection Level 4 resources. Only authorized personnel, designated by a Unit Commander, have access to controlled areas.

Controlled Movement Area (CMA)—As defined in Airfield Operation Instructions, any portion of the airfield requiring aircraft, vehicles and pedestrians to obtain specific Air Traffic Control Tower (ATCT) approval for (normally via two-way radio contact with the ATCT). Controlled Movement Areas include but are not limited to areas used for takeoff, landing and as required taxiing of aircraft. **Note:** This definition is used in lieu of "movement area" as defined in the FAA Pilot Controller Glossary. Also called CMA.

Controlled Movement Area Violation (CMAV) Event—An airfield infraction caused by aircraft, vehicles, or pedestrians entering the control movement area without specific ATCT approval. This definition includes runway incursions and infractions caused by communication errors. Refer to AFI 91-223 paragraphs 1.3.1.8. for reportable HATR reporting procedures and 1.3.1.9. for reportable CMAV events.

Expedite—Used by ATC when prompt compliance is required to avoid the development of an imminent situation.

Foreign Object Damage (FOD)—Any damage to an aircraft, engine, aircraft system, component, tire, munitions, or support equipment caused by a foreign object(s) which may or may not degrade the required safety and/or operational characteristics of the aforementioned items.

Government Owned Vehicles (GOVs)—Vehicles that are owned or leased by the US government.

Ground Vehicle Traffic Lane—A defined and marked lane on the flight line used for the movement of vehicle traffic.

Hold or Hold Short—Used by ATC to indicate you must stay where you are currently located or for you to hold at the Runway Hold line/VFR hold line prior to receiving approval into the CMA.

Host Wing Commander—The individual with ultimate responsibility for operating the airfield.

Hot Spot—A runway safety related problem area or intersection on an airfield. Typically, it is a complex or confusing taxiway/taxiway or taxiway/runway intersection. A confusing condition may be compounded by a miscommunication between a controller and a pilot, and may cause an aircraft separation standard to be compromised. The area may have a history of surface incidents or the potential for surface incidents.

Immediately—Used by ATC when such action compliance is required to avoid an imminent situation.

Instrument Hold line—A designated boundary intended to protect the runway environment. Found at the point where a taxiway and runway intersect. Instrument hold line is marked in retro-reflective yellow paint.

Light Gun—A handheld directional light signaling device which emits a brilliant narrow beam of white, green, or red light as selected by the tower controller. The color and type of light transmitted can be used to approve or disapprove anticipated pilot actions where radio communication is not available. The light gun is used for controlling traffic operating in the vicinity of the airport and on the airport movement area.

Major Command (MAJCOM)—For the purpose of this instruction, includes all USAF Major Commands plus the Air National Guard Readiness Center, Air Force Reserve Command, Direct Reporting Units, and Field Operating Agencies. MAJCOM also refers to the OPR for Airfield Operations in this AFI.

Negative—No, or permission not granted, or that is not correct.

Over—My transmission is ended; I expect a response.

Parking Ramp/Apron—Areas where aircraft are parked, loaded and unloaded and serviced between flights. Vehicles and aircraft operate in close proximity in these areas, so it is vital to maintain a safe distance between your vehicle and aircraft. Always yield to aircraft and never drive under an aircraft or its wings. Slow speed and extreme caution are required in these areas.

Privately Owned Vehicle (POVs)—A vehicle that is owned or leased by a private party.

Proceed—Authorization to begin/continue on approved routes.

Ramp—Either concrete or asphalt (depending on the weight of the aircraft and the sub-base of the ground beneath) used to park aircraft or equipment.

Restricted Area—An area on the airfield designated for the use by aircraft/equipment requiring security protection level. Marked with signs prior to entering, Red Lines will indicate the boundaries.

Roger—I understand and have received all of your transmission.

Runway—A defined rectangular area on an airfield prepared for the landing and takeoff of aircraft.

Runway Hold line—A designated boundary intended to protect the runway environment. Found at the point where a taxiway and runway intersect.

Runway Incursion—Any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft. For the purpose of this instruction, the protected area is the same as the CMA. These are further classified into three operational categories:

1) Operational Error (OE)—A failure of the air traffic control system that results in loss of separation.

2) Pilot Deviation (PD)—The action of a pilot that results in the violation of ATC instructions, AFIs and/or FARs.

3) Vehicle/Pedestrian Deviation(V/PD)—Any entry or movement on the controlled movement area by a vehicle (including aircraft operated by non-pilots) or pedestrian that has not been authorized by Air Traffic Control.

Say Again—Used to request a repeat of the last transmission. Usually specifies transmission was not understood or received.

Stand By—To pause while other duties of a higher priority are attended to. Also means to standby for clearance/approval.

Taxilane—Ramp space between rows of parked aircraft used to maneuver aircraft to and from parking spots and taxiways.

Taxiway—A paved surface for taxiing aircraft from parking ramp to runway.

Wing Commander—The individual with ultimate responsibility for operating the airfield.

Without Delay—With a sense of urgency, proceed with approved instructions in a rapid manner.

Wilco—I have received your message, understand it, and will comply with it.

Attachment 2

UNIT AIRFIELD DRIVING PROGRAM MANAGER AND TRAINER(S) APPOINTMENT LETTER

Figure A2.1. Unit Airfield Driving Program Manager And Trainer(S) Appointment Letter.

[Date]

MEMORANDUM FOR 213 OSS/OSA

FROM: (Unit Commander Office Symbol)

SUBJECT: Appointment of Unit Airfield Driving Program Managers and Trainers

1. The following individuals are appointed as Unit ADPMs (primary/alternate) and trainers. Individuals have received training in accordance with Air Force Instruction 13-213 and applicable wing/base supplement. Both ADPM and Alt ADPM have the authority to certify personnel are qualified to drive on the airfield and will ensure completion and tracking of all airfield drivers training for unit assigned and temporarily assigned personnel.

NAME/Email	**OFFICE SYM**	**DP**	**483 #_____**
PRIMARY:			
ALTERNATE:			

2. The following individuals are appointed as Airfield Driving Program Trainers:

NAME/Email	**OFFICE SYM**	**DP**	**483 #_____**

3. This letter supersedes all previous letters, same subject.

XXXX X. XXXXX, Lt Col, USAF
Commander

Attachment 3

UNIT AIRFIELD DRIVING PROGRAM MANAGER CHECKLIST

Figure A3.1. Unit Airfield Driving Program Manager Checklist, Part 1.

UNIT AIRFIELD DRIVING PROGRAM MANAGER CHECKLIST			
SECTION I TRAINEE INFORMATION (Completed by the Wing Airfield Driving Program Manager)			
Name: (Last, First, MI)	Rank, Civilian Grade or equivalent	Unit/Office Symbol or Company Name	Duty Phone
SECTION II QUALIFICATION TRAINING (Completed by Trainee and Wing Airfield Driving Program			
	Date	**Trainee Initials**	**WG ADPM Initials**
1. Unit Airfield Driving Program Manager (ADPM) duties and responsibilities.			
2. Appointment of unit trainers.			
3. Runway incursion prevention.			
4. Governing Directives.			
4.1. Air Force Manual 24-306, *Manual for the W heeled Vehicle Operator*, Chapter 18 and 20.			
4.2. AFMAN 91-203, *Air Force Occupational Safety Fire and Health Standards*, Chapter 24			
4.3. Air Force Instruction 21-101, *Aircraft and Equipment Maintenance Management*.			
5. Testing requirements to include testing security/compromise.			
6. Color vision testing requirements. See Air Force Instruction 48-123, *Medical Examinations and Standards* for additional information.			
7. Airfield Driver's training requirements.	**Date Completed**	**Trainee Initials**	**WG ADPM Initials**
7.1. Local Qualification.			
7.2. Refresher.			
8. Unit ADPM Continuity Binder.			
9. Reporting, Enforcement, and Violations Consequences.			
10. Vehicle Passes (Privately Owned/Government Leased).			
11. Controlled Movement Area (CMA) procedures and training for unit personnel.			
12. Temporarily assigned personnel/Non-based assigned contractors briefing and/or training requirements.			
13. Escort procedures.			
14. Procedures for issuing, revoking and reissuing an AF Form 483, *Certificate of Competency*.			
15. Participate with the Unit ADPM on an actual training session and practical check ride.			
16. AF Form 483 CERTIFICATE #:			

Figure A3.2. Unit Airfield Driving Program Manager Checklist, Part 2.

SECTION III TRAINING CERTIFICATION (Completed by the Unit Airfield Driving Program Manager and Wing Airfield Driving Program Manager or designated representative)			
Unit Airfield Driving Program Manager			
I have received and completed all of the above training requirements and will comply with Air Force Instruction 13-213 and wing/base supplement.			
Name: (Last, First, MI):	Rank, Civilian Grade or equivalent:	Signature:	Date:
Wing Airfield Driving Program Manager			
Name: (Last, First, MI):	Rank, Civilian Grade or equivalent:	Signature:	Date:
NOTE: A local form may be used as long as it includes all information listed above.			

Attachment 4

AIRFIELD DRIVING TRAINING DOCUMENTATION AND CERTIFICATION CHECKLIST

Figure A4.1. Airfield Driving Training Documentation And Certification Checklist, Part 1.

AIRFIELD DRIVING TRAINING DOCUMENTATION AND CERTIFICATION CHECKLIST			
SECTION I - TRAINEE INFORMATION (Completed by the Unit ADPM)			
Name: (Last, First, MI):	Rank, Civilian Grade or equivalent:	Unit/Office Symbol or Company Name	Duty Phone
SECTION II - QUALIFICATION TRAINING (Completed by the Trainee and Unit Trainer)			
	Date	**Trainee's**	**Trainer's Initials**
1. Trainee possesses a valid (List State of Issue) Driver's License (List restrictions).			
2. Trainee possesses a valid Government Driver's License.			
3. Airfield Driver Classroom Training (as determined locally)			
4. Airfield Driving Qualification Training Checklist/Curriculum. (Completion of this checklist).			
5. Local Airfield Familiarization. Training Outcome(s): Trainee must be familiar with knowledge of the local airfield environment.	**Date Completed**	**Trainee's Initials**	**Trainer's Initials**
5.1. Non-Movement Area Boundary Marking as applicable.			
5.2. Non-Standard Airfield Markings as applicable.			
5.3. Aircraft Arresting Gear Markings as applicable.			
5.4. Locations of airfield Navigational Aids and Visual Approach Aids.			
5.5. Location of Restricted Area and Entry Control Points.			
5.6. Location of Free Zones as applicable.			
5.7. Location of the Fire Department, Air Traffic Control Tower (ATCT) and Airfield Management.			
5.8. Location/use of traffic control device as applicable.			
5.9. Hazardous Jet Blast locations on the airfield.			
5.10. Runway(s) configuration (e.g. dimensions, location, designation). Also, explain and define runway approach end and departure end.			
5.11. Taxiway configuration (e.g. dimensions, location, designation).			
5.12. Controlled Movement Area Boundaries.			
5.13. Congested Areas.			

Figure A4.2. Airfield Driving Training Documentation And Certification Checklist, Part 2.

5.14. Hot Spots as required locally.			
5.15. ATCT and vehicle blind spots.			
6. Local Vehicle Operator Requirements. Training Outcome(s): Trainee must be knowledgeable on local procedures and requirement for operating a vehicle on the airfield.	**Date Completed**	**Trainee's Initials**	**Trainer's Initials**
6.1. Use of perimeter and infield roadways.			
6.2. Lateral distance requirements for mobile obstacles on an apron/ramp and taxiway.			
6.3. Speed limits for vehicles operating on an apron/ramp and taxiway.			
6.4. Procedures for reporting and removing FOD.			
6.5. Restricted visibility and/or night driving.			
6.6. Procedures for operating bicycles, tricycles, etc. on			
6.7. Use of traction control devices as applicable.			
6.8. Emergency Response Vehicle requirements.			
6.9. Vehicle Escort/Convoy driving procedures as applicable.			
7. Practical Day Airfield Familiarization Training. Training Outcome(s): Trainee must be knowledgeable of the airfield environment. At a minimum, the trainee must demonstrate the ability to operate a vehicle to and from their designated work areas.			
7.1. Practical Day Driving Check-ride			
8. Practical Night (as applicable) Airfield Familiarization Training. Training Outcome(s): Trainee must be knowledgeable of the airfield environment. At a minimum, the trainee must demonstrate the ability to operate a vehicle to and from their designated work areas.			
8.1. Practical Night Driving Check-ride (as applicable).			
9. Review Local AFI 13-213 supplement.			
10. USAF Airfield Driving CBT (Date Completed).			
11. Runway Incursion Prevention Training.			
12. Airfield Diagram/Layout Test [Score:]			
13. General Knowledge Test (written) [Score:]			
14. Runway Incursion Prevention Test [Score:]			
15. Communication Test [Score:]			

Figure A4.3. Airfield Driving Training Documentation And Certification Checklist, Part 3.

16. Demonstrate the ability to contact ATCT for approval to enter/exit the **CMA**. **Note:** Required for all personnel that require access on or across taxiways, helipad, and aprons located in the CMA.			
17. Demonstrate the ability to contact ATCT for approval to enter/exit the **runway**. **Note:** Required for all personnel that require access on or across taxiways, helipad and aprons located in the CMA.			
SECTION III - Color Vision Test for CMA drivers only. (Completed by Hospital/Medical Treatment Facility Optometry)			
Results: Pass / Fail (Circle one)			
Name: (Last, First, MI):	Rank, Civilian Grade or equivalent:	Signature:	Date:
SECTION IV - TRAINER CERTIFICATION (Completed by Authorized Airfield Driving Trainer)			
I certify the trainee has received all required qualification training requirement annotated above.			
Name: (Last, First, MI):	Rank, Civilian Grade or equivalent:	Signature:	Date:
I have received and completed all of the training requirement and will comply with my local base's Airfield Driving AFI 13-213 Supplement instructions. I am also fully aware that no vehicle or pedestrian shall enter a runway or other controlled movement area without approval from the Air Traffic Control Tower (ATCT).			
Name: (Last, First, MI):	Rank, Civilian Grade or equivalent:	Signature:	Date:
SECTION VI - UNIT CERTIFICATION (Completed by Unit Commander or Unit ADPM)			
I certify that the above trainee has successfully completed all training requirements to operate a vehicle on _____ airfield.			
Check all applicable restrictions and/or special access.			
Ramp Only / Daylight Only	CMA Authorized	Other (Specify):	
Name: (Last, First, MI):	Rank, Civilian Grade or equivalent:	Signature:	Date:
SECTION VII - AIRFIELD DRIVING AUTHORIZATION (Completed by the Wing ADPM or designated representative)			
Approved / **Disapproved**		**AF Form 483#:**	
Name: (Last, First, MI):	Rank, Civilian Grade or equivalent:	Signature:	Date:
NOTE: A local form may be used as long as it includes all information listed above.			

Attachment 5

TDY PERSONNEL/NON-BASE ASSIGNED CONTRACTORS TRAINING CHECKLIST

Figure A5.1. TDY Personnel/Non-Base Assigned Contractors Training Checklist, Part 1.

TEMPORARILY ASSIGNED PERSONNEL/NON-BASED ASSIGNED CONTRACTORS TRAINING CHECKLIST			
SECTION I - TRAINEE INFORMATION (Completed by the Unit Airfield Driving Program Manager or Wing Airfield Driving Program Manager)			
Name: (Last, First, MI):	Rank, Civilian Grade or equivalent:	Unit/Office Symbol or Company Name	Duty Phone
SECTION II - QUALIFICATION TRAINING (Completed by the Trainee, Unit Airfield Driving Program Manager or Designated Trainer)			
	Date Completed	**Trainee's Initials**	**Trainer's Initials**
1. Explain the difference between mandatory/informational local airfield signs.			
2. Explain the different types of airfield marking (i.e. runway, taxiway, apron/ramp). Provide examples of local airfield markings.			
3. Explain the different types of airfield lighting systems (i.e. runway, taxiway, apron/ramp). Provide examples of local airfield lighting.			
4. Identify the speed limits for general/special purpose vehicles operating on aircraft parking aprons/ramps and taxiways.			
5. Identify the procedures for vehicle operating in the immediate vicinity of base assigned and transient (if applicable) aircraft.			
6. Explain the requirements for parking and chocking vehicles and/or equipment on the airfield.			
7. Identify the lateral distance requirements for mobile obstacles on taxiways and aprons.			
8. Discuss Foreign Object Damage (FOD) control/prevention measures for the airfield.			
9. Identify methods/practices to prevent a runway incursion.			
10. Explain the different types of airfield violations and their consequences.			
11. Identify the proper radio terminology and phraseology.			
12. Provide a local Airfield Diagram.			
13. Identify all restricted areas and entry control points.			
14. Identify all Control Movement Area boundaries.			
15. Identify Free zones, when applicable.			
16. Practical airfield familiarization training. At a minimum, familiarize individual on route(s) to and from the designated work area.			

Figure A5.2. TDY Personnel/Non-Base Assigned Contractors Training Checklist, Part 2.

17. Explain procedures for Night Driving, Reduced visibility and Inclement weather, when applicable.			
18. Explain procedures for reporting an accident or vehicles maintenance problems.			
SECTION III - TRAINING CERTIFICATION (Completed by Trainee, Unit Airfield Driving Program Manager and Wing Airfield Driving Program Manager, as required)			
TRAINEE			
I have received and completed all of the above training requirements and will comply with Air Force Instruction 13-213 and (if applicable) wing/base supplement. I am also fully aware that no vehicle or pedestrian shall enter a runway or other controlled movement areas without approval from the Air Traffic Control Tower.			
Name: (Last, First, MI):	Rank, Civilian Grade or equivalent:	Signature:	Date:
UNIT AIRFIELD DRIVING PROGRAM MANAGER			
I certify that the above individual has completed all training requirements outlined in Air Force Instruction 13-213 and (if applicable) wing/supplement. Check all applicable restrictions.			
Ramp Only	**Daylight Hours**	**Other (Specify):**	
Name: (Last, First, MI):	Rank, Civilian Grade or equivalent:	Signature:	Date:
WING AIRFIELD DRIVING PROGRAM MANAGER OR DESIGNATED REPRESENTATIVE (as required)			
Name: (Last, First, MI):	Rank, Civilian Grade or equivalent:	Signature:	Date:
NOTE: A local form may be used as long as it includes all information listed above.			

Attachment 6

REQUEST FOR ISSUE OF AIRFIELD CONE/PLACARD

Figure A6.1. Request For Issue Of Airfield Cone/Placard.

REQUEST FOR ISSUE OF AIRFIELD CONE/PLACARD			
To:	*From (Unit or Company):*		
Name (Last, First Middle Initial):	*Rank:*	*Phone:*	
Justification:			
I certify that I have read and understand 305 AMWI 13-213 and will comply with all requirements therein. I further understand that I can be held pecuniary for any damage to government property caused by my POV while on the airfield.			
Vehicle Information:			
Year:			
Make:			
Model:			
Color:			
State/License Plate #:			
Signature (Project Manager or Individual Requesting POV Access):		*Date:*	
Signature (Project Manager, Unit/CC or Designated Representative):		*Date:*	
☐ Approved ☐ *Disapproved*	*Airfield Manager, Deputy Airfield Manager or NCOIC, Airfield Management Operations/Training*	*483 #:*	
Signature Of Issuing Official:	*Date Issued:*	*Cone/Placard Color and #:*	

OSAA FORM 7, Jan 16 Previous *Editions Are Obsolete*

Attachment 7

REINSTATEMENT OF AIRFIELD DRIVING PRIVILEGES

Figure A7.1. Reinstatement Of Airfield Driving Privileges.

DEPARTMENT OF THE AIR FORCE
305TH AIR MOBILITY WING (AMC)

Date

MEMORANDUM FOR 305 OSS/OSAA

FROM:

SUBJECT: Reinstatement of Airfield Driving Privileges

1. Due to the lack of manning in the UNIT GOES HERE it would be in the best interest of the squadron for [MEMBERS NAME] to have his/her Airfield Driving privileges restored.
.
2. [MEMBERS NAME] has been sent back to step 2 in the ADTP site and has re-accomplished all training and testing requirements listed in 305 AMWI 13-213.

3. Any questions, please contact CURRENT ADPM at EMAIL ADDRESS, DSN 650-XXXX / COMM 609-754-XXXX.

Commanders name, Lt Col, USAF
Commander

Attachment 8

MCGUIRE AIRFIELD VEHICLE CALL-SIGN LIST

Figure A8.1. McGuire Airfield Vehicle Call-Sign List, Part 1.

Call Sign	*UNIT ASSIGNED*
305th AMW	
Can Do 1	Wing Commander
Can Do 2	Vice Commander
305th OPERATIONS GROUP	
Can Do 3	Operations Group Commander
Can Do 3A	Deputy Operations Group Commander
ROCK 1	OSS/CC
ROCK 2	OSS/DO
AOF 1	AOF/CC
AOF 2	AOF/DO
Airfield 1	Airfield Manager
Airfield 2	Deputy Airfield Manager
Airfield 3-4	Airfield Management Personnel
305th MAINTENANCE GROUP	
Maintenance 1	305th Maintenance Group Commander
Maintenance 1A	514th Maintenance Group Commander
Maintenance 2	305th Maintenance Group Deputy
Transient Alert	
TA 1	Aircraft Services Contract Dispatch
TA 2, 3, 4, 5	Aircraft Services Contract Vehicles
305th AMW/SAFETY	
Safety 1	Chief of Safety
Flight Safety	Flt Safety
Ground Safety	Ground Safety
Wildlife 1	USDA
Wildlife 2	USDA
87th ABW/SAFETY	
Joint Base Safety	Joint Base Safety
Joint Base Ground Safety	Joint Base Ground Safety
Joint Base Weapons Safety	Joint Base Weapons Safety

Figure A8.2. McGuire Airfield Vehicle Call-Sign List, Part 2.

305 OSS RAWS

Ghost 1	Airfield Systems Maintenance
Ghost 2	Airfield Systems Maintenance
Ghost 3	Airfield Systems Maintenance
Ghost 4	Airfield Systems Maintenance

87th CIVIL ENGINEERING SQ

CE 1	Chief of Operations
CE 2	Deputy Chief of Operations
CE Ops 1	Chief Operations
CE Ops 2	Deputy Chief Operations
CE Ops 3	Superintendent Operation
CE Support 8	Operations Support (Ground Maintenance)
CE Support 9	Operations Support (Paint/Signs)
CE Support 10	Operations Support (Concrete/Asphalt)
CE Support 12	Operations Support (Rubber Removal)
CE Support 14	Operations Support (Refuge)
Electric 1	Electric Shop Supervisor
Electric 2	Electric Shop Technician
Power 1	Foreman Power Pro
Power 2	Repairman Stand-by Generators
Snow 1	Snow Barn
Snow 31	Airfield snow operation
Snow 32	Streets and Parking lots
Plow 10-80	CE Airfield Plow
Blower 22-25	CE Airfield Blower
Broom 1-4	CE Airfield Broom
CE control	CE Operations Control
Snow control	CE Snow Control
Inspector 1-8	Construction Management

87 CES/CEF Fire Emergency Services

Fire Control	Fire Alarm Communication Center (FACC)
Chief 1	Fire Chief
Chief 2	Assistant Chief for Operations
Engine 4	Structural Fire Fighting Vehicle
Engine 5	Structural Fire Fighting Vehicle
Crash 6	Aircraft Rescue Fire Fighting (ARFF) Vehicle
Crash 8	ARFF Vehicle
Crash 11	ARFF Ramp Vehicle
Crash 12	ARFF Vehicle
Rescue 10	Rescue Vehicle
HazMat 13	HAZ-MAT Truck

Figure A8.3. McGuire Airfield Vehicle Call-Sign List, Part 3.

Fire Maintenance 15	Extinguisher Maintenance ¾ Ton Truck
Tanker 16	Water Tanker
Fire Maintenance 17	Fire Inspector Vehicle
87 LRS	
Trans1 – 100	Vehicle Operations
POL 1-5	Fuels
714 AES	
Air-evac 1, 2	Mission Launch and Recovery
108 OPERATIONS GROUP	
Airfield 5	Airfield Management

Attachment 9

SPOT CHECK FORM

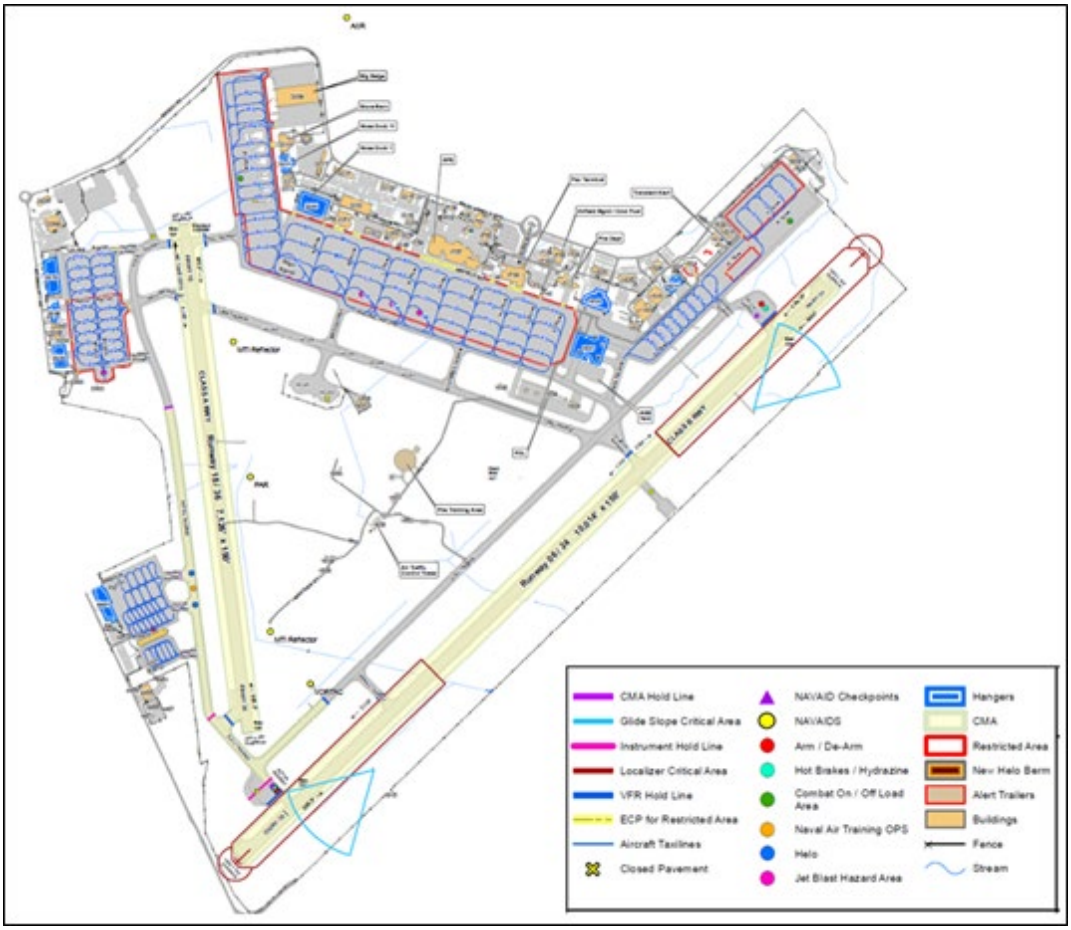
Figure A9.1. Spot Check Form.

AIRFIELD SPOT CHECK LOG							
NOTE: Ensure vehicle has AFVA 11-240 (Airport signs/markings/ Light Gun Signals placard), AFVA 13-222 (red placard), AIRFIELD Diagram Displayed in Driver's Area							
DATE	Rank and Name	UNIT/OFFICE SYMBOL	PLACARD # / VALID Y/N OR N/A	483? Y/N	RESTRICTION CODES Y/N	AFVAs & AIRFIELD Diagram? Y/N	Remarks

Attachment 10

MCGUIRE FIELD (KWRI) AIRFIELD DIAGRAM

Figure A10.1. Mcguire Field (KWRI) Airfield Diagram.



A10.1. Note:. Contact 305 OSS/OSAA for higher resolution version of the Master Airfield Diagram.

Attachment 11

483 RESTRICTION CODES

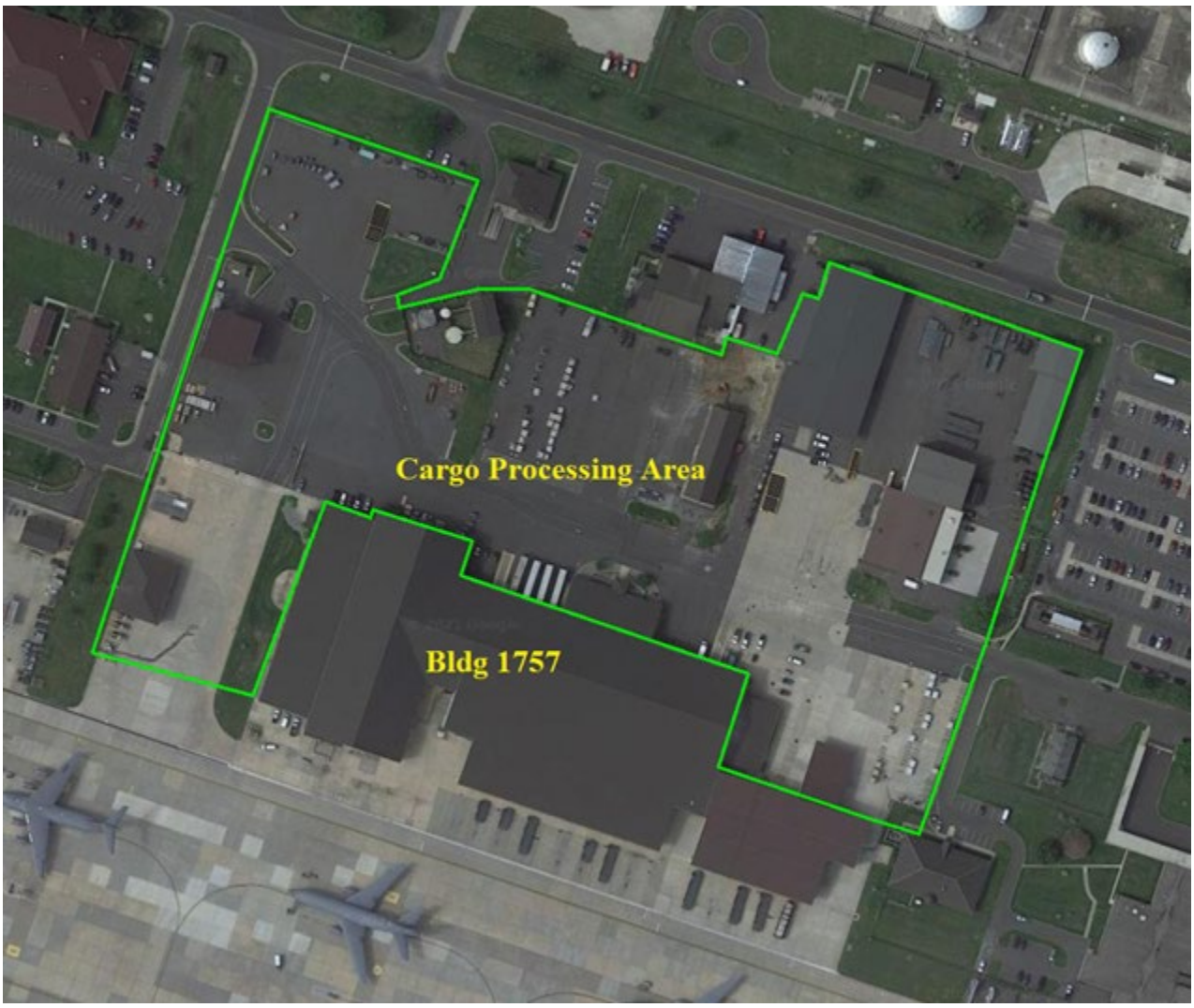
Figure A11.1. 483 Restriction Codes.

Restrictions	
Name	Letter
Alpha Bravo Ramp	D
ANG Ramp Only	A
Army Aviation Ramp	F
CMA Access	C
Daylight Hours Only	L
Main Ramp Only	B
Non-CMA	E
NVD Qualified	N

Attachment 12

CARGO PROCESSING AREA

Figure A12.1. Cargo Processing Area.



SECTION 01 14 00

WORK RESTRICTIONS
11/22, CHG 5: 05/25

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety -- Safety and Occupational Health (SOH) Requirements

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

List of Contact Personnel

1.3 SPECIAL SCHEDULING REQUIREMENTS

a. Permission to interrupt any Activity roads, railroads, or utility service must be requested in writing a minimum of 15 calendar days prior to the desired date of interruption. Roads must only be closed one lane at a time, and vehicular traffic must be allowed to pass through the construction area. Work on or near roadways must be flagged in accordance with the safety requirements in EM 385-1-1. Work located along the alert force route shall not cause blockage, and the Contractor shall maintain unobstructed access for alert force traffic at all times.

b. Refer to drawings GC101 PHASING PLAN, and GC103 PHASING NOTES for additional scheduling requirements.

1.4 CONTRACTOR ACCESS AND USE OF PREMISES

1.4.1 Activity Regulations

Ensure that Contractor personnel employed on the Activity become familiar with and obey Activity regulations including safety, fire, traffic and security regulations. Keep within the limits of the work and avenues of ingress and egress. Wear appropriate personal protective equipment (PPE) in designated areas. Do not enter any restricted areas unless required to do so and until cleared for such entry. Ensure all Contractor equipment,

including delivery vehicles, are clearly identified with their company name.

1.4.1.1 Subcontractors and Personnel Contacts

Provide a list of contact personnel in accordance with ATTACHMENT 2 TO APPENDIX 4 TO ANNEX C TO JB MDL JIDP - Contractor Entry Authority List (EAL) Requirements found at the end of this section.

1.4.1.2 Site Security And Vehicle Identification

a. The Contractor shall be responsible for the security of the areas within the contract limits. When the Government takes possession of certain areas, the Contractor shall be responsible for the areas remaining under Contractor control.

b. The Contract must maintain continual base security with personnel security guard and temporary fences. Wherever there are fence disruptions due to the construction of this project, the Contractor shall continually monitor and maintain the fence.

c. The Contractor shall be responsible for furnishing an identification required by JB MDL to each employee in accordance with paragraph titled IDENTIFICATION OF EMPLOYEES.

d. The Contractor shall be responsible for requiring each employee engaged on the work to display such identification as may be approved and directed by the Contracting Officer. All prescribed identification shall immediately be delivered to the Contracting Officer for cancellation upon release of any employees. When required by the Contracting Officer, the Contractor shall obtain and submit fingerprints of all persons employed or to be employed on the project.

e. The Contractor and subcontractors shall register all company and private vehicles that will be used in the execution of this contract with the Installation Provost Marshall's office prior to start of work by the Contractor/subcontractor. Entry to the installation requires the following prior coordination with the Contracting Officer or designated representative; current vehicle registration, proof of insurance, valid driver's license for the vehicle driver, and procure identification for other personnel. Contractors/Subcontractors and their employees requiring access to the installation will be required to comply with the installation access control policy/procedures. The government will not be responsible for damages due to delay/stoppages caused by failure to comply.

f. All vehicles and personnel are subject to search and seizure of contraband and/or unauthorized government property. Contractor vehicles (Contractor-owned and personal), contractor personnel, and their personal property shall be subject ot searches upon entering of leaving the installation. The search and seizure provisions of AR 190-22 shall apply to contractor personnel entering or leaving JB MDL

1.4.1.3 No Smoking Policy

Smoking is prohibited in the project site, except in designated smoking areas. Discarding tobacco materials other than into designated tobacco receptacles is considered littering and is subject to fines. The Contracting Officer will identify designated smoking areas.

1.4.2 Working Hours

Regular working hours must consist of a 10 hour period, between 7 a.m. and 5 p.m.,Monday through Friday, excluding Government holidays.

1.4.3 Work Outside Regular Hours

Work outside regular working hours requires Contracting Officer approval. Make application 15 calendar days prior to such work to allow arrangements to be made by the Government for inspecting the work in progress, giving the specific dates, hours, location, type of work to be performed, contract number and project title. Based on the justification provided, the Contracting Officer may approve work outside regular hours. During periods of darkness, the different parts of the work must be lighted in a manner approved by the Contracting Officer. Make utility cutovers after normal working hours or on Saturdays, Sundays, and Government holidays unless directed otherwise. The Contractor must comply with paragraph Fatigue Management Plan (FMP) of EM 385-1-1.

1.4.4 Exclusionary Period

Work outside regular working hours requires Contracting Officer approval. Make application 15 calendar days prior to such work to allow arrangements to be made by the Government for inspecting the work in progress, giving the specific dates, hours, location, type of work to be performed, contract number and project title. Based on the justification provided, the Contracting Officer may approve work outside regular hours. During periods of darkness, the different parts of the work must be lighted in a manner approved by the Contracting Officer. Make utility cutovers after normal working hours or on Saturdays, Sundays, and Government holidays unless directed otherwise. The Contractor must comply with paragraph Fatigue Management Plan (FMP) of EM 385-1-1.

1.4.5 Utility Cutovers and Interruptions

a. Make utility cutovers and interruptions after normal working hours or on Saturdays, Sundays, and Government holidays. Conform to procedures required in paragraph WORK OUTSIDE REGULAR HOURS.

b. Ensure that new utility lines are complete, except for the connection, before interrupting existing service.

c. Interruption to water, sanitary sewer, storm sewer, telephone service, electric service, air conditioning, heating, fire alarm, compressed air, and are considered utility cutovers pursuant to the paragraph WORK OUTSIDE REGULAR HOURS. Such interruptions are further limited to four hours. This time limit includes time for deactivation and reactivation.

d. Operation of Installation Utilities: The Contractor must not operate nor disturb the setting of control devices in the station utilities system, including water, sewer, electrical, and steam services. The Government will operate the control devices as required for normal conduct of the work. The Contractor must notify the Contracting Officer giving reasonable advance notice when such operation is required.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

HQ 87 ABW (AMC)
JB MDL, NJ 08641-5002
20 September 2023

APPENDIX 4 TO ANNEX C TO JB MDL JIDP
CONTRACTOR SECURITY APPENDIX

1. SITUATION. This annex provides the 87th Security Forces Squadron (SFS) appendix to all statements of work for JB MDL.

1.1. Enemy. Refer to Basic Plan.

1.2. Friendly. Refer to Basic Plan.

1.3. Assumptions. Refer to Annex C of this plan.

1.4. Limiting Factors. Not all members listed below will be monitoring the radio.

2. MISSION. To provide Installation entry control procedures for all contractors.

3. EXECUTION. The following appendix provides information from Air Force Instruction 31-101, AFMAN 31-101V3 and local supplements on requirements for entering and conducting business while on Joint Base McGuire-Dix-Lakehurst (JB MDL), New Jersey.

3.1. Contract Award. JB MDL requires all visitors/contractors/vendors to conduct a criminal history background check and Wants/Warrants check prior to being issued an Installation Access Pass/Card. This check is done at no expense to the contractor and will be accomplished at the Welcome Center or Commercial Vehicle Inspection Area. This will be completed prior to any access credential for JB MDL being issued to the contractor personnel.

3.1.1. All personnel requesting an installation visitor pass must complete the *JB MDL request for criminal history form* at the Welcome Center or Commercial Vehicle Inspection facility. Failure to provide all required information may result in access to the installation being denied.

3.1.2. If the contractor requires access to the installation for more than 60 days and up to one-year, Welcome Center personnel will conduct a QWA Person Inquiry and criminal record check prior to issuing a card. Prior to issuing another Pass/Card another QWA Person Inquiry and criminal record check will be conducted.

3.1.3. If the contractor requires access for less than a 60-day period, a QWA Person Inquiry and criminal history check will be conducted prior to the contractor/vendor being issued an Installation Access Pass. Any subsequent request for entry will require another QWA Person Inquiry and criminal history background check to be accomplished.

3.1.4. The Contracting Squadron and Project Manager are required to contact Security Forces if a contract or contractor is terminated, and the individual is refusing to return any access control equipment (keys/cards).

3.1.5. The Welcome Center will conduct the required background checks, review the results and

determine whether personnel will be authorized to enter JB MDL. The Welcome Center will forward any derogatory/disqualifying information to 87 SFS/S5R for debarment initiation. If no derogatory/disqualifying information is identified, any printed QWA Person Inquiries or criminal background checks will be destroyed immediately.

3.1.6. The Welcome Center will also notify the appropriate Administrative Contracting Office or unit POC of those personnel who are being denied access to the installation due to derogatory information identified in the individual's criminal background investigation. The disposition date (date the charges were finalized in court) is the date used to determine time frames. The list of criminal history findings which will automatically disqualify a person from being granted access to the installation are located in the AUTOMATIC DENIAL DISQUALIFIERS

3.1.7. The contractor will provide an Entry Authority List (EAL) to the administrative contracting office or installation Point of Contact (POC) (i.e. 87 CONUS, US Army Corps of Engineers (USACE), 87 CES, etc.). The contracting office will provide a copy of the initial EAL to the 87 SFS/Welcome Center. The contracting office will maintain any required documentation until the contract has been completed or terminated for any reason.

3.1.8. The administrative contracting office or installation POC will authenticate and forward the EAL to the 87 SFS Welcome Center, *NLT 72 hours prior* to contract start date.

3.1.9. If EALs are not accurate or contain fraudulent information, contractor identification badges will not be issued.

3.1.10. Pen and ink changes for deletion purposes may be made to an EAL.

3.1.11. Pen and ink additions to an EAL will not be accepted. All additions must be made by initiating a new EAL.

3.1.12. The Master EAL will be resubmitted with the additions included. Individual letters for long term employees will not be accepted if the contract exceeds 60 days.

3.1.13. The Welcome Center will maintain a copy of the documents for 90 days after expiration for future reference.

3.1.14. Contractor/vendor Criminal History Record and Background Checks will be valid for a period not to exceed 3 years.

3.1.15. At the one year mark, the contractor/vendor is required to complete a new check for each individual still employed and working at JB MDL.

3.1.16. Background checks older than one year will be updated by accomplishing a new JB MDL Criminal History Request Form. Records older than three years on file will be destroyed.

3.1.17. Holders of other federal credentials must have a validated need for installation access and will not be granted unlimited or unrestrained access to JB MDL. Therefore, identification credentials/tokens issued by other Federal departments, such as the Transportation Workers Identification Credential

(TWIC) [produced in accordance with the *Maritime Transportation Security Act of 2002* and Security and Accountability for Every (SAFE) Port Act of 2006] or other Federal credentials, may be used as identity proofing only and the person must be vetted and issued an Installation Access Pass/Card.

3.2. Contractor Visitor Passes for Entry to JB MDL. Contractors and vendors will be issued a computer-generated Visitor Pass, or Defense Biometrics Identification System (DBIDS) card identifying them as a contractor authorized access to JB MDL. Vendors cannot receive a pass for more than one day.

3.2.1. A criminal history check will be conducted prior to issuing any pass or card.

3.2.2. Contractor visitor passes will be issued at a Welcome Center or the Commercial Vehicle Inspection facility for all contractors who require access to the installation for less than 60 days in a year.

3.2.3. Visitor passes will be issued to contractors who do not access the installation at least three days per week.

3.2.4. Contractors and vendors who access the installation less than three days per week but will access the installation for longer than one month will be included on an EAL with the date the contract expires. These personnel must stop at the Welcome Center each time they are needed to perform work. They will be issued a Visitor Pass each time they need to enter the installation. These personnel will be identified on the EAL as requiring periodic access.

3.2.5. DBIDS Installation Access Cards will only be issued to contractors requiring access at least 3 days a week for more than 60 days in a year. Personnel will only be issued an Installation Access Card after all required Criminal History Checks are completed. Installation Access Passes will only be issued at any of the Welcome Centers or Commercial Vehicle Inspection facilities for the entire JB MDL. These personnel will be identified on the EAL as requiring daily access.

3.2.6. Contractor passes will be updated annually at the Welcome Center or Checkpoint 9 for contracts lasting 1 year.

3.2.7. Contractor passes will be issued for the duration of the contract, or the length of the option period not to exceed 1 year.

3.3. NON-U.S. CITIZENS. All non-U.S. citizens must request access through the Installation Foreign Disclosure Officer (FDO), assigned to the 87 ABW/XP Office in Bldg. #2901, prior to coming to the welcome center for a pass, IAW TAB D TO APPENDIX 6 TO ANNEX C. Visitors must provide a Work Permit Visa, Passport or Alien Registration Card with immigration number when requesting entry onto JB MDL. Upon approval from the FDO/OSI and completion of an approved Alien Immigration background check, the foreign national will be permitted to be sponsored onto the installation.

3.3.1. Sponsors must meet their Foreign National visitor at the Lakehurst Welcome Center.

3.3.2. Non-US citizens will not be issued an Installation Access Card for longer than their Work Permit Visa is valid.

3.3.3. Those contractors working under the AF Industrial Security program will provide an EAL to the

Welcome Center.

3.3.4. Those contractors under the AF Industrial Security program requiring access to the AF computer network may be issued a Common Access Card (CAC) in lieu of the normal contractor visitor pass.

3.3.5. Those contractors under the AF Industrial Security program who have not been issued a CAC will be issued a contractor visitor pass if they will be on the installation less than 60 days. These Contractors will be issued an Installation Access Card if they will be on the installation longer than 60 days.

3.3.6. Those contractors under the AF Industrial Security Program who maintain an active DoD security clearance shall provide a Joint Personnel Adjudication System (JPAS) printout in lieu of the required background checks.

3.3.7. Installation Access Cards or temporary visitor / vehicle passes are issued for a specific purpose. It is not intended to allow unrestricted installation access and is to be used only when access is required for the stated purpose. Access Cards are the property of the government and must be returned to the issuing office when no longer authorized (termination, retirement, end of contract, expired, etc.) or required. The misuse of an Access Card or a temporary pass may be cause for confiscation and barment from the installation. All visitors and contractors will be advised that the acceptance of an Access Card and or temporary pass will be considered implied consent to inspect passenger(s) and vehicle at any time while on the installation. When an Access Card, visitor or vehicle pass has expired, renewal is not automatic. The sponsor or requesting individual must resubmit required information.

3.4. Contractor Vehicle Passes for Entry to JB MDL. Contractor vehicle passes will be issued at any Welcome Center or Commercial Vehicle Inspection Area.

3.4.1. All vehicles and drivers must have the following documentation prior to being issued a Visitor Pass/Card and being granted access to JB MDL:

3.4.1.1. Valid state driver's license with photo.

3.4.1.2. Valid state driver’s license without photo with another government/state issued form of identification with photo.

3.4.1.3. Valid vehicle insurance.

3.4.1.4. Valid vehicle registration.

3.4.1.5. Bill of Lading (if available).

3.4.1.6. A JB MDL point of contact with a phone number.

3.4.2. Contractors will be issued Visitor Pass/Card for entry to JB MDL provided the required documentation listed in 3.2 is valid.

3.4.3. Commercial vehicles identified in Appendix 4 and issued a Visitor Pass/Card must enter the installation through a Commercial Vehicle Inspection Area unless identified on the Installation Commercial Vehicle Access list. Checkpoints, Entry Points, and Welcome Centers will maintain an up-to-date copy of the approved vehicles list and redirect any vehicles not on the list to the appropriate

commercial screening area.

3.5. Contractor, Commercial and Oversized Vehicles. All contractors, commercial, and oversized vehicles not on the Installation Commercial Vehicle Access list must enter JB MDL Main Base through Checkpoint-9 located on Saylor's Pond Road or through Lakehurst via the Commercial Vehicle Inspection (CVI) gate located on CR 547.

3.5.1. The Installation Commercial Vehicle Access list is for Government sponsored organizations (United Communities, PRIDE, etc) and the vehicles must be registered on the access list in order to be exempt from Commercial Checkpoint screening. The Installation Commercial Vehicle Access list will be maintained by 87 SFS/S3 and posted at the gates/checkpoints.

3.5.2. The following are considered "commercial and oversized" vehicles at JB MDL and these vehicles can only enter the installation via the commercial vehicle gates:

3.5.2.1. All vehicles registered and licensed for commercial purposes with "commercial" license plates, regardless of state of issue.

3.5.2.2. All vehicles, regardless of type, license plate, or size, having more than two (2) axles.

3.5.2.3. All commercially licensed vehicles used to carry tools, machinery, equipment, or other commercial related equipment onto the installation must go through Checkpoint 9

3.5.2.4. All commercially licensed vehicles displaying a commercial plaque, logo or emblem carrying tools, machinery, equipment, or other commercial related equipment onto the installation must go through Checkpoint 9.

3.5.2.5. Pick-up trucks, without commercial plates, which have not been equipped with storage containers and are not loaded with material in the bed of truck may enter JB MDL through any gate.

3.6. Contractor vehicle and personnel processing requirements. Checkpoint - 9 is open for personnel and vehicle processing from 0600-1600 Monday-Friday/0800-1200 Saturday/Closed Sunday and Holidays.

3.6.1. Contractor/Commercial vehicles requesting JB MDL Main Base entry from 1600-0600 will not be allowed entry. Unusual circumstances will be handled on a case-by-case basis. Contact the Emergency Communication Center (ECC) at (609) 754-6001.

3.6.2. Lakehurst CVI is open for personnel and vehicle processing from 0600-1400 hours Monday-Friday/Closed Saturday, Sunday, and Holidays.

3.6.3. Contractor/Commercial vehicles requesting JB MDL Lakehurst entry from 1400-0600 or on weekends must be coordinated with the Operations Emergency Communication Center (ECC and BDOC) at (609) 754-6001/1730/1731.

3.7. Sub-Contractors. All subcontractors are required to follow the same instructions listed above for their subcontractor personnel.

3.7.1. Contractors with an immediate access requirement for a short-term subcontractor must coordinate with their Contracting Officer prior to authorization of access without following the normal procedures.

3.7.2. Short term Subcontractors will be issued a pass not to exceed 1 week.

3.8. Contractors. Contractors working in USAF Restricted Areas will comply with the following:

3.8.1. All contractors meeting the standard of visitor groups DoD 5200.02_IAW AFMAN 16-1405 will be issued line badges for working on the flight line and restricted areas. Those contractors must work 90 or more consecutive days (not counting weekends or holidays). All other contractors will require escort by the DoD unit most associated with the work being conducted.

3.8.2. Each individual contractor (person) will be required to complete a Standard Form (SF) 85 Tier 1 - Questionnaire for Public Trust Position before accessing the Restricted Area. This is an investigation to determine the trustworthiness of the individual requiring access to the Restricted Area. This is not the same type of investigation as the NJ or other state background checks required to be conducted to access JB MDL.

3.8.3. Each individual will work with the unit security manager the contractor is supporting to complete the SF 85 Tier 1.

3.8.4. Upon completion, the contractor will submit to the unit security manager for review.

3.8.5. If the SF 85 package contains errors, the individual will work with the security manager to correct.

3.8.6. If unable to correct, the individual will not be allowed access to the restricted area and may be asked to leave the installation.

3.8.7. If the SF 85, Tier 1 package contains no errors, the unit security manager will complete an AF Form 2586 - Unescorted Entry Authorization Certificate for accessing the restricted area.

3.8.8. The unit security manager will make an appointment with 87 ABW/IPP Personnel Security office for contractor processing and turn-in AF Form 2586.

3.8.9. The contractor will meet 87 ABW/IPP personnel and submit the completed SF 85, Tier 1. 87 ABW/IPP will review SF 85, Tier 1 for accuracy and completion. If the SF 85 package contains errors, the individual will work with the personnel security office to correct.

3.8.9.1. If unable to correct, the individual will not be allowed access to the restricted area and may be asked to leave the installation.

3.8.9.2. If no issues with SF 85, the 87 SFS Reports and Analysis will conduct local files check on the individual and/or NCIC III check.

3.8.10. Upon local files check completion (no issues), contractor will be directed to the Pass & Registration (Dix Welcome Center) where a restricted area badge can be issued on an interim basis based

on submission of the AF2586 to 87 SFS Badging Office.

3.8.10.1. Badging Office will review AF Form 2586 for accuracy and completion.

3.8.10.2. If there are no errors, then an AF Form 1199 - Restricted Area Badge will be produced for the contractor.

3.8.10.3. If there are errors on the AF Form 2586, the contractor will be directed to return to the unit security manager for re-accomplishment of the form.

3.8.11. If potential disqualifying information is discovered the file is forwarded to the 87th ABW IPP office. The IPP office will coordinate with the unit and appropriate wing to determine an appropriate status for the contractor. If the determination is unfavorable the IPP office will notify the 87 SFS and unescorted entry privileges to restricted areas and the flightline will be withdrawn automatically.

3.8.12. Any work on or near the flightline will be coordinated through the 87 SFS/S5 office. The 87 SFS Resource Protection section (Bldg. 6049 / Room 8) and Plans Manager (Bldg. 6049 / Room 7) must review prior to start of any work in or around a Controlled/Restricted Area.

3.8.13. The 87 SFS Plans Manager will verify the need to access the restricted area and determine if a Free Zone must be established.

3.8.14. The 87 SFS Resource Protection office needs to review all Statements of Work, Blueprints, and Contracts to ensure all JB MDL Force Protection needs are met and any police support is identified.

3.9. Flightline Driving. Only authorized contracted or privately owned vehicles with colored cones/placards are authorized on the flightline and/or flightline road unless driving a government vehicle or under authorized escort.

3.9.1. Contractor personnel who are authorized to drive on the flightline will be issued a colored cone/placard from Airfield Management.

3.9.2. Cones/placards must be visible during operations of the vehicle when driving on the flightline and when parked on the flightline.

3.9.3. The cone/placard must be secured (put away) upon departure from the flightline.

3.10. Restricted Areas. Defined as an area delineated by ropes, red lines or barriers that contain Protection Level resources (i.e. aircraft or equipment).

3.10.1. These areas require a certain level of protection, and entry is only allowed by authorized personnel wearing a restricted area badge or personnel under authorized escort.

3.10.2. Aircraft hangars are restricted areas when aircraft are present.

3.10.3. Signs are posted every 100 feet on the exterior of restricted area boundaries stating; "Deadly Force is Authorized."

3.10.4. Contractors will never enter restricted areas unless properly escorted or authorized by the installation commander or designee through the issuance of a restricted area badge.

3.10.5. If the Security Forces or a military member detains a contractor or contract employee at any time or for any reason, the contractor will comply with their request and will not become combative or argumentative.

3.10.6. Project Managers or Long Term Contractors requesting to control entry/exit through a gated/ secured flight line ECP for a mission critical need must be in possession of a DOD CAC and must possess a RAB if project/access is near/adjacent to a Restricted Area. The CAC/RAB holder must remain at the ECP while the area is open and are responsible for returning the key to the ECC at the end of the day. Entry and exit to restricted areas and free zones are covered in Appendix 8 to Annex C.

3.10.6.1. All contractor controlled, or mission partner controlled, entry concerns must be pre-approved and coordinated with 305th AMW/ Airfield Management and Security Forces (87 SFS/S5) prior to the contract being awarded.

3.11. Miscellaneous Requirements. All requests for additional contractor personnel must meet the same requirements listed in para A1 above before Installation Access Passes will be issued.

3.11.1. The administrative contracting office will be notified when personnel leave the contractor company for any reason and provide that information to the Welcome Center.

3.11.2. The contractor company is responsible for the return of all contractor identification badges at the end of the contract or when personnel depart for any reason. All badges and passes will be returned to the Welcome Center.

3.11.3. During increased Force Protection Conditions (FPCONs) there may be limited entry to the installation.

3.11.4. Retired military or government personnel may be allowed to enter the installation through any gate providing the vehicle operator has a current and valid base entry ID card.

3.11.5. Retired military or government personnel must be listed on the company EAL.

3.11.6. All retired military or government personnel will complete all Criminal History Record Information/Background Check regardless of their military/government retired status.

3.11.7. All contractor vehicles entering must be registered at the Welcome Center or Commercial Vehicle Inspection Facility.

3.11.8. Personnel authorized to receive a long-term Access Pass will not be issued a vehicle pass. The vehicle information will be included in the bar code of the pass. Personnel entering JB MDL who do not qualify for a long-term pass or are using a vehicle temporarily, will be issued an AF Form 75, Vehicle Pass and Authenticated by an E-6 or Civilian equivalent or higher.

3.11.9. Non-CAC Contractors (green striped DBIDS) are NOT authorized to sponsor personnel on to JB MDL.

3.11.9.1. There are no exceptions to this rule IAW DAFMAN 31-101V3, Installation Perimeter Access Control GM 9 Oct 24.

3.11.10. Any contractor found in violation of these requirements will be escorted off the installation. They will be removed from the company entry authority list and will not be allowed to reenter JB MDL without the express written permission of the Installation Commander.

3.11.11. Contractors are required to obey all entry requirements, traffic rules and requirements of JB MDL. Failure to comply will result in debarment from the installation.

3.11.12. Contractors are not authorized to utilize cell phones while operating a motor vehicle of any type while on JB MDL unless they can be operated hands free to include turning on, answering, speaking, and turning off.

3.11.13. Headsets are not authorized for use while operating a vehicle on JB MDL.

3.12. Questions or Problems. Questions on entry onto the installation may be directed to any one of the following locations: McGuire Gate Welcome Center – (609) 754-3197 or (609) 754-3003 Checkpoint 9 – (609) 562-3938, Ft Dix Welcome Center – (609) 562-6603, Lakehurst Welcome Center – (732) 323-2693

3.12.1. If a contractor has any problems while on JB MDL in any way related to base entry or security, the contractor should contact the Emergency Communication Center. (609)754-6001/1730/1731.

ATTACHMENT 1 TO APPENDIX 4 TO ANNEX C TO JB MDL JIDP
Contractor Entry Authority List (EAL) Requirements

A2.1. The EAL must include the following information regarding the contractor:

A2.1.1. Company Name.

A2.1.2. Company Address.

A2.1.3. Company Point of Contact (POC). A2.1.4.

Company POC Phone number.

A2.1.5. Company On Site Contact name. A2.1.6.

Company On Site Phone number. A2.1.7. Contract

Number

A2.1.8. Purpose of contract.

A2.1.9. Duration of contract (Start and End Dates) A2.1.10.

Location where contract is to be performed. A2.1.11. JB MDL

Unit POC Name and Grade, A2.1.12. JB MDL Unit of Sponsor

A2.1.13. JB MDL Unit POC Phone number A2.1.14.

Administrative Contracting Officer POC

A2.1.15. Administrative Contracting Officer POC Phone Number

A2.1.16. Days of the week access is required (ie, Monday-Friday)

A2.1.17. Hours of the day access is required (ie 0600-1800)

A2.1.18. Alphabetical listing of all contractor personnel to include full name (LAST, First Middle Initial).

A2.1.19. Social Security Number of all contractors. A2.1.20.

Date of Birth of all contractors.

A2.1.21. Alien Registration Number or passport number for all Non-U.S. legal immigrants.

A2.2.. Subcontractors must be processed in the same manner as a prime contractor.

A2.2.1. Subcontractors require all the above listed information and the following additional information which must be submitted:

A2.2.1.1. Sub contractor company Name, A2.2.1.2.

Sub contractor company Address,

A2.2.1.3. Sub contractor company Point of Contact (POC), A2.2.1.4. Sub

contractor company POC Phone number,

NOTE: Any military ID card holder working as a contractor must be included on the EAL.

YOUR COMPANY LETTERHEAD

DATE

FROM: (Your Company Address Information)

MEMORANDUM FOR 87th Security Forces Squadron Welcome Center SUBJECT:

Entry Authority List (EAL)

1. The (Your Company Name) will be working on Contract Number (Example: F12958-06- C-0092) for the purpose of building the new Temporary Lodging Facility near Bldg. 2717 from 1 May 2009 through 31 May 2011.

2. My onsite POC will be (Example) John J. Johnson, and his on-site phone number is (Example: (123) 456-7890).

3. The JB MDL Unit POC is (Example: Lt Tom T. Thompson) from the (insert unit name Ex: SFS, 819 GRS, 87th CES), his phone number is (Example: (456)789-0123).

4. The Procurement/Administrative Contracting Officer is (Example: Mrs. Joan J. Jett) and her phone number is (Example: (789) 012-3456).

5. The following personnel will be required to access JB MDL on a daily basis for the length of the contract.

LAST, First, MI	***SSAN***	***Date of Birth***	***Days of Week Access Required***	***Hours of Day Access Required***
THUMB, Thomas J.	123-45-6789	1 Jan 1981	M-F	0600-1800
PLUMMER, Patricia M.	456-78-9012	25 Dec 1986	Tues only	1200-1600
KRAVER, Gregory A.	789-01-2345	4 Jul 1976	Sun-Sat (7 days/week)	24 hours
MORPHIUS, Neo D.	123-98-7654	31 Dec 1982	Mon & Wed only	0800-1200

6. If there are any questions, please contact me at (098) 765-4321.

1st Endorsement, Contracting Officer

Signature Block of Company Approving Official

Signature Block of Procurement/ Administrative Contracting Officer

FOR OFFICIAL USE ONLY

ATTACHMENT 2 TO APPENDIX 4 TO ANNEX C TO JB MDL JIDP
Contractor Free Zone Requirements and Procedures

A3.1. Free zones are temporary work zones free of protection level resources that are created within restricted areas when construction projects and similar activities make normal circulation controls inappropriate.

A3.1.1. Requests to establish free zones must be coordinated with those agencies involved in the project, including the unit commander or staff agency chief having immediate responsibility for the operational resources of the area, the 87 SFS/CC and 87 SFS/S5.

A3.1.2. Free zones are limited in size to the minimum necessary for the contract work to be completed. The free zone must seclude the construction area from the restricted area, cannot be adjacent to resources (within 50 ft.).

A3.1.3. The Force Protection Council (FPC) or JB MDL/CC approves free zone establishment and concept of operations. Free zone approval must be in writing and is maintained by 87 SFS/S5 and the organization most responsible for the project.

A3.2. Requests to establish free zones will be submitted by letter to the FPC or JB MDL/CC voting membership after routing through the unit commander having immediate responsibility for the operational resources of the area, the restricted area OPR, and the 87 SFS/CC.

A3.2.1. Projects within or adjacent to flight line controlled areas must be routed through 305 OSS/OSAM and Flight Safety (87 ABW/SE) prior to submittal to the IDC.

A3.2.2. The 87 ABW/CC is the final approving authority.

A3.2.3. Written requests for free zone establishment must contain the following information:

A3.2.4. Estimated start and completion dates of the project.

A3.2.5. Physical description of the area.

A3.2.6. Prohibited areas.

A3.2.7. A map indicating the requested free zone area and access routes to or from the free zone.

A3.2.8. An outline of security procedures to be used to ensure restricted area integrity.

A3.3. If a contractor is completing the work, the installation contracting officer gives the contractor a letter signed by the installation commander or the group commander responsible for the security of the area, outlining the contractor's security responsibilities.

A3.4. The organization or agency most directly associated with the project must watch the free zone boundary, provide escorts, and prevent unauthorized entry into the restricted area. Ensure sufficient personnel are available to provide constant surveillance for the entire free zone boundary.

A3.5. Entry control to restricted areas containing free zones will not be delegated to contractors unless the contractors have been authorized a RAB for the applicable area.

A3.6. The organization or agency most directly associated with the project ensures the free zone boundary is clearly marked with an elevated rope, barrier, fencing, or other suitable material, clearly delineating it from the restricted area. Normally, the provision and placement of boundary materials and markers are included in the contract as a contractor responsibility.

A3.6.1. Signs identifying the free zone should face away from the free zone, so that they are visible upon approaching the free zone.

A3.6.2. Restricted area signs will be placed every 100 feet on the inside of the free zone boundary, visible to workers inside the free zone, clearly marking the restricted area boundary where it adjoins the free zone.

A3.6.3. Security forces will provide technical assistance in marking and maintaining the free zone boundary. (Note: Free zones WILL NOT be granted to replace, or granted as a convenience in place of, the need for escort officials and escorts.)

A3.6.4. The free zone will be closed and secured at the end of working hours each day.

A3.6.5. ECC will be notified by owner/user prior to opening/closing/securing the free zone.

A3.6.6. Security forces must conduct a sweep of the free zone area when closed for the day in areas containing PL1 and 2 resources.

A3.7. Free Zones for Protection Level 4 Resources (Controlled Areas).

A3.7.1. Free zones are established within controlled areas when construction projects and similar activities make it inappropriate/impractical to apply normal circulation controls.

A3.7.2. Establish a free zone corridor from some point on the controlled area boundary to the work project to aid in moving personnel and equipment.

A3.8. Controlled Area Free Zones. Establish free zones when construction projects or other temporary work activities make escort procedures impractical. Follow these general guidelines.

A3.8.1. Allow entry to the project work area at some point on the boundary of the controlled area with a free zone corridor.

A3.8.2. Ensure that the responsible activity maintains surveillance over the boundary of the free zone.

A3.8.3. Close the free zone and secure the controlled area after normal work project hours.

A3.8.4. If the temporary free zone inside a CA requires contractors to complete work around sensitive equipment or materials, owner/user personnel will be present any time contractors are in the area or will have the sensitive equipment or materials removed from the area.

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS
11/20, CHG 5: 02/25

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2024) Safety -- Safety and Occupational Health (SOH) Requirements

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

View Location Map

Progress and Completion Pictures

1.3 VIEW LOCATION MAP

Submit, prior to or with the first digital photograph submittals, a sketch or drawing indicating the required photographic locations. Update as required if the locations are moved.

1.4 PROGRESS AND COMPLETION PICTURES

Photographically document site conditions prior to start of construction operations. Provide monthly, and within one month of the completion of work, digital photographs, 1600x1200x24 bit true color minimum resolution in JPEG file format showing the sequence and progress of work. Take a minimum of 20 digital photographs each week throughout the entire project from a minimum of ten different viewpoints selected by the Contractor unless otherwise directed by the Contracting Officer. Submit with the monthly invoice one set of digital photographs in the agency construction management system of record, cumulative of all photos to date. Indicate photographs demonstrating environmental procedures. Provide photographs for each month in a separate monthly directory and name each file to indicate its location on the view location sketch. Also provide the view location sketch with the submission in the agency construction management system of record as a digital file. Include a date designator in file

names. Photographs provided are for unrestricted use by the Government.

1.5 MINIMUM INSURANCE REQUIREMENTS

Provide the minimum insurance coverage required by FAR 28.307-2 Liability, during the entire period of performance under this contract. Provide other insurance coverage as required by New Jersey State law and 52.228-5 - Insurance - Work on a Government Installation.

a. Before commencing work under this contract, the Contractor must notify the Contracting Officer in writing that the required insurance has been obtained. The policies evidencing required insurance must contain an endorsement to the effect that cancellation or material change adversely affecting the Government's interest cannot be effective for such a period as may be prescribed by the laws of the State in which this contract is to be performed and in no event less than 30 days after written notice thereof to the Contracting Officer.

b. The Contractor must insert the substance of this clause, including this paragraph (b), in subcontracts under this contract that require work on a Government installation and must require subcontractors to provide and maintain the insurance required in the Schedule or elsewhere in the contract. The Contractor must maintain a copy of all subcontractors' proofs of required insurance, and must make copies available to the Contracting Officer upon request.

c. This insurance will be included at no additional cost to the government.

1.6 VETERANS EMPLOYMENT EMPHASIS FOR U.S. ARMY CORPS OF ENGINEERS CONTRACTS

In addition to complying with the requirements outlined in FAR Part 22.13, FAR Provision 52.222-38, FAR Clause 52.222-35, FAR Clause 52.222-37, DFARS 222.13 and Department of Labor regulations, U.S. Army Corps of Engineers (USACE) Contractors and subcontractors at all tiers are encouraged to promote the training and employment of U.S. veterans while performing under a USACE contract. While no set-aside, evaluation preference, or incentive applies to the solicitation or performance under the resultant contract, USACE Contractors are encouraged to seek out highly qualified veterans to perform services under this contract.

The following resources are available to assist USACE Contractors in their outreach efforts:

Federal Veteran employment information at
http://www.fedshirevets.gov/index.aspx
Department of Labor Veterans Employment Assistance
https://www.dol.gov/vets/
Department of Veterans Affairs-VOW to Hire Heroes Act
http://benefits.va.gov/vow/
Army Wounded Warrior Program-
http://wtc.army.mil/modules/employers/index.html
U.S. Chamber of Commerce Foundation-Hiring Our Heroes
http://www.hiringourheroes.org/

1.7 PROJECT MANAGER

Provide a Project Manager with minimum of 15 years of construction experience in similar size project as a project manager. Project manager

will serve as the Governments' sole point of contact in all matters relating to work including, but not limited to, contract compliance, progress of work, overall project scheduling, financial matters, and change orders. Performs all project management duties of the project and attend all job meetings. Individual must be on site a minimum of one days per week and authorized to negotiate changes. The Contracting Officer may request proof of the project manager's qualifications at any point in the project if the performance of the superintendent is in question.

Project manager must be capable of reading, writing, and conversing fluently in the English language.

1.8 SUPERVISION

1.8.1 Superintendent Qualifications

Provide project superintendent with a minimum of 10 years experience in construction with at least 5 of those years as a superintendent on projects similar in size and complexity. The individual must be familiar with the requirements of EM 385-1-1 and have experience in the areas of hazard identification and safety compliance. The individual must be capable of interpreting a critical path schedule and construction drawings. The qualification requirements for the alternate superintendent are the same as for the project superintendent. The Contracting Officer may request proof of the superintendent's qualifications at any point in the project if the performance of the superintendent is in question.

1.8.2 Minimum Communication Requirements

Have at least one qualified superintendent, or competent alternate, capable of reading, writing, and conversing fluently in the English language, on the job-site at all times during the performance of Contract work. In addition, if a Quality Control (QC) representative is required on the Contract, then that individual must also have fluent English communication skills.

1.8.3 Duties

The project superintendent is primarily responsible for managing subcontractors and coordinating day-to-day production and schedule adherence on the project. The superintendent is required to attend Red Zone meetings, partnering meetings, and quality control meetings. The superintendent or qualified alternative must be on-site at all times during the performance of this contract until the work is completed and accepted.

1.8.4 Non-Compliance Actions

The Project Superintendent is subject to removal by the Contracting Officer for non-compliance with requirements specified in the contract and for failure to manage the project to ensure timely completion. Furthermore, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders is acceptable as the subject of claim for extension of time or excess costs or damages by the Contractor.

1.9 SUPERINTENDENCE OF SUBCONTRACTORS

a. The Contractor shall be required to furnish the following, in addition to the superintendence required by the Contract Clause titled, "SUPERINTENDENCE BY THE CONTRACTOR".

(1) If more than 50% and less than 70% of the value of the contract work is subcontracted, one superintendent shall be provided at the site and on the Contractor's payroll to be responsible for coordinating, directing, inspecting and expediting the subcontract work.

(2) If 70% or more of the value of the work is subcontracted, the Contractor shall be required to furnish two such superintendents to be responsible for coordinating, directing, inspecting and expediting the subcontract work.

b. If the Contracting Officer, at any time after 50% of the subcontracted work has been completed, finds that satisfactory progress is being made, he may waive all or part of the above requirement for additional superintendence subject to the right of the Contracting Officer to reinstate such requirement if at any time during the progress of the remaining work he finds that satisfactory progress is not being made.

1.10 PRECONSTRUCTION CONFERENCE

prior to commencing any work at the site, coordinate with the Contracting Officer a time and place to meet for the Preconstruction Conference. The purpose of this conference is to discuss and develop a mutual understanding of the administrative requirements of the Contract including but not limited to: daily reporting, invoicing, value engineering, safety, base-access, outage requests, hot work permits, schedule requirements, quality control, schedule of prices or earned value report, shop drawings, submittals, cybersecurity, prosecution of the work, government acceptance, final inspections and contract close-out. Contractor must present and discuss their basic approach to scheduling the construction work and any required phasing.

The Contractor must provide at this conference the following items as indicated:

a. Initial Project Schedule; Section 01 32 01.10 18 PROJECT SCHEDULE - MILCON.

b. Accident Prevention Plan (APP); Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS.

c. Contractor Quality Control (CQC) Plan; Section 01 45 00 QUALITY CONTROL.

d. List of Contact Personnel; Section 01 14 00 WORK RESTRICTIONS.

e. Letter appointing Superintendent.

1.10.1 Attendees

Contractor attendees must include the Project Manager, Superintendent, Site Safety and Health Officer (SSHO), Quality Control Manager and major subcontractors.

1.11 FACILITY TURNOVER PLANNING MEETINGS (Red Zone Meetings)

Meet with the Government to identify strategies to ensure the project is carried to expeditious closure and turnover to the Client. Start planning the turnover process at the Pre-Construction Conference meeting with a discussion of the Red Zone process and convene at regularly scheduled Red Zone Meetings beginning at approximately 75 percent of project completion. Include the following in the facility Turnover effort:

1.11.1 Red Zone Checklist

a. Contracting Officer's Technical Representative (COTR) will provide the Contractor a copy of the Red Zone Checklist template.

b. Prior to 75 percent completion, modify the Red Zone Checklist template by adding or deleting critical activities applicable to the project and assign planned completion dates for each activity. Submit the modified Red Zone Checklist to the Contracting Officer. The Contracting Officer may request additional activities be added to the Red Zone Checklist at any time as necessary.

1.11.2 Meetings

a. Conduct regular Red Zone Meetings beginning at approximately 75 percent project completion, or three to six months prior to Beneficial Occupancy Date (BOD), whichever comes first.

b. The Contracting Officer will establish the frequency of the meetings, which is expected to increase as the project completion draws nearer. At the beginning, Red Zone meetings may be every two weeks then increase to weekly towards the final month of the project.

c. Using the Red Zone Checklist as a Plan of Action and Milestones (POAM) and basis for discussion, review upcoming critical activities and strategies to ensure work is completed on time.

d. During the Red Zone Meetings discuss with the COTR any upcoming activities that require Government involvement.

e. Maintain the Red Zone Checklist by documenting the actual completion dates as work is completed and update the Red Zone Checklist with revised planned completion dates as necessary to match progress. Distribute copies of the current Red Zone Checklist to attendees at each Red Zone Meeting.

1.12 SUBMISSION OF CLAIMS

The following must be submitted to the Contracting Officer at the following address: U.S. Army Corps of Engineers, Room 16-300, New York District, 26 Federal Plaza, New York, New York 10278-0090:

a. Claims referencing or mentioning the Contracting Disputes Act of 1978.

b. Requests for a written decision by the Contracting Officer.

c. Claims certified in accordance with the Contract Disputes Act of 1978.

No other Government representative is authorized to accept such requests.

A copy must also be provided to the Authorized Representative of the Contracting Officer.

Provide the Contracting Officer with a copy of any requests for additional time, money or interpretation of contract requirements which were provided to the Authorized Representative of the Contracting Officer and which have not been resolved after 90 days.

1.13 (S-102) CONTRACTOR SUPPLY and USE OF ELECTRONIC SOFTWARE FOR PROCESSING DAVIS-BACON ACT CERTIFIED LABOR PAYROLLS (April 2011)

The Contractor is encouraged to use a commercially-available electronic system to process and submit certified payrolls electronically to the Government. The requirements for preparing, processing and providing certified labor payrolls are established by the Davis-Bacon Act as stated in FAR 52.222-8, PAYROLLS AND BASIC RECORDS and FAR 52.222-13, COMPLIANCE WITH DAVIS-BACON AND RELATED ACT REGULATIONS.

If the Contractor elects to use an electronic Davis-Bacon payroll processing system, then the Contractor must be responsible for obtaining and providing for all access, licenses, and other services required to provide for receipt, processing, certifying, electronically transmitting to the Government, and storing weekly payrolls and other data required for the Contractor to comply with Davis-Bacon and related Act regulations. When the Contractor uses an electronic Davis-Bacon payroll system, the electronic payroll service shall be used by the Contractor to prepare, process, and maintain the relevant payrolls and basic records during all work under this construction contract and the electronic payroll service must be capable of preserving these payrolls and related basic records for the required three years after contract completion. If the Contractor chooses to use an electronic Davis-Bacon payroll system, then the Contractor must obtain and provide electronic system access to the Government, as required to comply with the Davis-Bacon and related Act regulations over the duration of this construction contract. The access must include electronic review access by the Government contract administration office to the electronic payroll processing system used by the Contractor.

The Contractor's provision and use of an electronic payroll processing system must meet the following basic functional criteria: Commercially available; compliant with appropriate Davis Bacon Act payroll provisions in the FAR; able to accommodate the required numbers of employees and subcontractors planned to be employed under the contract; demonstrated security of data and data entry rights; ability to produce Contractor-certified electronic versions of weekly payroll data; ability to identify erroneous entries and track the data/time of all versions of the certified Davis Bacon payrolls submitted to the Government over the life of the contract; capable of generating a durable record copy, that is, a CD or DVD and PDF file record of data from the system database at end of the contract closeout. This durable record copy of data from the electronic Davis-Bacon payroll processing system must be provided to the Government during contract closeout.

All Contractor-incurred costs related to the Contractor's provision and use of an electronic payroll processing service must be included in the Contractor's price for the overall work under the contract. The costs for Davis-Bacon Act compliance using electronic payroll processing services must not be a separately bid/proposed or reimbursed item under this contract.

1.14 DESIGNATION OF PROPERTY ADMINISTRATOR

The Chief, Property and Accounting Section, U.S. Army Engineer District, New York, Federal Building, 26 Federal Plaza, New York, N.Y. 10278-0090 is designated as Property Administrator, in connection with this contract.

1.15 PARTNERING

To most effectively accomplish this Contract, the Contractor and Government must form a cohesive partnership with the common goal of drawing on the strength of each organization in an effort to achieve a successful project without safety mishaps, conforming to the Contract, within budget and on schedule. The partnering team must consist of personnel from both the Government and Contractor including project level and corporate level leadership positions. Key Personnel from the supported command, end user, , Contractor, key subcontractors and the Designer of Record (DOR) (regardless of whether the contract is a design-build or a design-bid-build) are required to participate in the Partnering process.

1.15.1 Facilitated (Formal) Partnering

a. Within 35 calendar days after award and prior to the start of work, host a Formal Partnering session with key personnel from the project team including both Contractor and Government personnel. All costs associated with the Partnering session including the third-party independent Facilitator Consultant, meeting room and other incidental items are the responsibility of the Contractor.

b. Before the Facilitated (Formal) Partnering session, coordinate with the Facilitator all requirements for incidental items (such as audio-visual equipment, easels, flipchart paper, colored markers, note pads, pens/pencils, colored flash cards) and have these items available at the Partnering session. Provide copies of any documents required for distribution to all attendees. Participants will bear their own costs for meals, lodging and transportation associated with Partnering.

c. The Initial Partnering Session must be a duration of one day and be held at a location off base as agreed to by the Contracting Officer. Partnering session may take place concurrently with the Meeting.

d. Facilitator must be experienced in conducting corporate Partnering sessions and must be a third-party independent facilitating consultant - not an employee of the Contractor. The Facilitator is responsible for leading all aspects of the Partnering session necessary to achieve the Partnering goal.

e. An outcome of the Partnering session must be an escalation matrix and developing a Construction Joint Risk Register agreed upon by both the Government and Contractor, which identifies key Government and Contractor decision makers by name and anticipated decision durations.

f. Host follow-on Partnering Sessions at three- to six-month intervals or more frequently if needed and lasting generally a half day or less. Attendees need only be those required to resolve current issues. The same Facilitator used in the Initial Partnering session must lead the follow-on sessions unless an alternative is permitted by the

Contractor Officer. All costs associated with follow-on Partnering sessions are the responsibility of the Contractor.

g. Provide a completed partnering agreement to all participants within 30 days of partnering session.

1.16 ELECTRONIC MAIL (E-MAIL) ADDRESS

Establish and maintain electronic mail (e-mail) capability along with the capability to open various electronic attachments as text files, pdf files, and other similar formats. Within 10 days after contract award, provide the Contracting Officer a single (only one) e-mail address for electronic communications from the Contracting Officer related to this contract including, but not limited to contract documents, invoice information, request for proposals, and other correspondence. The Contracting Officer may also use email to notify the Contractor of base access conditions when emergency conditions warrant, such as hurricanes or terrorist threats. Multiple email addresses are not allowed.

It is the Contractor's responsibility to make timely distribution of all Contracting Officer initiated e-mail with its own organization including field office(s). Promptly notify the Contracting Officer, in writing, of any changes to this email address.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 GENERAL MEETING REQUIREMENTS

3.1.1 Preparatory and Initial Phase meeting checklists

See Section 01 45 00 QUALITY CONTROL for Preparatory and Initial Phase meeting checklists. Contractor is responsible for phase and progress meetings to include:

a. Meeting notification to participants

b. Prepare agenda for meetings

c. Use phase checklists for Preparatory and Initial Phase meetings

d. Physical arrangements for meetings

e. Preside at meetings

f. Record minutes recording proceedings and decisions

g. Copy and send minutes to:

(1) Meeting participants

(2) Project parties affected by decisions

(3) Contracting Officer (No later than 3 working days)

3.1.2 Weekly Progress Meetings Agenda

See section 01 32 01.10 18 PROJECT SCHEDULE - MILCON for the weekly progress meeting. Modify agenda as needed for on-going work.

a. Review minutes from previous progress meetings

b. Review RMS CM Contractor Action Item Report

c. Review work progress since previous meeting

d. Review current definable features of work:

-- Identify phases of current features of work

-- Identify pending phase changes

-- Identify features for discussion in next scheduled meeting

e. Discuss problem prevention:

(1) Field observations

(2) Deficiencies and tracking

(3) Procedures working well

(4) Problems, conflicts

(5) Methods to improve

f. Review construction schedule:

(1) Identify delays

(2) Discuss proposed corrective actions to regain schedule

g. Submittals and Requests for Information (design interpretation):

(1) Review submittal register

(2) Identify submittals to expedite as required

h. Review off-site activities:

(1) Fabrications

(2) Material and equipment delivery schedule

i. Review Testing:

(1) Type, Schedule

(2) Received Results

j. Review changes to construction schedule:

(1) Planned progress during succeeding work period

(2) Coordination of various schedules

(3) Effect of changes on construction and completion date

k. Review site safety

l. Discuss maintaining contract quality for materials and workmanship

m. Discuss pending modifications, changes and substitutions

n. Discuss other business, as appropriate

-- End of Section --

SECTION 01 32 01.10 18

PROJECT SCHEDULE - MILCON
08/23, CHG 1: 08/24

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AACE INTERNATIONAL (AACE)

AACE 29R-03	(2011) Forensic Schedule Analysis
AACE 52R-06	(2006) Time Impact Analysis - As Applied in Construction
AACE 84R-13	(2015) Planning and Accounting for Adverse Weather

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 67-17	(2017) Schedule Delay Analysis

U.S. ARMY CORPS OF ENGINEERS (USACE)

ER 1-1-11	(2017) Administration -- Project Schedules

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Project Scheduler Qualifications; G, RO

Preliminary Project Schedule; G, RO

Initial Project Schedule; G, RO

Periodic Schedule Update; G, RO

1.3 PROJECT SCHEDULER QUALIFICATIONS

Submit scheduler qualifications to Government for review and rejection or approval. Designate an authorized scheduler to be responsible for the preparation of the schedule and all required updating and production of reports. The authorized representative must have a minimum of 5-years experience scheduling construction projects similar in size and nature to

this project with scheduling software that meets the requirements of this specification. The scheduler must have extensive comprehensive knowledge of CPM scheduling, principles, application, and obtain the skill/knowledge on following and adhering to this Contract, specification and drawing.

The Designated Project Scheduler must have prepared and maintained at least five previous construction schedules of similar size and complexity to this Contract, utilizing the most recent version of Oracle Primavera P6. During the entire Contract duration, the Government may require the Project Scheduler to be present at the contractor's project site office/trailers as often as needed to develop, maintain and provide the Government with a fully completed detail status-to-date schedule.

Scheduler is to obtain the sole project responsibilities of schedule updates, status, perform maintenance, query & forward weekly-monthly reports and maintain detail healthy schedules on a weekly and monthly basis. This sole responsibility is not to be shared with other project roles and responsibilities.

PART 2 PRODUCTS

2.1 SOFTWARE

Primavera P6 will be the scheduling software utilized to produce and update the schedules required herein must be capable of meeting all requirements of this specification.

2.1.1 Government Default Software

The Government utilizes recent version of Primavera P6.

2.1.2 Contractor Software

The version of Primavera P6 scheduling software used by the contractor must be commercially available from the software vendor for purchase with vendor software support agreements available. One of many uses of the software is to routinely create the required SDEF file, which must be created and supported by the software manufacturer.

2.1.2.1 Primavera

Primavera P6 must provide the "xer" export file in a version of P6 importable by the Government system. Consult with the Government for version verification. Verify at the SEKO meeting which version of P6 is in use by the Government. Export the schedule in a version of P6 no newer than that used by the Government.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

All schedules will achieve 100% Project Controls for all parties, throughout the entire project duration. All Permits, regardless of whom is the responsible party, must be captured and started on the NTP date. On-site work will begin at time Government Approval received of both the Preliminary schedule. Work will continue at time Government Approves the

Initial Baseline Schedule.

Preliminary schedule is due within 15 calendar days of contractor signed Notice To Proceed. Initial Baseline schedule is due within 42 calendar days of contractor has signed Notice To Proceed.

Prepare for approval detailed Project Schedules, as specified herein, pursuant to FAR Clause 52.236-15 Schedules for Construction Contracts. Show in the detail schedules the accurate sequence to perform the work and dates contemplated for starting and completing all schedule activities. The scheduling, status, updates and maintenance of the entire project for the entire duration is required.

The scheduling and weekly status, updating and maintenance of project is the responsibility of the Contractor, to be reviewed, commented, rejected or approved by the Government. Contractor management personnel must actively participate in its development. Subcontractors and suppliers working on the project must also contribute with developing and maintaining an accurate Project Schedule. Provide a schedule that is a forward planning as well as a project monitoring tool. Use the Critical Path Method (CPM) of network calculation to generate all Project Schedules. Prepare each Project Schedule using the Precedence Diagram Method (PDM).

Throughout the entire project duration of the project, monthly schedule submissions are due on the first of each month, regardless of progress performance percentage. Throughout the project duration, at Governments direction submit a detail recovery or re-baseline schedule with in 10 calendar days.

3.1.1 Scheduling Expectations Kickoff Meeting(SEKO)

Weeks prior, at the very latest on the day of signed NTP, the Government and the Contractor will hold a separate, and distinct Scheduling Expectations Kickoff Meeting (SEKO). The objective of this meeting is for the Government to review with the contractor the requirements of the scheduling specification, communicate the Government's expectations regarding detail schedule development, submissions, and management, project controls, status, updates, maintenance, and answer any questions the Contractor may have regarding the schedule requirements. Consult with the Government for project template(s).

3.1.2 Project Schedules

Submit separate Detail Preliminary, Initial Baseline and Monthly Project Schedules. Detail Preliminary Schedule is due within 15 calendars day of signed NTP Acknowledgement.

Detail Initial Baseline Schedule is due within 42 calendar days of signed NTP Acknowledgement. Throughout the entire duration of the project schedules are to be updated, status and maintained on a weekly basis. Periodic schedule updates are due on the first of each month. Consult with the Government with questions.

3.1.3 Approved Project Schedule

Use the Government Approved Project Schedule to accurately measure the

progress of the work and aid in evaluating time extensions, and to provide the basis of all progress payments. Develop the detail schedule realistically-accurately, cost load solely on-site physical work activities and activity associate schedule data.

The schedule will provide the basis for all progress payments. When Contractor fails to submit schedules within the time prescribed, the Contracting Officer will withhold approval of progress payments until the Contractor submits the required schedule.

3.1.4 Schedule Status Reports

Provide and perform Schedule Updates and Status Report(s) weekly and monthly. If in the opinion of the Contracting Officer, the Contractor falls behind the approved schedule, within 3 calendar days the Contractor must take steps necessary to improve its progress, without additional cost to the Government. In this circumstance, the Contracting Officer will require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction planned, resources and to submit for approval a supplementary/recovery/re-baseline schedule. The Contracting Officer will have the final decision on which methods will be utilized.

3.1.5 Default Terms

Failure of the Contractor to comply with the requirements of this Contract will be grounds for a determination by the Contracting Officer that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the Contract. Upon making this determination, the Contracting Officer will terminate the Contractor's right to proceed with the work, or separable parts of it, in accordance with the default terms of the Contract.

3.1.6 Adhering to Contract Documents

Review comments made by the Government and any other parties on the detail creation, development, status, update, maintenance of all schedules do not relieve the Contractor from compliance with requirements of these Contract Documents.

3.2 BASIS FOR PAYMENT AND COST LOADING

The detailedschedule is the basis for determining contract earnings during each update period and therefore the amount of each progress payment. The aggregate value of all activities coded to a contract CLIN must equal the value of the CLIN. Match the progress payment "Pay Period Thru" date in RMS to the schedule data date.

3.2.1 Activity Cost Loading

Cost load solely end of each Design Package at time Government Approves. Example: Govt Approval Received 30% Design, is to be cost loaded 30% of total design cost, Govt Approval Received 60% Design Package, is to be cost loaded additional 30% of total design cost, equaling 60% of total design cost, same cost loading requirement for each design package.

Cost load solely on-stie physical work activities. Activity cost loading must be reasonable, realistic, accurate and without any form of front-end

loading. As directed from a Contracting Officer, within two calendar days provide additional documentation to demonstrate cost accuracy. Activities with a negative cost loading is not allowed.

Testing activities must be cost loaded. Testing and Close-Out activities will be 100% paid at 100% complete.

Do not include field overhead positions as individual pay items. Evenly disperse overhead costs and profit to each activity over the duration of the project.Activities such as General Conditions or similar, are prohibited from obtaining cost.

It is the discretion of the Government of which activities are to be cost loaded. Cost of activities will be reviewed, rejected or approved by the Government. When directed by the Government contractor must apply and or reallocate activity cost appropriately.

3.2.2 Drawings Activities

Layout, Shop, Schematic and Coordination drawings activities are prohibited from cost loading. Drawings activities are paid with the associated on-site physical work activity.

3.2.3 Mobilization and Demobilization Cost

Under a separate WBS for each Mobilization and Demobilization include detail activities with reasonable. Realistic and accurate cost. Not all activities will obtain cost. Front-end loading is prohibited. Provide the Government with detail documentation and cost of Mobilization and Demobilization prior to submitting a Preliminary Schedule.

3.2.4 Cost Loading Testing Activities

Systems where Testing and Approvals are required must be cost loaded no less than 5 percent of the procurement and install cost.

Activity(ies) for "Government Approval Received Final Testing Report" shall be valued no less than $50,000.00.

3.2.5 Cost Loading of Submittals

No costs are to be assigned to activities for the preparation, review, or approval of submittals, except as described under paragraph COST LOADING OF CLOSEOUT ACTIVITIES, paragraph AS-BUILT DRAWINGS, and paragraph O&M MANUALS.

3.2.6 Withholdings / Payment Rejection

Failure to meet the requirements of this specification may result in the disapproval of the preliminary, initial, or periodic schedule updates and subsequent rejection of payment requests until compliance is met.

In the event that the Contracting Officer directs schedule revisions and those revisions have not been included in subsequent Project Schedule revisions or updates, the Contracting Officer may withhold 10 percent of pay request amount from each payment period until such revisions to the

project schedule have been made.

3.3 PROJECT SCHEDULE DETAILED REQUIREMENTS

3.3.1 Level of Detail Required

Develop the Project Schedule to the appropriate level of detail to address major milestones and to allow for satisfactory project planning and execution. Failure to develop the Project Schedule to an appropriate and accurate level of detail will result in its disapproval. The Contracting Officer will consider, but is not limited to, the following characteristics and requirements to determine appropriate level of detail:

3.3.2 Activity Durations

Reasonable activity durations are those that allow the progress of ongoing activities to be accurately determined between update periods. Non-procurement activities Original Durations (OD) are not to exceed 20 workdays or 30 calendar days.

Activity Durations are consecutive workdays. The use of sporadic, random and start-stop-restart logic are prohibited. At time of activity start, contractor is to adhere to baseline original durations.

Float does not extend activity original durations. Activities where actual durations have exceeded original duration will required to be split/separated, including cost, duration and associated activity data.

3.3.3 Procurement Activities

Regardless of the responsible party all long lead activities must be captured in the Preliminary and Initial Baseline schedules, 30 to 40 calendar days after signed NTP. Examples: Generators, Electrical Panels, Transformer, Switchgear, HVAC Equipment, Custom manufactured, fabricated materials, items, components, machinery and others as project requires. Include in the schedule activities associated with the critical submittals and their approvals, procurement, fabrication, and delivery of long lead materials, equipment, fabricated assemblies, and supplies. Critical activities are to be identified, captured in all schedules. Long lead procurement activities are those with an anticipated procurement sequence of over 90 calendar days.

3.3.4 Mandatory Activities

Include the following activities in the initial project schedule and all updates. Lumping or nesting of more than one activity is prohibited.

a. Submission, review and acceptance of SD-01 Preconstruction Submittals (individual activity for each).

b. Submission, review and acceptance of features requiring design completion

c. Submission of mechanical/electrical/information systems layout drawings.

d. Submission and approval of O & M manuals.

e. Submission and approval of as-built drawings.

f. Submission and approval of DD1354 data and installed equipment lists.

g. Submission and approval of testing and air balance (TAB).

h. Submission of TAB specialist design review report.

i. Submission and approval of fire protection specialist.

j. Submission and approval of Building Commissioning Plan, Controls testing plan, test data, and reports: Develop the schedule logic associated with testing and commissioning of mechanical systems to a level of detail consistent with the contract commissioning requirements. All tasks associated with building testing and commissioning will be completed prior to submission of building commissioning report and subsequent contract completion.

   These activities may include but are not limited to: air and water balancing, building commissioning -functional performance testing, controls testing, and performance verification testing. Include other systems testing, if required. Include additional commissioning requirements noted elsewhere in the Contract as required in the schedule and discuss during the SEKO meeting, noted in paragraph SCHEDULING EXPECTATIONS KICKOFF MEETING (SEKO).

k. Contractor's pre-final inspection.

l. Correction of punch list from Contractor's pre-final inspection.

m. Government's pre-final inspection.

n. Correction of punch list from Government's pre-final inspection.

o. Final inspection.

p. All Sub-Contractor Buy-outs activities

q. Submission, Review, and Approval activities of the Preliminary and Initial Baseline schedules.

r. Required meetings, conferences, and including 3-Phase Preparatory Meetings.

3.3.5 Government Activities

Show in schedule, Government and other agency activities that could impact progress. These activities include, but are not limited to approvals, environmental permit approvals by State regulators, inspections, utility tie-in, Government Furnished Equipment (GFE) and Notice to Proceed (NTP) for phasing requirements.

3.3.6 Standard Activity Coding Dictionary

Use the activity coding structure defined in the Standard Data Exchange Format (SDEF) in ER 1-1-11. This exact structure is mandatory. Develop and assign all Activity Codes to activities as detailed herein.

The SDEF format is as follows:

Field	Activity Code	Length	Description
1	WRKP	3	Workers per day
2	RESP	4	Responsible party
3	AREA	4	Area of work
4	MODF	6	Modification Number
5	BIDI	6	Bid Item (CLIN)
6	PHAS	2	Phase of work
7	CATW	1	Category of work
8	FOW	20	Feature of work*

*Some systems require that FEATURE OF WORK values be placed in several activity code fields. The notation shown is for Primavera P6. Refer to the specific software guidelines with respect to the FEATURE OF WORK field requirements.

3.3.6.1 Workers Per Day (WRKP)

Assign Workers per Day for all field construction or direct work activities, if directed by the Contracting Officer. Workers per day is based on the average number of workers expected each day to perform a task for the duration of that activity.

3.3.6.2 Responsible Party Coding (RESP)

Assign responsibility code for all activities to the Prime Contractor, Subcontractor(s) or Government agency(ies) responsible for performing the activity.

a. Activities coded with a Government Responsibility code include, but are not limited to: Government approvals, Government design reviews, environmental permit approvals by State regulators, Government Furnished Property/Equipment (GFP) and Notice to Proceed (NTP) for phasing requirements.

b. Activities cannot have more than one Responsibility Code. Examples of acceptable activity code values are: DOR (for the designer of record); ELEC (for the electrical subcontractor); MECH (for the mechanical subcontractor); and GOVT (for USACE).

3.3.6.3 Area of Work Coding (AREA)

Assign Work Area code to activities based upon the work area in which the activity occurs. Define work areas based on resource constraints or space constraints that would preclude a resource, such as a particular trade or craft work crew from working in more than one work area at a time due to restraints on resources or space. Examples of Work Area Coding include different areas within a floor of a building, different floors within a

building, and different buildings within a complex of buildings. Activities cannot have more than one Work Area Code.

3.3.6.4 Modification Number (MODF)

Assign a Modification Number Code to any activity or sequence of activities added to the schedule as a result of a Contract Modification, when approved by Contracting Officer. Key all Code values to the Government's modification numbering system. An activity can have only one Modification Number Code.

3.3.6.5 Bid Item Coding (BIDI)

Assign a Bid Item Code to all activities using the Contract Line Item Number (CLIN) to which the activity belongs, even when an activity is not cost loaded. An activity can have only one BIDI Code.

3.3.6.6 Phase of Work Coding (PHAS)

Assign Phase of Work Code to all activities. Examples of phase of work are procurement phase and construction phase. Each activity can have only one Phase of Work code.

a. Code proposed fast track design and construction phases proposed to allow filtering and organizing the schedule by fast track design and construction packages.

b. If the contract specifies phasing with separately defined performance periods, identify a Phase Code to allow filtering and organizing the schedule accordingly.

3.3.6.7 Category of Work Coding (CATW)

Assign a Category of Work Code to all activities. Category of Work Codes include, but are not limited to construction submittal, procurement, fabrication, weather sensitive installation, non-weather sensitive installation, start-up, and testing activities. Each activity can have no more than one Category of Work Code.

3.3.6.8 Feature of Work Coding (FOW)

Assign a Feature of Work Code to appropriate activities based on the Definable Feature of Work to which the activity belongs based on the approved QC plan.

Definable Feature of Work is defined in Section 01 45 00 QUALITY CONTROL. An activity can have only one Feature of Work Code.

3.3.7 Contract Milestones and Constraints

Milestone activities are to be used for significant project events including, but not limited to, project phasing, project start and end activities, or interim completion dates. The use of artificial float constraints such as "zero free float" or "zero total float" are prohibited.

Mandatory constraints that ignore or affect network logic are prohibited. No constrained dates are allowed in the schedule other than those specified herein. Submit additional constraints to the Contracting

Officer for approval on a case by case basis.

3.3.7.1 Project Start Date Milestone and Constraint

The first activity in the project schedule must be a start milestone titled "NTP Acknowledged," which must have a "Start On" constraint date equal to the date that the NTP is acknowledged.

3.3.7.2 End Project Finish Milestone and Constraint

The last activity in the schedule must be a finish milestone titled "End Project." Must be a "Finish On" constraint date.

Constrain the project schedule to the Contract Completion Date in such a way that if the schedule calculates an early finish, then the float calculation for "End Project" milestone reflects positive float on the longest path. If the project schedule calculates a late finish, then the "End Project" milestone float calculation reflects negative float on the longest path.

3.3.7.3 Interim Completion Dates and Constraints

Constrain contractually specified interim completion dates to show negative float when the calculated late finish date of the last activity in that phase is later than the specified interim completion date.

3.3.7.3.1 Start Phase

Use a start milestone as the first activity for a project phase. Call the start milestone "Start Phase X" where "X" refers to the phase of work.

3.3.7.3.2 End Phase

Use a finish milestone as the last activity for a project phase. Call the finish milestone "End Phase X" where "X" refers to the phase of work.

3.3.8 Adverse Weather

Ensure anticipated adverse weather is accounted for in the Project Schedule. AACE 84R-13 provides methodologies for techniques in planning for adverse weather. The preferred methodology is the use of a weather calendar. If a method other than a weather calendar is proposed, discuss the reason during the SEKO meeting.

3.3.9 Calendars

Schedule activities on a Calendar to which the activity logically belongs. Develop calendars to accommodate any contract defined work period such as a 7-day calendar for Government Acceptance activities, concrete cure times, etc. Develop the default Calendar to match the physical work plan with non-work periods identified including weekends and holidays. Develop Seasonal Calendar(s) and assign to seasonally affected activities as applicable. Minimum three calendars required: 7 workdays without holidays and weather days, 5 workdays with holidays, 5 workdays with holiday and weather days. Utilize additional calendars as project requires.

If a weather calendar is used its implementation and execution is to be in accordance with AACE 84R-13

3.3.10 Open Ended Logic

Only two open ended activities are allowed: the first activity "NTP Acknowledged" is to have no predecessor logic, and the last activity -"End Project" is to have no successor logic. Except as noted above, each activity must have at least a start-to-start or finish-to-start relationship with its predecessor and a finish-to-finish or finish-to-start relationship with its successor.

Predecessor open ended logic may be allowed in a time impact analyses upon the Contracting Officer's approval.

3.3.11 Default Progress Data Disallowed

Actual Start and Finish dates must not automatically update with default mechanisms included in the scheduling software. Updating of the percent complete and the remaining duration of any activity must be independent functions. Disable program features that calculate one of these parameters from the other. Activity Actual Start (AS) and Actual Finish (AF) dates assigned during the updating process must match those dates provided in the Contractor Quality Control Reports. Failure to document the AS and AF dates in the Daily Quality Control report will result in disapproval of the Contractor's schedule.

3.3.12 Out-of-Sequence Progress

Activities that have progressed before all preceding logic has been satisfied (Out-of-Sequence Progress) will be allowed only on a case-by-case basis subject to approval by the Contracting Officer. Propose logic corrections to eliminate out of sequence progress or justify not changing the sequencing for approval prior to submitting an updated project schedule. Address out of sequence progress or logic changes in the Narrative Report and in the periodic schedule update meetings.

3.3.13 Added and Deleted Activities

Do not delete activities from the project schedule or add new activities to the schedule without approval from the Contracting Officer. Activity ID and description changes are considered new activities and cannot be changed without Contracting Officer approval.

3.3.14 Original Durations

Activity Original Durations (OD) must be reasonable to perform the work item. OD changes are prohibited unless justification is provided and approved by the Contracting Officer.

All Original Duration are consecutive workdays. The use of sporadic, random, start-stop-restart-etc Original Durations are prohibited. Float does not extend Original Durations. Activities where the Actual Duration has exceeded the Original Duration will be split / separated into two more additional activities, to include Duration, cost and associated data.

3.3.15 Leads, Lags, and Start to Finish Relationships

Lags are not to be used unless approved by the Government on a case-by-case basis prior to incorporating the schedules. Lags must be reasonable as determined by the Government and not used in place of

realistic original durations, must not be in place to artificially absorb or create float, or to replace proper schedule logic.

a. Leads (negative lags) are prohibited.

b. Start to Finish (SF) relationships are prohibited.

3.3.16 Retained Logic

Schedule calculations must retain the logic between predecessors and successors ("retained logic" mode) even when the successor activity(s) starts and the predecessor activity(s) has not finished (out-of-sequence progress). Software features that in effect sever the tie between predecessor and successor activities when the successor has started and the predecessor logic is not satisfied ("progress override") are not be allowed.

3.3.17 Percent Complete

Update the percent complete for each activity started, based on the realistic assessment of earned value. Activities which are complete but for remaining minor punch list work and which do not restrain the initiation of successor activities may be declared 100 percent complete to allow for proper schedule management. Budgeted cost of activity is to be reduced by the amount needed to correct deficiency. The activity referenced in paragraph COST LOADING of CLOSEOUT ACTIVITIES must have its budgeted cost increased by this amount.

3.3.18 Remaining Duration

Update the remaining duration for each activity based on the number of estimated workdays it will take to complete the activity. Remaining duration may not mathematically correlate with percentage found under paragraph entitled Percent Complete. The remaining duration for unstarted activities are not to be less than its orginal duration.

3.3.19 Cost Loading of Closeout Activities

Cost load the "Correction of punch list from Government pre-final inspection" activity(ies) not less than 1 percent of the present contract value. Activity(ies) may be declared 100 percent complete upon the Government's verification of completion and correction of all punch list work identified during Government pre-final inspection(s).

3.3.19.1 As-Built Drawings

If there is no separate contract line item (CLIN) for as-built drawings, cost load the "Submission and approval of as-built drawings" activity not less than $35,000 or 1 percent of the present contract value, which ever is greater, up to $200,000. Activity will be declared 100 percent complete upon the Government's approval.

3.3.19.2 O & M Manuals

Cost load the "Submission and approval of O & M manuals" activity not less than $20,000. Activity will be declared 100 percent complete upon the Government's approval of all O & M manuals.

3.3.20 Early Completion Schedule and the Right to Finish Early

An Early Completion Schedule is an Initial Project Schedule (IPS) that indicates all scope of the required contract work will be completed before the contractually required completion date.

a. No IPS indicating an Early Completion will be accepted without being fully resource-loaded (including crew sizes and hours) and the Government agreeing that the schedule is reasonable and achievable.

b. The Government is under no obligation to accelerate work items it is responsible for to ensure that the early completion is met nor is it responsible to modify incremental funding (if applicable) for the project to meet the contractor's accelerated work.

3.3.21 Activity Grouping, Lumping, Combining, Nesting

Activities are prohibited from Grouping, Lumping, Combining, and Nesting. Refrain from listing a single high-level activity in place of two or more activities. Example: Forming, Tie of Rebar, Pouring and Curing are 4 separate activities.

3.3.22 WBS and Activities

WBS (Work Breakdown Structure) is to be detailed. Fifteen or less activities per WBS. Greater than fifteen activities will require Contracting Officer Approval and are not to exceed fifteen activities. Utilize work Area, Section, Sub-section, Sectors locations to properly WBS and Activity(ies) exact location.

3.3.23 Activity Excessive Actual Durations

Activity Actual Duration greater than Original Duration must be divided into separate activities. Divide activity Original Duration, cost and associated data. Newly separated activities are to be added to the Approved Baseline schedule. Resubmit Baseline schedule for Contracting Officer Approval.

3.3.24 Activity Actual Start

The Actual Start of activities for the sole purpose of collecting the cost of the material is prohibited. Material is paid at time of install is in progress and verified.

3.3.25 Activity Early Start and Late Start

Notify the Government of Early Start(s). Prior to an early start, the activity must have all resources readily available. Activity early start does not extend the original duration and must maintain the baseline schedule original durations.

Notify the Government of Late Start(s). Prior to a late start, the activity must have all resources readily available.

Activity start date, float does not extend baseline specified Original Durations. The activity must maintain the baseline schedule's original duration.

3.4 PROJECT SCHEDULE SUBMISSIONS

Provide the submissions as described below. The data reports and network diagrams required for each submission are contained in paragraph SUBMISSION REQUIREMENTS. If the Contractor fails or refuses to furnish the information and schedule updates as set forth herein, the Contractor will be deemed not to have provided an estimate upon which a progress payment can be made.

Review comments made by the Government on the schedule(s) do not relieve the Contractor from compliance with requirements of the Contract Documents.

3.4.1 Preliminary Project Schedule Submission

Within 15 calendar days after the NTP is acknowledged, submit the Preliminary Project Schedule defining the planned operations detailed for the first 90 calendar days for review, rejection, or approval. Payments will begin at time Government Approves the Detail Preliminary Project Schedule. Only the approved Preliminary Project Schedule will be used for payment purposes not to exceed 90 calendar days after NTP. Completely cost load the Preliminary Project Schedule to balance the contract award CLINS shown on the Price Schedule. The Preliminary Project Schedule may be summary in nature for the remaining performance period. It must be early start and late finish constrained and logically tied as specified. The Preliminary Project Schedule forms the basis for the Initial Project Schedule specified herein and must include all of the required plan and program preparations, submissions and approvals identified in the contract (for example, Quality Control Plan, Safety Plan, and Environmental Protection Plan) as well as design activities, planned submissions of all early design packages, permitting activities, design review conference activities, and other non-construction activities intended to occur within the first 90 calendar days. Government acceptance of the associated design package(s) and all other specified Program and Plan approvals must occur prior to any planned construction activities. Code activities that are summary in nature, after the first 90 calendar days, with the following activity codes: Bid Item (CLIN) code (BIDI), Responsibility Code (RESP), and Feature of Work code (FOW)..

3.4.2 Initial Deatil Project Schedule Submission

Submit the Initial Project Schedule for approval within 42 calendar days after notice to proceed is issued. The schedule must demonstrate a reasonable and realistic sequence of activities which represent all work through the entire contract performance period. No payment will be made for work items not fully detailed in the Project Schedule.

3.4.3 Periodic Schedule Updates

Update the Project Schedule on a regular basis, monthly at a minimum. Provide a draft Periodic Schedule Update for review at the schedule update meetings as prescribed in the paragraph PERIODIC SCHEDULE UPDATE MEETINGS. These updates will enable the Government to assess Contractor's progress.

a. Update information including Actual Start Dates (AS), Actual Finish Dates (AF), Remaining Durations (RD), and Percent Complete. Updated information is subject to the approval of the Government at the meeting.

b. AS and AF dates must match the date(s) reported on the Contractor's Quality Control Report for an activity start or finish.

3.5 SUBMISSION REQUIREMENTS

Submit the following items for the Preliminary Schedule, Initial Schedule, and every Periodic Schedule Update throughout the life of the project:

3.5.1 Electronic Scheduling Data

Provide electronic scheduling data containing the current project schedule and all previously submitted schedules in the format of the scheduling software (e.g. .xer). Also include the Narrative Report and all required Schedule Reports. The electronic file is to identify the type of schedule (Preliminary, Initial, Update), full contract number, Data Date and schedule file name. Each schedule must have a unique file name and use project specific settings. The file naming convention is to be determined at SEKO meeting.

3.5.2 Narrative Report

Provide a Narrative Report with each schedule submission. Four copies of the schedules showing codes, values, categories, numbers, and other items, etc., as required. The Schedule Narrative Report is a "stand alone" report in PDF or Word format. Title the report "Schedule Narrative Report". Show the Report date, schedule name, and contract number on the first page. Indicate who is responsible for the schedule update and narrative report. Provide a brief description of the Project Scope. The Narrative Report is expected to communicate to the Government the thorough analysis of the schedule output and the plans to compensate for problems, either current or potential, which are revealed through that analysis. Include the following information at a minimum in the Narrative Report:

a. Identify and discuss the work scheduled to start in the next update period.

b. Describe activities along the critical path in addition to activities on the next float path after the critical path.

c. Describe current and anticipated problem areas, delaying factors and their impact, and an explanation of corrective actions taken or required to be taken. Identify the party responsible for delay, if applicable.

d. Identify and explain why activities, based on their calculated late dates, should have either started or finished during the update period but did not.

e. Identify and discuss all schedule changes by activity ID and activity name including what specifically was changed and why the change was needed. Include at a minimum new and deleted activities, logic changes, duration changes, calendar changes, lag changes, resource changes, and actual start and finish date changes.

f. Identify and discuss out-of-sequence work.

g. If the longest path changes from a monthly update to the next, provide an explanation of the factors driving the change.

h. Respond to USACE Schedule Review Comments from the previous update(s).

3.5.3 Schedule Reports

The format, filtering, organizing, and sorting for each schedule report will be as directed by the Contracting Officer. Typically, reports contain Activity Numbers, Activity Description, Original Duration, Remaining Duration, Early Start Date, Early Finish Date, Late Start Date, Late Finish Date, Total Float, Actual Start Date, Actual Finish Date, and Percent Complete. Provide the reports electronically in .pdf format. Provide three set(s) of hardcopy reports. The following lists typical reports that will be requested:

3.5.3.1 Activity Report

List of all activities sorted according to activity number.

3.5.3.2 Logic Report

List of detailed predecessor and successor activities for every activity in ascending order by activity number.

3.5.3.3 Total Float Report

A list of all incomplete activities sorted in ascending order of total float. List activities which have the same amount of total float in ascending order of Early Start Dates. Do not show completed activities on this report.

3.5.3.4 Earnings Report by CLIN

A compilation of the Total Earnings on the project from the NTP to the data date, which reflects the earnings of activities based on the agreements made in the schedule update meeting defined herein. Provided a complete schedule update has been furnished, this report serves as the basis of determining progress payments. Group activities by CLIN number and sort by activity number. Provide a total CLIN percent earned value, CLIN percent complete, and project percent complete. The printed report must contain the following for each activity: the Activity Number, Activity Description, Original Budgeted Amount, Earnings to Date, Earnings this period, Total Quantity, Quantity to Date, and Percent Complete (based on cost).

3.5.3.5 Scheduling and Leveling Report

Provide a Scheduling/Leveling Report generated from the current project schedule being submitted.

3.5.4 Network Diagram

The Network Diagram is required for the Preliminary, Initial and Periodic Updates. Depict and display the order and interdependence of activities and the sequence in which the work is to be accomplished. The Contracting Officer will use, but is not limited to, the following conditions to review compliance with this paragraph:

3.5.4.1 Continuous Flow

Show a continuous flow from left to right with no arrows from right to left. Show the activity number, description, duration, and estimated earned value on the diagram.

3.5.4.2 Project Milestone Dates

Show dates on the diagram for start of project, any contract required interim completion dates, and contract completion dates.

3.5.4.3 Critical Path

Show all activities on the critical path. The critical path is defined as the longest path.

3.5.4.4 Grouping and Sorting

Group and sort activities as directed to assist in the understanding of the activity sequence. Typically, this flow will group activities by major elements of work, category of work, work area and/or responsibility.

3.5.4.5 Cash Flow / Schedule Variance Control (SVC) Diagram

With each schedule submission, provide a SVC diagram showing 1) Cash Flow S-Curves indicating planned project cost based on projected early and late activity finish dates, and 2) Earned Value to-date.

3.6 PERIODIC SCHEDULE UPDATE

3.6.1 Periodic Schedule Update Meetings

Conduct periodic schedule update meetings for the purpose of reviewing the proposed Periodic Schedule Update, Narrative Report, Schedule Reports, and progress payment. Conduct meetings at least monthly within five days of the proposed schedule data date. Provide a computer with the scheduling software loaded and a projector which allows all meeting participants to view the proposed schedule during the meeting. The Contractor's authorized scheduler must organize, group, sort, filter, perform schedule revisions as needed and review functions as requested by the Contractor and/or Government. The Contractor scheduler must attend in person unless virtual attendance is approved by Contracting Officer. The meeting is a working interactive exchange which allows the Government and Contractor the opportunity to review the updated schedule on a real time and interactive basis. The meeting will last no longer than 8 hours. Submit schedule file and narrative to the Government a minimum of two workdays in advance of the meeting. The Contractor's Project Manager must attend the meeting with the authorized representative of the Contracting Officer. Superintendents, foremen and major subcontractors must attend the meeting as required to discuss the project schedule and work. Following the schedule update meeting, make corrections to the schedule and resubmit, following the required schedule naming convention. Include only those changes approved by the Government in the schedule review meeting. Only approved schedules may be used to generate invoices for payment.

3.6.2 Update Submission Following Progress Meeting

Submit the complete Periodic Schedule Update of the Project Schedule containing all approved progress, revisions, and adjustments, pursuant to

paragraph SUBMISSION REQUIREMENTS not later than 4 workdays after the periodic schedule update meeting. Payments can only be distributed with a Government Approved Periodic Schedule Update.

3.7 WEEKLY PROGRESS MEETINGS

Status, Update and Maintain a healthy schedule on the last workday of each week. On the first work days of each week prior to 10 A.M. forward 3 reports and the P6 .XER to the Government.

Reports: 1. Activities In-Progress, 2. Three Week Look Ahead, and 3. Longest Path. Compare all reports to the Government approved baseline schedule.

Conduct a weekly meeting with the Government (or as otherwise mutually agreed to) between the meetings described in paragraph entitled PERIODIC SCHEDULE UPDATE MEETINGS for the purpose of jointly reviewing the actual progress of the project as compared to the as planned progress and to review planned activities for the upcoming two weeks. Use the current approved schedule update for the purposes of this meeting and for the production and review of reports. At the weekly progress meeting, address the status of RFIs, RFPs and Submittals.

3.8 REQUESTS FOR TIME EXTENSIONS

ASCE 67-17 provides delay analysis guidelines. If there is a conflict between the contract and guidance provided in ASCE 67-17, the contract will govern. Provide justification of delays, analysis, fragnets, and time extensions to the Contracting Officer in accordance with the contract provisions and clauses for approval, within 10 days of any possible duration and or cost deviations occurring. Also prepare a time impact analysis for each Government request for proposal (RFP).

Following Requirements are due within 10 workday of impact, delay or initial discovery:

3.8.1 Justification of Delay

Provide a description of the event(s) that caused the delay and/or impact to the work. As part of the description, identify all schedule activities impacted. Show that the event that caused the delay/impact was the responsibility of the Government. Provide a time impact analysis that demonstrates the effects of the delay or impact on the project completion date, or interim completion date(s). Evaluate multiple impacts chronologically; each with its own justification of delay. With multiple impacts consider any concurrence of delay. A time extension and the schedule fragnet becomes part of the project schedule and all future schedule updates upon approval by the Contracting Officer.

3.8.2 Changes That Do Not Cause Delay

If it is determined that a change does not constitute a schedule time extension, a fragnet as described in paragraph FRAGMENTARY NETWORK, is to be created and inserted into the Project schedule.

3.8.3 Time Impact Analysis (Prospective Analysis)

Submit requests for time extensions based on a prospective analysis if the work involved or the impact identified has not already occurred. Where

the impact is ongoing a prospective analysis may be considered. However, the Government reserves the right to require a retrospective analysis be prepared after the impact has ended.

Prepare a time impact analysis for approval by the Contracting Officer based on industry recommended practice AACE 52R-06. Utilize a copy of the last approved schedule prior to the first day of the impact or delay for the time impact analysis. If Contracting Officer determines the time frame between the last approved schedule and the first day of impact is too great, prepare an interim updated schedule to perform the time impact analysis. Unless approved by the Contracting Officer, no other changes may be incorporated into the schedule being used to justify the time impact.

3.8.4 Forensic Schedule Analysis (Retrospective Analysis)

Submit requests for time extensions based on a retrospective analysis if the work involved or the impact identified has already occurred. The analysis must account for the actual performance of both the impacted work and all other contract work in the schedule.

If a methodology is chosen from AACE 29R-03, the method must adhere to the principles identified in ASCE 67-17. If there is a conflict with the methodology chosen from AACE 29R-03 and ASCE 67-17, ASCE 67-17 will govern. Choice of methodology should be discussed prior to submission to Government.

3.8.5 Fragmentary Network (Fragnet)

Prepare a proposed fragnet for time impact analysis consisting of a sequence of new activities that are proposed to be added to the project schedule to demonstrate the influence of the delay or impact to the project's contractual dates. Clearly show how the proposed fragnet is to be tied into the project schedule including all predecessors and successors to the fragnet activities. The proposed fragnet must be approved by the Contracting Officer prior to incorporation into the project schedule.

3.8.6 Time Extension

The Contracting Officer must approve the Justification of Delay including the time impact analysis before a time extension will be granted. No time extension will be granted unless the delay consumes all available Project Float and extends the projected finish date ("End Project" milestone) beyond the Contract Completion Date. The time extension will be in calendar days.

Actual delays that are found to be caused by the Contractor's own actions, which result in a calculated schedule delay, are not a cause for an extension to the performance period, completion date, or any interim milestone date.

a. Notwithstanding other provisions of this contract, it is mutually understood that the time extensions for changes in the work will depend upon the extent by which the changes cause delay in the completion of the various elements of construction. The change order granting the time extension may provide that the contract completion date will be extended only for those specific elements so delayed and that the remaining

contract completion dates for all other portions of the work will not be altered and may further provide for an equitable readjustment of liquidated damages under the new completion schedule. (FAR 52.212 6)

b. TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER:

1. This provision specifies the procedure for determination of time extension for usually severe weather in accordance with the contract clause entitled “Default: (Fixed Price Construction).” In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

   a. The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

   b. The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the Contractor.

2. The following schedule of monthly anticipated adverse weather delays is based on National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The Contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

MONTHLY ANTICIPATED ADVERSE WEATHER DELAY WORK DAYS BASED ON (5) DAY WORK WEEK											
JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
(7)	(4)	(5)	(5)	(4)	(5)	(4)	(4)	(4)	(5)	(4)	(6)

3. Upon acknowledgment of the Notice to Proceed (NTP) and continuing throughout the contract, the Contractor will record on the daily CQC report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the Contractor’s scheduled workday. The number of actual adverse weather delay days must include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated in paragraph 2 above, the Contracting Officer will convert qualifying delays to calendar days, giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the contract clause entitled “Default (Fixed Price Construction)”.

3.8.7 Impact to Early Completion Schedule

No extended overhead will be paid for delay prior to the original Contract Completion Date for an Early Completion IPS unless the Contractor actually performed work in accordance with that Early Completion Schedule. The

Contractor must show that an early completion was achievable had it not been for the impact.

3.9 FAILURE TO ACHIEVE PROGRESS

Should the progress fall behind the approved project schedule for reasons other than those that are excusable within the terms of the contract, the Contracting Officer may require provision of a written recovery plan for approval. The plan must detail how progress will be made-up to include which activities will be accelerated by adding additional crews, longer work hours, extra workdays, etc.

3.9.1 Artificially Improving Progress

Artificially improving progress by means such as, but not limited to, revising the schedule logic, modifying, or adding constraints, shortening activity durations, or changing calendars in the project schedule is prohibited. Indicate assumptions made and the basis for any logic, constraint, duration, and calendar changes used in the creation of the recovery plan. Any additional resources, manpower, or daily and weekly work hour changes proposed in the recovery plan must be evident at the work site and documented in the daily report along with the Schedule Narrative Report.

3.9.2 Failure to Perform

Failure to perform work and maintain progress in accordance with the supplemental recovery plan may result in an interim and final unsatisfactory performance rating and may result in corrective action directed by the Contracting Officer pursuant to FAR 52.236-15 Schedules for Construction Contracts, FAR 52.249-10 Default (Fixed-Price Construction), and other contract provisions.

3.9.3 Recovery Schedule

Should the Contracting Officer find it necessary, submit a recovery schedule pursuant to FAR 52.236-15 Schedules for Construction Contracts.

3.10 OWNERSHIP OF FLOAT

Except for the provision given in the paragraph IMPACT TO EARLY COMPLETION SCHEDULE, float available in the schedule, at any time, belongs to the Project and is available for Contractor and Government use. This includes activity and project float. Activity float is the number of workdays that an activity can be delayed without causing a delay to the "End Project" finish milestone. Project float (if applicable) is the number of work days between the projected early finish and the "End Project" finish.

3.11 TRANSFER OF SCHEDULE DATA INTO RESIDENT MANAGEMENT SYSTEM

Ensure schedule data is uploaded to RMS. This data is additional supporting data in a form and detail required by the Contracting Officer pursuant to FAR 52.232-5 Payments under Fixed-Price Construction Contracts. The receipt of a proper payment request pursuant to FAR 52.232-27 Prompt Payment for Construction Contracts is contingent upon the Government receiving both acceptable and approvable hard copies and matching electronic versions of the application for progress payment.

3.12 PRIMAVERA P6 MANDATORY REQUIREMENTS

Ensure Primavera P6 settings provide a schedule capable of fulfilling the requirements of the contract. The following settings are mandatory and required in all schedule submissions to the Government:

a. Activity Codes must be Project Level, not Global or EPS level.

b. Calendars must be Project Level, not Global or Resource level.

c. Activity Duration Types must be set to "Fixed Duration & Units".

d. Percent Complete Types must be set to "Physical".

e. Time Period Admin Preferences must remain the default "8.0 hr/day, 40 hr/week, 172 hr/month, 2000 hr/year". Set Calendar Work Hours/Day to 8.0 Hour days.

f. Set Schedule Option for defining Critical Activities to "Longest Path".

g. Set Schedule Option for defining progressed activities to "Retained Logic".

h. Set up cost loading using a single lump sum non-labor resource. The Price/Unit must be $1/hr, Default Units/Time must be "8h/d", and settings "Auto Compute Actuals" and "Calculate costs from units" un-selected.

i. Activity ID's must not exceed 10 characters.

j. Begin Testing Activity IDs with "T-".

k. Activity Names must have a verb-noun structure and contain the most defining and detailed description within the first 30 characters. Refer and utilize schedule specification verbiage. Activity Names verbiage and acronyms are to be consistent and accurate throughout the schedule(s). It is the discretion of the Government which verbiage and acronyms will be utilized.

l. The daily ending hour for all work calendars must be the same.

= m. Schedule Review comments made by the Contractor, Government and or other parties on the schedule(s) do not relieve the Contractor from compliance with requirements of the Contract Documents.

-- End of Section --

SECTION 01 33 00

SUBMITTAL PROCEDURES
08/18, CHG 4: 02/21

PART 1 GENERAL

1.1 SUMMARY

1.1.1 Submittal Information

The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective sections. Each submittal is to be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

Units of weights and measures used on all submittals are to be the same as those used in the contract drawings.

1.1.2 Project Type

The Contractor's Quality Control (CQC) System Manager are to check and approve all items before submittal and stamp, sign, and date indicating action taken. Proposed deviations from the contract requirements are to be clearly identified. Include within submittals items such as: Contractor's, manufacturer's, or fabricator's drawings; descriptive literature including (but not limited to) catalog cuts, diagrams, operating charts or curves; test reports; test cylinders; samples; O&M manuals (including parts list); certifications; warranties; and other such required submittals.

1.1.3 Submission of Submittals

Schedule and provide submittals requiring Government approval before acquiring the material or equipment covered thereby. Pick up and dispose of samples not incorporated into the work in accordance with manufacturer's Safety Data Sheets (SDS) and in compliance with existing laws and regulations.

1.2 DEFINITIONS

1.2.1 Submittal Descriptions (SD)

Submittal requirements are specified in the technical sections. Examples and descriptions of submittals identified by the Submittal Description (SD) numbers and titles follow:

SD-01 Preconstruction Submittals

Submittals that are required prior to or at the start of construction (work) or the next major phase of the construction on a multiphase contract.

Government approved Division 01 preconstruction submittals that are required prior to or commencing with the start of work must be submitted within 30 calendar days of contract award unless specified elsewhere in the specifications. Contractor approved Division 01 submittals that are

required prior to or commencing with the start of work must be submitted within 45 calendar days of contract award unless specified elsewhere in the specifications.

Preconstruction Submittals include schedules and a tabular list of locations, features, and other pertinent information regarding products, materials, equipment, or components to be used in the work.

Certificates Of Insurance

Surety Bonds

List Of Proposed Subcontractors

List Of Proposed Products

Baseline Network Analysis Schedule (NAS)

Submittal Register

Schedule Of Prices Or Earned Value Report

Accident Prevention Plan

Work Plan

Quality Control (QC) plan

Environmental Protection Plan

SD-02 Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project.

Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03 Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions and brochures illustrating size, physical appearance and other characteristics of materials, systems or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04 Samples

Fabricated or unfabricated physical examples of materials, equipment or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards by which the work can be judged.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site establish standards ensuring work can be judged. Includes assemblies or portions of assemblies that are to be incorporated into the project and those that will be removed at conclusion of the work.

SD-05 Design Data

Design calculations, mix designs, analyses or other data pertaining to a part of work.

SD-06 Test Reports

Report signed by authorized official of testing laboratory that a material, product or system identical to the material, product or system to be provided has been tested in accord with specified requirements. Unless specified in another section, testing must have been within three years of date of contract award for the project.

Report that includes findings of a test required to be performed on an actual portion of the work or prototype prepared for the project before shipment to job site.

Report that includes finding of a test made at the job site or on sample taken from the job site, on portion of work during or after installation.

Investigation reports

Daily logs and checklists

Final acceptance test and operational test procedure

SD-07 Certificates

Statements printed on the manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that the product, system, or material meets specification requirements. Must be dated after award of project contract and clearly name the project.

Document required of Contractor, or of a manufacturer, supplier, installer or Subcontractor through Contractor. The document purpose is to further promote the orderly progression of a portion of the work by documenting procedures, acceptability of methods, or personnel qualifications.

Confined space entry permits

Text of posted operating instructions

SD-08 Manufacturer's Instructions

Preprinted material describing installation of a product, system or material, including special notices and Safety Data Sheets(SDS)concerning impedances, hazards and safety precautions.

SD-10 Operation and Maintenance Data

Data provided by the manufacturer, or the system provider, including manufacturer's help and product line documentation, necessary to maintain and install equipment, for operating and maintenance use by facility personnel.

Data required by operating and maintenance personnel for the safe and efficient operation, maintenance and repair of the item.

Data incorporated in an operations and maintenance manual or control system.

SD-11 Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

Submittals required for Guiding Principle Validation (GPV) or Third Party Certification (TPC).

Special requirements necessary to properly close out a construction contract. For example, Record Drawings and as-built drawings. Also, submittal requirements necessary to properly close out a major phase of construction on a multi-phase contract.

1.2.2 Approving Authority

Office or designated person authorized to approve the submittal.

1.2.3 Work

As used in this section, on-site and off-site construction required by contract documents, including labor necessary to produce submittals, construction, materials, products, equipment, and systems incorporated or to be incorporated in such construction. In exception, excludes work to produce SD-01 submittals.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Submittal Register; G

1.4 SUBMITTAL CLASSIFICATION

1.4.1 Government Approved (G)

Government approval is required for extensions of design, critical materials, variations, equipment whose compatibility with the entire

system must be checked, and other items as designated by the Government.

Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, submittals are considered to be "shop drawings."

1.4.2 For Information Only

Submittals not requiring Government approval will be for information only. Within the terms of the Contract Clause SPECIFICATIONS AND DRAWINGS FOR CONSTRUCTION, they are not considered to be "shop drawings."

1.5 PREPARATION

1.5.1 Transmittal Form

Use the ENG Form 4025-R transmittal form for submitting both Government-approved and information-only submittals. Submit in accordance with the instructions on the reverse side of the form. These forms or similar forms are included in the RMS CM software that the Contractor is required to use for this contract. Properly complete this form by filling out all the heading blank spaces and identifying each item submitted. Exercise special care to ensure proper listing of the specification paragraph and sheet number of the contract drawings pertinent to the data submitted for each item.

1.5.2 Submittal Format

1.5.2.1 Format of SD-01 Preconstruction Submittals

When the submittal includes a document that is to be used in the project, or is to become part of the project record, other than as a submittal, do not apply the Contractor's approval stamp to the document itself, but to a separate sheet accompanying the document.

Provide data in the unit of measure used in the contract documents.

1.5.2.2 Format for SD-02 Shop Drawings

Provide shop drawings not less than 8 1/2 by 11 inches nor more than 30 by 42 inches, except for full-size patterns or templates. Prepare drawings to accurate size, with scale indicated, unless another form is required. Ensure drawings are suitable for reproduction and of a quality to produce clear, distinct lines and letters, with dark lines on a white background.

a. Include the nameplate data, size, and capacity on drawings. Also include applicable federal, military, industry, and technical society publication references.

b. Dimension drawings, except diagrams and schematic drawings. Prepare drawings demonstrating interface with other trades to scale. Use the same unit of measure for shop drawings as indicated on the contract drawings. Identify materials and products for work shown.

Submit an electronic copy of drawings in PDF format and native electronic format.

1.5.2.2.1 Drawing Identification

Include on each drawing the drawing title, number, date, and revision

numbers and dates, in addition to information required in paragraph IDENTIFYING SUBMITTALS.

Number drawings in a logical sequence. Each drawing is to bear the number of the submittal in a uniform location next to the title block. Place the Government contract number in the margin, immediately below the title block, for each drawing.

Reserve a blank space, on the right-hand side of each sheet for the Government disposition stamp.

1.5.2.3 Format of SD-03 Product Data

Present product data submittals for each section. Include a table of contents, listing the page and catalog item numbers for product data.

Indicate, by prominent notation, each product that is being submitted; indicate the specification section number and paragraph number to which it pertains.

1.5.2.3.1 Product Information

Supplement product data with material prepared for the project to satisfy the submittal requirements where product data does not exist. Identify this material as developed specifically for the project, with information and format as required for submission of SD-07 Certificates.

Provide product data in units used in the Contract documents. Where product data are included in preprinted catalogs with another unit, submit the dimensions in contract document units, on a separate sheet.

1.5.2.3.2 Standards

Where equipment or materials are specified to conform to industry or technical-society reference standards of such organizations as the American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), or Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.5.2.3.3 Data Submission

Collect required data submittals for each specific material, product, unit of work, or system into a single submittal that is marked for choices, options, and portions applicable to the submittal. Mark each copy of the product data identically. Partial submittals will not be accepted for expedition of the construction effort.

Submit the manufacturer's instructions before installation.

1.5.2.4 Format of SD-04 Samples

1.5.2.4.1 Sample Characteristics

Furnish samples in the following sizes, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately the same size as specified:

a. Sample of Equipment or Device: Full size.

b. Sample of Materials Less Than 2 by 3 inches: Built up to 8 1/2 by 11 inches.

c. Sample of Materials Exceeding 8 1/2 by 11 inches: Cut down to 8 1/2 by 11 inches and adequate to indicate color, texture, and material variations.

d. Sample of Linear Devices or Materials: 10 inch length or length to be supplied, if less than 10 inches. Examples of linear devices or materials are conduit and handrails.

e. Sample Volume of Nonsolid Materials: Pint. Examples of nonsolid materials are sand and paint.

f. Color Selection Samples: 2 by 4 inches. Where samples are specified for selection of color, finish, pattern, or texture, submit the full set of available choices for the material or product specified. Sizes and quantities of samples are to represent their respective standard unit.

g. Sample Panel: 4 by 4 feet.

h. Sample Installation: 100 square feet.

1.5.2.4.2 Sample Incorporation

Reusable Samples: Incorporate returned samples into work only if so specified or indicated. Incorporated samples are to be in undamaged condition at the time of use.

Recording of Sample Installation: Note and preserve the notation of any area constituting a sample installation, but remove the notation at the final clean-up of the project.

1.5.2.4.3 Comparison Sample

Samples Showing Range of Variation: Where variations in color, finish, pattern, or texture are unavoidable due to nature of the materials, submit sets of samples of not less than three units showing extremes and middle of range. Mark each unit to describe its relation to the range of the variation.

When color, texture, or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.

1.5.2.5 Format of SD-05 Design Data

Provide design data and certificates on 8 1/2 by 11 inch paper.

1.5.2.6 Format of SD-06 Test Reports

By prominent notation, indicate each report in the submittal. Indicate the specification number and paragraph number to which each report pertains.

1.5.2.7 Format of SD-07 Certificates

Provide design data and certificates on 8 1/2 by 11 inch paper.

1.5.2.8 Format of SD-08 Manufacturer's Instructions

Present manufacturer's instructions submittals for each section. Include the manufacturer's name, trade name, place of manufacture, and catalog model or number on product data. Also include applicable federal, military, industry, and technical-society publication references. If supplemental information is needed to clarify the manufacturer's data, submit it as specified for SD-07 Certificates.

Submit the manufacturer's instructions before installation.

1.5.2.8.1 Standards

Where equipment or materials are specified to conform to industry or technical-society reference standards of such organizations as the American National Standards Institute (ANSI), ASTM International (ASTM), National Electrical Manufacturer's Association (NEMA), Underwriters Laboratories (UL), or Association of Edison Illuminating Companies (AEIC), submit proof of such compliance. The label or listing by the specified organization will be acceptable evidence of compliance. In lieu of the label or listing, submit a certificate from an independent testing organization, competent to perform testing, and approved by the Contracting Officer. State on the certificate that the item has been tested in accordance with the specified organization's test methods and that the item complies with the specified organization's reference standard.

1.5.2.9 Format of SD-09 Manufacturer's Field Reports

By prominent notation, indicate each report in the submittal. Indicate the specification number and paragraph number to which each report pertains.

1.5.2.10 Format of SD-10 Operation and Maintenance Data (O&M)

Comply with the requirements specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA for O&M Data format.

1.5.2.11 Format of SD-11 Closeout Submittals

When the submittal includes a document that is to be used in the project or is to become part of the project record, other than as a submittal, do not apply the Contractor's approval stamp to the document itself, but to a separate sheet accompanying the document.

Provide data in the unit of measure used in the contract documents.

1.5.3 Source Drawings for Shop Drawings

1.5.3.1 Source Drawings

The entire set of source drawing files (DWG) will not be provided to the Contractor. Request the specific Drawing Number for the preparation of shop drawings. Only those drawings requested to prepare shop drawings will be provided. These drawings are provided only after award.

1.5.3.2 Terms and Conditions

Data contained on these electronic files must not be used for any purpose other than as a convenience in the preparation of construction data for the referenced project. Any other use or reuse is at the sole risk of the Contractor and without liability or legal exposure to the Government. The Contractor must make no claim, and waives to the fullest extent permitted by law any claim or cause of action of any nature against the Government, its agents, or its subconsultants that may arise out of or in connection with the use of these electronic files. The Contractor must, to the fullest extent permitted by law, indemnify and hold the Government harmless against all damages, liabilities, or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.

These electronic source drawing files are not construction documents. Differences may exist between the source drawing files and the corresponding construction documents. The Government makes no representation regarding the accuracy or completeness of the electronic source drawing files, nor does it make representation to the compatibility of these files with the Contractor hardware or software. The Contractor is responsible for determining if any conflict exists. In the event that a conflict arises between the signed and sealed construction documents prepared by the Government and the furnished source drawing files, the signed and sealed construction documents govern. Use of these source drawing files does not relieve the Contractor of the duty to fully comply with the contract documents, including and without limitation the need to check, confirm and coordinate the work of all contractors for the project. If the Contractor uses, duplicates or modifies these electronic source drawing files for use in producing construction data related to this contract, remove all previous indication of ownership (seals, logos, signatures, initials and dates).

1.5.4 Electronic File Format

Provide submittals in electronic format, with the exception of material samples required for SD-04 Samples items. In addition to the electronic submittal, provide three hard copies of the submittals. Compile the submittal file as a single, complete document, to include the Transmittal Form described within, and also separately attach the native files which were used to create PDF. The attached files should include the original digital files used to create the submittal. Name the electronic submittal file specifically according to its contents, and coordinate the file naming convention with the Contracting Officer. Electronic files must be of sufficient quality that all information is legible. Use PDF as the electronic format, unless otherwise specified or directed by the Contracting Officer. Generate PDF files from original documents with bookmarks so that the text included in the PDF file is searchable and can be copied. If documents are scanned, optical character resolution (OCR) routines are required. Index and bookmark files exceeding 30 pages to

allow efficient navigation of the file. When required, the electronic file must include a valid electronic signature or a scan of a signature.

E-mail electronic submittal documents smaller than 10MB to an e-mail address as directed by the Contracting Officer. Provide electronic documents over 10 MB on an optical disc or through an electronic file sharing system such as the DOD SAFE Web Application located at the following website: https://safe.apps.mil/.

1.6 QUANTITY OF SUBMITTALS

1.6.1 Number of SD-01 Preconstruction Submittal Copies

Unless otherwise specified, submit two sets of administrative submittals.

1.6.2 Number of SD-04 Samples

a. Submit two samples, or two sets of samples showing the range of variation, of each required item. One approved sample or set of samples will be retained by the approving authority and one will be returned to the Contractor.

b. Submit one sample panel or provide one sample installation where directed. Include components listed in the technical section or as directed.

c. Submit one sample installation, where directed.

d. Submit one sample of nonsolid materials.

1.7 INFORMATION ONLY SUBMITTALS

Submittals without a "G" designation must be certified by the QC manager and submitted to the Contracting Officer for information-only. Provide information-only submittals to the Contracting Officer a minimum of 14 calendar days prior to the Preparatory Meeting for the associated Definable Feature of Work (DFOW). Approval of the Contracting Officer is not required on information only submittals. The Contracting Officer will mark "receipt acknowledged" on submittals for information and will return only the transmittal cover sheet to the Contractor. Normally, submittals for information only will not be returned. However, the Government reserves the right to return unsatisfactory submittals and require the Contractor to resubmit any item found not to comply with the contract. This does not relieve the Contractor from the obligation to furnish material conforming to the plans and specifications; will not prevent the Contracting Officer from requiring removal and replacement of nonconforming material incorporated in the work; and does not relieve the Contractor of the requirement to furnish samples for testing by the Government laboratory or for check testing by the Government in those instances where the technical specifications so prescribe.

1.8 PROJECT SUBMITTAL REGISTER

A sample Project Submittal Register showing items of equipment and materials for when submittals are required by the specifications is provided as "Attachment A - Submittal Register."

1.8.1 Submittal Management

Prepare and maintain a submittal register, as the work progresses. Do not change data that is output in columns (c), (d), (e), and (f) as delivered by Government; retain data that is output in columns (a), (g), (h), and (i) as approved. As an attachment, provide a submittal register showing items of equipment and materials for which submittals are required by the specifications. This list may not be all-inclusive and additional submittals may be required. Maintain a submittal register for the project in accordance with Section 01 45 00.15 10 RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE(RMS CM).

Column (c): Lists specification section in which submittal is required.

Column (d): Lists each submittal description (SD Number. and type, e.g., SD-02 Shop Drawings) required in each specification section.

Column (e): Lists one principal paragraph in each specification section where a material or product is specified. This listing is only to facilitate locating submitted requirements. Do not consider entries in column (e) as limiting the project requirements.

Thereafter, the Contractor is to track all submittals by maintaining a complete list, including completion of all data columns and all dates on which submittals are received by and returned by the Government.

1.8.2 Preconstruction Use of Submittal Register

Submit the submittal register. Include the QC plan and the project schedule. Verify that all submittals required for the project are listed and add missing submittals. Coordinate and complete the following fields on the register submitted with the QC plan and the project schedule:

Column (a) Activity Number: Activity number from the project schedule.

Column (g) Contractor Submit Date: Scheduled date for the approving authority to receive submittals.

Column (h) Contractor Approval Date: Date that Contractor needs approval of submittal.

Column (i) Contractor Material: Date that Contractor needs material delivered to Contractor control.

1.8.3 Contractor Use of Submittal Register

Update the following fields in the Government-furnished submittal register program or equivalent fields in the program used by the Contractor with each submittal throughout the contract.

Column (b) Transmittal Number: List of consecutive, Contractor-assigned numbers.

Column (j) Action Code (k): Date of action used to record

Contractor's review when forwarding submittals to QC.

Column (l) Date submittal transmitted.

Column (q) Date approval was received.

1.8.4 Approving Authority Use of Submittal Register

Update the following fields:

Column (b) Transmittal Number: List of consecutive, Contractor-assigned numbers.

Column (l) Date submittal was received.

Column (m) through (p) Dates of review actions.

Column (q) Date of return to Contractor.

1.8.5 Action Codes

1.8.5.1 Contractor Action Codes

DESIGN BID BUILD SUBMITTALS			
Submittal Classifications shown in UFGS Sections	Submittal Classification	Corresponding SpecsIntact Submittal Register Code which is populated in the SI Submittal Register. Software Limitations: (The software shows one character delineation in the SpecsIntact Submittal Register)	RMS – The following Submittal Classifications are populated in RMS when the SpecsIntact Submittal Data File is pulled into RMS)
G	Submittal requires Government Approval	G	GA
BLANK	Submittal is For Information Only (FIO)	BLANK	FIO
S	Submittal is for documentation of Sustainable requirements	S	S/FIO

1.8.6 Delivery of Copies

Submit an updated electronic copy of the submittal register to the Contracting Officer with each invoice request. Provide an updated Submittal Register monthly regardless of whether an invoice is submitted.

1.9 VARIATIONS

Variations from contract requirements require Contracting Officer approval pursuant to contract Clause FAR 52.236-21 Specifications and Drawings for Construction, and will be considered where advantageous to the Government.

1.9.1 Considering Variations

Discussion of variations with the Contracting Officer before submission of a variation submittal will help ensure that functional and quality requirements are met and minimize rejections and resubmittals. For variations that include design changes or some material or product substitutions, the Government may require an evaluation and analysis by a licensed professional engineer hired by the contractor.

Specifically point out variations from contract requirements in a transmittal letter. Failure to point out variations may cause the Government to require rejection and removal of such work at no additional cost to the Government.

1.9.2 Proposing Variations

When proposing variation, deliver a submittal, clearly marked as a "VARIATION" to the Contracting Officer, with documentation illustrating the nature and features of the variation including any necessary technical submittals and why the variation is desirable and beneficial to Government. If lower cost is a benefit, also include an estimate of the cost savings. In addition to documentation required for variation, include the submittals required for the item. Clearly mark the proposed variation in all documentation.

"

Specifically point out variations from contract requirements in a transmittal letter. Failure to point out variations may cause the Government to require rejection and removal of such work at no additional cost to the Government.

Check the column "variation" of ENG Form 4025 for submittals that include variations proposed by the Contractor. Set forth in writing the reason for any variations and note such variations on the submittal. The Government reserves the right to rescind inadvertent approval of submittals containing unnoted variations.

1.9.3 Warranting that Variations are Compatible

When delivering a variation for approval, the Contractor warrants that this contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of work.

1.9.4 Review Schedule Extension

In addition to the normal submittal review period, a period of 14 calendar days will be allowed for the Government to consider submittals with variations.

1.10 SCHEDULING

Schedule and submit concurrently product data and shop drawings covering component items forming a system or items that are interrelated. Submit pertinent certifications at the same time. No delay damages or time extensions will be allowed for time lost in late submittals. .

a. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work will not be delayed by submittal processing. The Contractor is responsible for additional time required for Government reviews resulting from required resubmittals. The review period for each resubmittal is the same as for the initial submittal.

b. Submittals required by the contract documents are listed on the submittal register. If a submittal is listed in the submittal register but does not pertain to the contract work, the Contractor is to include the submittal in the register and annotate it "N/A" with a brief explanation. Approval by the Contracting Officer does not relieve the Contractor of supplying submittals required by the contract documents but that have been omitted from the register or marked "N/A."

c. Resubmit the submittal register and annotate it monthly with actual submission and approval dates. When all items on the register have been fully approved, no further resubmittal is required.

Contracting Officer review will be completed within 30 calendar days after the date of submission.

1.11 GOVERNMENT APPROVING AUTHORITY

When the approving authority is the Contracting Officer, the Government will:

a. Note the date on which the submittal was received.

b. Review submittals for approval within the scheduling period specified and only for conformance with project design concepts and compliance with contract documents.

c. Identify returned submittals with one of the actions defined in paragraph REVIEW NOTATIONS and with comments and markings appropriate for the action indicated.

Upon completion of review of submittals requiring Government approval, stamp and date submittals. Copy of the submittal will be retained by the Contracting Officer and copy of the submittal will be returned to the Contractor.

1.11.1 Review Notations

Submittals will be returned to the Contractor with the following notations:

a. Submittals marked "approved" or "accepted" authorize proceeding with the work covered.

b. Submittals marked "approved as noted" or "approved, except as noted, resubmittal not required," authorize proceeding with the work covered provided that the Contractor takes no exception to the corrections.

c. Submittals marked "not approved," "disapproved," or "revise and resubmit" indicate incomplete submittal or noncompliance with the contract requirements or design concept. Resubmit with appropriate changes. Do not proceed with work for this item until the resubmittal is approved.

d. Submittals marked "not reviewed" indicate that the submittal has been previously reviewed and approved, is not required, does not have evidence of being reviewed and approved by Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Resubmit submittals returned for lack of review by Contractor or for being incomplete, with appropriate action, coordination, or change.

e. Submittals marked "receipt acknowledged" indicate that submittals have been received by the Government. This applies only to "information-only submittals" as previously defined.

1.12 DISAPPROVED SUBMITTALS

Make corrections required by the Contracting Officer. If the Contractor considers any correction or notation on the returned submittals to constitute a change to the contract drawings or specifications, give notice to the Contracting Officer as required under the FAR clause titled CHANGES. The Contractor is responsible for the dimensions and design of connection details and the construction of work. Failure to point out variations may cause the Government to require rejection and removal of such work at the Contractor's expense.

If changes are necessary to submittals, make such revisions and resubmit in accordance with the procedures above. No item of work requiring a submittal change is to be accomplished until the changed submittals are approved.

1.13 APPROVED SUBMITTALS

The Contracting Officer's approval of submittals is not to be construed as a complete check, and indicates only that

Approval or acceptance by the Government for a submittal does not relieve the Contractor of the responsibility for meeting the contract requirements or for any error that may exist, because under the Quality Control (QC) requirements of this contract, the Contractor is responsible for ensuring information contained with in each submittal accurately conforms with the requirements of the contract documents.

After submittals have been approved or accepted by the Contracting Officer, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

1.14 APPROVED SAMPLES

Approval of a sample is only for the characteristics or use named in such approval and is not be construed to change or modify any contract requirements. Before submitting samples, provide assurance that the materials or equipment will be available in quantities required in the project. No change or substitution will be permitted after a sample has

been approved.

Match the approved samples for materials and equipment incorporated in the work. If requested, approved samples, including those that may be damaged in testing, will be returned to the Contractor, at its expense, upon completion of the contract. Unapproved samples will also be returned to the Contractor at its expense, if so requested.

Failure of any materials to pass the specified tests will be sufficient cause for refusal to consider, under this contract, any further samples of the same brand or make as that material. The Government reserves the right to disapprove any material or equipment that has previously proved unsatisfactory in service.

Samples of various materials or equipment delivered on the site or in place may be taken by the Contracting Officer for testing. Samples failing to meet contract requirements will automatically void previous approvals. Replace such materials or equipment to meet contract requirements.

1.15 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

1.16 CERTIFICATION OF SUBMITTAL DATA

Certify the submittal data as follows on Form ENG 4025: "I certify that the above submitted items had been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as otherwise stated.

_____NAME OF CONTRACTOR _____ SIGNATURE OF CONTRACTOR

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

APPENDIX B

Eng Form 4025-R

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TRANSMITTAL OF SHOP DRAWINGS, EQUIPMENT DATA, MATERIAL SAMPLES, OR MANUFACTURER'S CERTIFICATES OF COMPLIANCE For use of this form, see ER 415-1-10; the proponent agency is CECW-CE.	DATE	TRANSMITTAL NO.

SECTION I - REQUEST FOR APPROVAL OF THE FOLLOWING ITEMS (*This section will be initiated by the contractor*)

TO:	FROM:	CONTRACT NO.	CHECK ONE: ☐ THIS IS A NEW TRANSMITTAL ☐ THIS IS A RESUBMITTAL OF TRANSMITTAL _____

SPECIFICATION SEC. NO. (*Cover only one section with each transmittal*)	PROJECT TITLE AND LOCATION	THIS TRANSMITTAL IS FOR: (*Check one*) ☐ FIO ☐ GA ☐ DA ☐ CR ☐ DA/CR ☐ DA/GA

ITEM NO. (*See Note 3*) a.	DESCRIPTION OF SUBMITTAL ITEM (*Type size, model number/etc.*) b.	SUBMITTAL TYPE CODE (*See Note 8*) c.	NO. OF COPIES d.	CONTRACT DOCUMENT REFERENCE		CONTRACTOR REVIEW CODE g.	VARIATION Enter "Y" if requesting a variation (*See Note 6*) h.	USACE ACTION CODE (*Note 9*) i.
				SPEC. PARA. NO. e.	DRAWING SHEET NO. f.			

REMARKS	I certify that the above submitted items had been reviewed in detail and are correct and in strict conformance with the contract drawings and specifications except as otherwise stated.	
	NAME OF CONTRACTOR	SIGNATURE OF CONTRACTOR

SECTION II - APPROVAL ACTION

ENCLOSURES RETURNED (*List by item No.*)	NAME AND TITLE OF APPROVING AUTHORITY	SIGNATURE OF APPROVING AUTHORITY	DATE

APPENDIX A

SUBMITTAL REGISTER

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INSTRUCTIONS

1. Section I will be initiated by the Contractor in the required number of copies.

2. Each Transmittal shall be numbered consecutively. The Transmittal Number typically includes two parts separated by a dash (-). The first part is the specification section number. The second part is a sequential number for the submittals under that spec section. If the Transmittal is a resubmittal, then add a decimal point to the end of the original Transmittal Number and begin numbering the resubmittal packages sequentially after the decimal.

3. The "Item No." for each entry on this form will be the same "Item No." as indicated on ENG FORM 4288-R.

4. Submittals requiring expeditious handling will be submitted on a separate ENG Form 4025-R.

5. Items transmitted on each transmittal form will be from the same specification section. Do not combine submittal information from different specification sections in a single transmittal.

6. If the data submitted are intentionally in variance with the contract requirements, indicate a variation in column h, and enter a statement in the Remarks block describing he detailed reason for the variation.

7. ENG Form 4025-R is self-transmitting - a letter of transmittal is not required.

8. When submittal items are transmitted, indicate the "Submittal Type" (*SD-01 through SD-11*) in column c of Section I.
   Submittal types are the following:
   SD-01 - Preconstruction SD-02 - Shop Drawings SD-03 - Product Data SD-04 - Samples SD-05 - Design Data SD-06 - Test Reports
   SD-07 - Certificates SD-08 - Manufacturer's Instructions SD-09 - Manufacturer's Field Reports SD-10 - O&M Data SD-11 - Closeout

9. For each submittal item, the Contractor will assign Submittal Action Codes in column g of Section I. The U.S. Army Corps of Engineers approving authority will assign Submittal Action Codes in column i of Section I. The Submittal Action Codes are:

   A -- Approved as submitted.
   B -- Approved, except as noted on drawings. Resubmission not required.
   C -- Approved, except as noted on drawings. Refer to attached comments. Resubmission required.
   D -- Will be returned by separate correspondence.
   E -- Disapproved. Refer to attached comments.
   F -- Receipt acknowledged.
   X -- Receipt acknowledged, does not comply with contract requirements, as noted.
   G -- Other action required *(Specify)*
   K -- Government concurs with intermediate design. (*For D-B contracts*)
   R -- Design submittal is acceptable for release for construction. (*For D-B contracts*)

10. Approval of items does not relieve the contractor from complying with all the requirements of the contract.

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
Repair McGuire Airfield Hazardous Cargo Loading Area

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		01 14 00	SD-01 Preconstruction Submittals																
			List of Contact Personnel	1.4.1.1															
		01 30 00	SD-01 Preconstruction Submittals																
			View Location Map	1.3															
			Progress and Completion	1.4															
			Pictures																
		01 32 01.10 18	SD-01 Preconstruction Submittals																
			Project Scheduler Qualifications	1.3	G	RO													
			Preliminary Project Schedule	3.4.1	G	RO													
			Initial Project Schedule	3.4.2	G	RO													
			Periodic Schedule Update	3.6.2	G	RO													
		01 33 00	SD-01 Preconstruction Submittals																
			Submittal Register	1.8	G														
		01 35 13	SD-01 Preconstruction Submittals																
			Heavy Equipment and Vehicle	3.1.4															
			List																
			Existing Conditions Survey	3.1.3.2															
			FAA Form 7460-1	3.1.2															
			FAA Form 7460-2	3.1.2															
			Construction Operations Plan	3.1.3.1															
		01 35 26	SD-01 Preconstruction Submittals																
			Accident Prevention Plan (APP)	1.8.1	G	RO													
			SD-06 Test Reports																
			Accident Reports	1.14.2	G	RO													
			LHE Inspection Reports	1.14.3															
			Monthly Exposure Reports	1.5	G	RO													

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							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)		(q)	(r)
		01 35 26	SD-07 Certificates																
			Activity Hazard Analysis (AHA)	1.9	G	RO													
			Certificate of Compliance	1.14.4															
			Hot Work Permit	1.15															
			License Certificates	1.16															
			Portable Gauge Operations	1.16.1	G	RO													
			Planning Worksheet																
			Radiography Operation Planning	1.16.1	G	RO													
			Work Sheet																
			Standard Lift Plan	1.14.4.2	G	RO													
			Critical Lift Plan	1.14.4.2	G	RO													
		01 35 29.13	SD-02 Shop Drawings																
			Work Zones	3.9.1	G														
			Decontamination Facilities	3.10.1	G														
			SD-03 Product Data																
			Amendments to the APP/SSHP	1.4	G														
			Exposure Monitoring/Air	3.5															
			Sampling Program																
			Site Control Log	3.9.2															
			SSHO's Daily Inspection Logs	1.8															
			SD-07 Certificates																
			Certificate Of Worker/Visitor	1.7															
			Acknowledgement																
			SD-11 Closeout Submittals																
			Safety And Health Phase-Out	1.9	G														
			Report																

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							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 45 00	SD-01 Preconstruction Submittals															
			Contractor Quality Control (CQC)	1.6.2	G	RO												
			Plan															
			SD-06 Test Reports															
			Verification Statement	1.13.3														
		01 50 00	SD-01 Preconstruction Submittals															
			Construction Site Plan	1.5	G	RO												
			Traffic Control Plan	3.4.1	G	RO												
			Haul Road Plan	2.2.1	G	RO												
			Contractor Computer	1.8.1.4	G	RO												
			Cybersecurity Compliance															
			Statements															
			Contractor Temporary Network	1.8.6	G	RO												
			Cybersecurity Compliance															
			Statements															
			SD-06 Test Reports															
			Backflow Preventer Tests	3.5														
			SD-07 Certificates															
			Backflow Tester	1.6.1														
			Backflow Preventers	1.6														
		01 57 19	SD-01 Preconstruction Submittals															
			Preconstruction Survey	1.5.1														
			Regulatory Notifications	1.5.2														
			Environmental Manager	1.5.4														
			Qualifications															
			Employee Training Records	1.5.5														

SUBMITTAL REGISTER

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							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		01 57 19	Environmental Protection Plan	1.6	G	RO												
			Dirt and Dust Control Plan	1.6.10.1														
			Solid Waste Management Permit	1.9														
			Stormwater Pollution Prevention	3.3.1.2	G	RO												
			Plan															
			Stormwater Notice of Intent	3.3.1.3														
			Spill Prevention Control And	3.13.2	G	RO												
			Countermeasure (SPCC) Plan															
			SD-06 Test Reports															
			Monthly Solid Waste Disposal	1.9.1	G	RO												
			Report															
			Inspection Reports	3.3.1.4														
			SD-07 Certificates															
			Employee Training Records	1.5.5	G	RO												
			Erosion and Sediment Control	1.5.5														
			Inspector															
			SD-11 Closeout Submittals															
			Regulatory Notifications	1.5.2	G	RO												
			Assembled Employee Training	1.5.5	G	RO												
			Records															
			Solid Waste Management Permit	1.9	G	RO												
			Stormwater Pollution Prevention	3.3.1.5	G	RO												
			Plan Compliance Notebook															
			Stormwater Notice of Termination	3.3.1.6	G	RO												
			As-Built Topographic Survey	3.3.1.6														

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		01 57 19	Waste Determination	3.8.1	G	RO												
			Documentation															
			Project Solid Waste Disposal	3.8.2.1	G	RO												
			Documentation Report															
			Sales Documentation	3.8.2.1	G	RO												
			Hazardous Waste/Debris	3.8.3.1	G	RO												
			Management															
			Disposal Documentation for	3.8.3.6	G	RO												
			Hazardous and Regulated Waste															
		01 58 00	SD-02 Shop Drawings															
			Sign Legend Orders	1.3.1	G	RO												
		01 74 19	SD-01 Preconstruction Submittals															
			Construction Waste Management	1.6	G	RO												
			Plan															
			SD-06 Test Reports															
			Quarterly Reports	1.8.2														
			Annual Report	1.8.3														
			SD-11 Closeout Submittals															
			Final Construction Waste	1.9	S													
			Diversion Report															
		01 78 00	SD-03 Product Data															
			Warranty Management Plan	1.8.1														
			Warranty Tags	1.8.5														
			Spare Parts Data	1.6														
			SD-08 Manufacturer's Instructions															
			Instructions	1.8.1														

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		01 78 00	SD-10 Operation and Maintenance															
			Data															
			Operation and Maintenance	3.7	G	RO												
			Manuals															
			SD-11 Closeout Submittals															
			As-Built Drawings	3.1	G	RO												
			Record Drawings	3.3	G	RO												
			Record Model	2.2	G	RO												
			As-Built Record of Equipment	1.8.1														
			and Materials															
			As-Built Record of Equipment	3.6														
			and Materials															
			Final Approved Shop Drawings	3.4	G	RO												
			Construction Contract	3.5	G	RO												
			Specifications															
			Certification of EPA Designated	2.3	G	RO												
			Items															
			Certification Of USDA Designated	2.4	G	RO												
			Items															
			Interim DD FORM 1354	3.9.1	G	RO												
			Checklist for DD FORM 1354	3.9.2	G	RO												
		01 78 23	SD-10 Operation and Maintenance															
			Data															
			Facility Data Workbook	1.4	G	RO												
			Operation And Maintenance	3.1.1	G	RO												
			Manual, Progress Submittal															

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		01 78 23	Operation And Maintenance	3.1.2	G	RO												
			Manual, Prefinal Submittal															
			Operation And Maintenance	3.1.3	G	RO												
			Manual, Final Submittal															
			SD-11 Closeout Submittals															
			Record Drawings And Utility	1.6.6.7	G	RO												
			Systems															
		02 41 00	SD-01 Preconstruction Submittals															
			Existing Conditions	1.10	G	RO												
			SD-07 Certificates															
			Demolition Plan	1.2.1	G	RO												
			Notification	1.6	G	RO												
		02 61 13	SD-01 Preconstruction Submittals															
			Work Plan	1.3	G													
			Work Plan	1.3.2	G													
			SD-02 Shop Drawings															
			SURVEYS	3.1	G													
			SD-06 Test Reports															
			Closure Report	3.10	G													
		02 81 00	SD-03 Product Data															
			Onsite Hazardous Waste	3.1	G													
			Management															
			Notices of Non-Compliance and	3.2	G													
			Notices of Violation															
			Packaging Notifications	2.1.1	G													
			SD-06 Test Reports															

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		02 81 00	Recordkeeping	3.5	G													
			Spill Response	3.6														
			Exception Report	3.5	G													
			SD-07 Certificates															
			Certification	1.4.3	G													
			Security Plan	3.2.4	G													
			Transportation and Disposal	1.4.1	G													
			Coordinator															
			Training	1.4.2	G													
			EPA Offsite Policy	3.2.2														
			Certificates of Disposal	3.2.5	G													
			Shipping Documents and	3.2.3	G													
			Packagings Certification															
			Waste Minimization	3.4	G													
		03 30 53	SD-02 Shop Drawings															
			Installation Drawings	1.4	G	RO												
			SD-03 Product Data															
			Air-Entraining Admixture	2.2.3.1	G	RO												
			Accelerating Admixture	2.2.3.2	G	RO												
			Water-Reducing or Retarding	2.2.3.3	G	RO												
			Admixture															
			Curing Materials	2.2.10	G	RO												
			Expansion Joint Filler Strips,	2.2.6	G	RO												
			Premolded															
			Joint Sealants - Field Molded	2.2.7	G	RO												
			Sealants															

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		03 30 53	Waterstops	2.4.1														
			Batching and Mixing Equipment	3.1.3.3														
			Conveying and Placing Concrete	3.2														
			Formwork	2.2.8														
			Mix Design Data	2.3	G	RO												
			Ready-Mix Concrete	2.3														
			Curing Compound	2.4.2														
			Mechanical Reinforcing Bar	2.2.5	G	RO												
			Connectors															
			SD-06 Test Reports															
			Aggregates	2.2.2														
			Concrete Mixture Proportions	2.1.3	G	RO												
			Compressive Strength Testing	3.8.3	G	RO												
			Slump	3.8.3	G	RO												
			Air Content	3.8.3	G	RO												
			Water	2.2.4														
			SD-07 Certificates															
			Cementitious Materials	2.2.1														
			Aggregates	2.2.2														
			Delivery Tickets	2.3														
			SD-08 Manufacturer’s Instructions															
			Curing Compound	2.4.2														
		03 42 13.00 10	SD-01 Preconstruction Submittals															
			Quality Control Procedures	1.3.2.2														
			SD-02 Shop Drawings															
			Standard Precast Units	2.1.1	G	DO												

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		03 42 13.00 10	SD-03 Product Data															
			Standard Precast Units	2.1.1														
			Embedded Items	3.1.3														
			Accessories	2.2.4														
			SD-05 Design Data															
			Design Calculations	2.1.1	G	DO												
			Concrete Mix Proportions	2.1.3.1	G	DO												
			SD-06 Test Reports															
			Test Reports	1.3.2.4														
			SD-07 Certificates															
			Quality Control Procedures	1.3.2.2														
		13 48 00	SD-02 Shop Drawings															
			Resilient Vibration Isolation	3.2	G	DO												
			Devices															
			Equipment Requirements	2.1	G	RO												
			SD-03 Product Data															
			Equipment Requirements	2.1	G	RO												
			Anchor Bolts	3.1	G	RO												
			Vibration Isolators	2.1.2	G	RO												
			SD-05 Design Data															
			Design Calculations	1.2.3	G	DO												
			SD-06 Test Reports															
			Anchor Bolts	3.1	G	RO												
		26 08 00	SD-06 Test Reports															
			Acceptance Tests and	3.1	G	RO												
			Inspections															

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		26 08 00	SD-07 Certificates																
			Qualifications	1.4.1	G	RO													
			Acceptance Test and Inspections	1.4.3	G	RO													
			Procedure																
		26 20 00	SD-02 Shop Drawings																
			Panelboards	2.10	G	DO													
			Marking Strips	3.1.7.1	G	DO													
			SD-03 Product Data																
			Switches	2.7	G	RO													
			Receptacles	2.9	G	RO													
			Circuit Breakers	2.10.3	G	RO													
			Surge Protective Devices	2.15	G	RO													
			SD-06 Test Reports																
			600-volt Wiring Test	3.5.2	G	RO													
			Grounding System Test	3.5.4	G	RO													
			Ground-fault Receptacle Test	3.5.3	G	RO													
			SD-07 Certificates																
			Fuses	2.8	G	RO													
			SD-10 Operation and Maintenance																
			Data																
			Metering	2.14	G	RO													
		26 32 15	SD-02 Shop Drawings																
			Engine-Generator Set and	2.1.1	G	DO													
			Auxiliary Equipment																
			Auxiliary Systems	1.4.10	G	DO													
			Detailed Drawings	1.4.9	G	DO													

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		26 32 15	Acceptance	3.16	G	RO												
			SD-03 Product Data															
			Harmonic Requirements	2.1.8	G	RO												
			Engine-Generator Set	2.1.1	G	RO												
			Efficiencies															
			Emissions	2.13	G	RO												
			filters	2.7.2	G	RO												
			special tools	2.15	G	RO												
			Engine-Generator Parameter	2.1.1														
			Schedule															
			Heat Exchanger	2.8.2														
			Generator	2.16														
			Manufacturer's Catalog	2.5														
			Site Welding	1.4.2														
			Spare Parts	1.7.2														
			Onsite Training	3.11														
			Vibration-Isolation	2.1.7														
			Posted Data and Instructions	3.15	G	RO												
			Instructions	3.5.7.1	G	RO												
			Experience	1.4.7														
			Field Engineer	1.4.8														
			General Installation	3.2														
			Exciter	2.17														
			SD-05 Design Data															
			Performance Criteria	2.16														
			Sound Limitations	2.9	G	RO												

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		26 32 15	Integral Main Fuel Storage Tank	2.6.4															
			Day Tank	1.4.10															
			Power Factor	3.5.1.2															
			Heat Exchanger	2.8.2															
			Time-Delay on Alarms	2.20.5															
			Cooling System	2.8															
			Vibration Isolation	2.1.7															
			Battery Charger	2.14.3.2															
			Capacity Calculations for	2.1.1	G	DO													
			Engine-Generator Set																
			Brake Mean Effective Pressure	2.1.1	G	RO													
			(BMEP) Calculations																
			Torsional Vibration Stress	2.1.1	G	RO													
			Analysis Computations																
			Capacity Calculations for	2.1.1	G	DO													
			Batteries																
			Turbocharger Load Calculations	2.1.1	G	DO													
			SD-06 Test Reports																
			Performance Tests	3.5.9															
			Factory Inspection and Tests	2.27															
			Factory Tests	2.27.2															
			Onsite Inspection and Tests	3.5	G	RO													
			Acceptance Checks and Tests	3.8.1	G	RO													
			Functional Acceptance Tests	3.9.2	G	RO													
			Maintenance Procedures	3.11	G	RO													

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		26 32 15	Operation and Maintenance	3.11	G	RO												
			Manuals															
			Inspections	3.5.3	G	RO												
			Functional Acceptance Test	3.8.5	G	RO												
			Procedure															
			SD-07 Certificates															
			Cooling System	2.8														
			Vibration Isolation	2.1.7														
			Prototype Test	2.27.2														
			Reliability and Durability	2.1.5														
			Start-Up Engineer	3.7	G	RO												
			Instructor's Qualification Resume	3.10.1	G	RO												
			Engine Emission Limits	2.1.2.1	G	RO												
			Sound Limitations	2.9														
			Site Visit	3.1														
			Materials and Equipment	2.4														
			Factory Inspection and Tests	2.27														
			Engine Tests	3.5.4	G	RO												
			Generator Tests	3.5.5	G	RO												
			Assembled Engine-Generator Set	3.5.6	G	RO												
			Tests															
			SD-10 Operation and Maintenance															
			Data															
			Preliminary Assembled Operation	3.8.4	G	RO												
			and Maintenance Manuals															
			Posted Data and Instructions	3.15	G	RO												

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		26 32 15	Training Plan	3.10.2	G	RO													
		26 36 23	SD-02 Shop Drawings																
			Automatic Transfer Switch	1.4.2	G	RO													
			Drawings																
			SD-03 Product Data																
			Automatic Transfer Switches	2.1	G														
			By-Pass/Isolation Switch (BP/IS)	2.2	G														
			SD-06 Test Reports																
			Acceptance Checks and Tests	3.3.1	G														
			Functional Acceptance Tests	3.3.2	G														
			Factory Testing	2.4	G														
			Factory Test Reports	2.4.2	G														
			SD-07 Certificates																
			Proof of Listing	1.4.1	G														
			SD-10 Operation and Maintenance																
			Data																
			Operation and Maintenance	1.3	G														
			Manual																
		26 41 00	SD-06 Test Reports																
			Lightning Protection and	1.4.3	G	RO													
			Grounding System Test Plan																
			Grounding Systems Testing	3.4.2	G	RO													
			SD-07 Certificates																
			Component UL Listed and	1.4.2	G	RO													
			Labeled																

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		26 41 00	Lightning Protection System	1.4.4	G	RO													
			Inspection Certificate																
		26 56 00	SD-02 Shop Drawings																
			Luminaire Drawings	1.5.1.1	G														
			Pole Drawings	1.5.1.2	G	RO													
			Control System One-Line	1.8.2	G	RO													
			Diagram																
			SD-03 Product Data																
			Luminaires	2.2	G														
			Light Sources	2.3	G														
			LED Drivers	2.4	G														
			Luminaire Warranty	1.7.1	G														
			Lighting Controls Warranty	1.7.2	G														
			Pole Warranty	1.7.3	G														
			Photosensors	2.5.1.1	G														
			Lighting Contactor	2.5.1.2	G														
			Poles	2.6	G														
			Brackets	2.6.2															
			Obstruction Marker Luminaires	2.2.2	G														
			SD-05 Design Data																
			Luminaire Design Data	1.5.2	G														
			SD-06 Test Reports																
			ANSI/IES LM-79 Test Report	1.5.3	G														
			ANSI/IES LM-80 Test Report	1.5.4	G														
			ANSI/IES TM-21 Test Report	1.5.5	G														
			SD-08 Manufacturer’s Instructions																

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		26 56 00	Poles	2.6															
			SD-10 Operation and Maintenance																
			Data																
			Lighting System	1.8.1	G														
			Exterior Lighting Control System	1.8.2	G														
		26 56 20	SD-01 Preconstruction Submittals																
			Protection plan	1.5.4	G														
			Training	3.11.2	G														
			SD-02 Shop Drawings																
			Lighting and visual navigation	2.1	G														
			aids																
			Posted instructions	3.11.4	G														
			SD-03 Product Data																
			Taxiway edge lights	2.3.1	G														
			Obstruction lighting	2.4	G														
			Light bases	2.5	G														
			Isolation transformers	2.7	G														
			Encapsulated isolation	2.7.1	G														
			transformers																
			Constant current regulators	2.8	G														
			Constant current regulators	3.8	G														
			Frangible couplings	2.9.2.7	G														
			Type P-605	2.9.6	G														
			Type P-606	2.9.6	G														
			Materials and equipment	1.5.2	G														
			SD-06 Test Reports																

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		26 56 20	Visual inspection	3.10	G													
			Visual inspection	3.10.1	G													
			Progress testing for series	3.10.5	G													
			lighting circuits															
			Counterpoise system test and	3.10.4	G													
			inspection															
			Operating test	3.10.2	G													
			Distribution conductors, 600-volt	3.10.3	G													
			class															
			Electrical acceptance tests	3.10.6	G													
			Low-voltage continuity tests	3.10.7	G													
			High-voltage insulation resistance	3.10.8	G													
			tests															
			Constant current regulators	2.8	G													
			Constant current regulators	3.8	G													
			SD-07 Certificates															
			Qualifications of contractor	1.5.3	G													
			Special tools	2.10.1	G													
			Special tools	3.11.2	G													
			4-Jack positioning jig	3.1.5	G													
			Elevated light level	3.1.5.1	G													
			Crimping tool	3.2.3.2	G													
			Cable penciler	3.2.3.3														
			List of parts	3.12.1	G													
			SD-08 Manufacturer’s Instructions															
			Posted instructions	3.11.4	G													

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		26 56 20	SD-10 Operation and Maintenance															
			Data															
			Constant current regulators	2.8	G													
			Constant current regulators	3.8	G													
			Maintenance and repair	3.12.2	G													
			instructions															
			Posted operations and	3.12.3														
			maintenance instructions															
			SD-11 Closeout Submittals															
			As-built drawings	3.11.3														
		31 00 00	SD-01 Preconstruction Submittals															
			Shoring	3.4	G	RO												
			Dewatering Work Plan	1.4.3	G	RO												
			SD-03 Product Data															
			Utilization of Excavated Materials	3.8	G	DO												
			Shoulder Construction	3.14														
			SD-06 Test Reports															
			Testing	3.17														
			Borrow Site Testing	2.1														
			SD-07 Certificates															
			Testing	3.17														
		32 01 13.63	SD-01 Preconstruction Submittals															
			Qualifications	1.6.1	G													
			Distributor Radar Or Distance	3.5.1	G													
			Measurement Instrument (DMI)															
			Calibration															

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		32 01 13.63	SD-03 Product Data																
			Manufacturer Representative's	1.6.2															
			Experience																
			Inspection Reports	3.1	G														
			Equipment And Tools	2.1	G														
			SD-04 Samples																
			Gilsonite Modified Asphalt	2.3.1															
			Emulsion																
			Aggregate	2.4.1	G														
			SD-06 Test Reports																
			Manufacturer's Certificate of	2.3.2															
			Compliance																
			Aggregates	1.6.3															
			Aggregates	2.4.2															
			Asphalt Materials	1.6.4	G														
			Asphalt Materials	2.3.2	G														
			Manufacturer's Certificate Of	2.5	G														
			Analysis for Polymer																
			Manufacturer's Certificate Of	2.2	G														
			Analysis For Emulsified Asphalt																
			Manufacturer's Certificate Of	2.3.2	G														
			Analysis For Emulsified Asphalt																
			Aggregate Spreader Calibration	3.5.5	G														
			Distributor Calibration	3.5.1	G														
			Distributor Calibration	3.5.1	G														

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		32 01 13.63	Abbreviated Distributor	3.5.3	G													
			Calibration															
		32 01 17.61	SD-01 Preconstruction Submittals															
			Equipment, Tools, And Machines	2.5	G													
			SD-03 Product Data															
			Manufacturer's Instructions	3.3	G													
			Crack Sealant	2.1	G													
			Backer Rod	2.4	G													
			Mastic Sealant	2.2														
			SD-06 Test Reports															
			Laboratory Tests	1.3	G													
			SD-07 Certificates															
			Mastic Certification	3.3	G RO													
			Mastic Certification	3.5.3	G RO													
			SD-08 Manufacturer’s Instructions															
			Installing Hot Poured Sealant	3.3	G													
			Installing Mastic Material	3.3	G													
		32 01 19.61	SD-03 Product Data															
			Sealants	2.1	G RO													
			Manufacturer's	3.4.2														
			Recommendations															
			Blocking Media/Backup Materials	2.3.1														
			Backer Rod	3.2.4.1														
			Bond Breaking Tapes	2.3.2														
			SD-06 Test Reports															
			Sealants	2.1														

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		32 01 19.61	SD-07 Certificates															
			Equipment List	3.1														
			SD-08 Manufacturer's Instructions															
			Sealants	2.1														
		32 01 29.61	SD-03 Product Data															
			Concrete Mix Design	1.3.1	G	DO												
			Concrete Mix Design	2.1.4.1	G	DO												
			Rigid Proprietary Repair Products	2.1.9	G	DO												
			Polymeric Proprietary Repair	2.1.10	G	DO												
			Products															
			Pigmented Liquid	2.1.5.1	G	DO												
			Membrane-Forming Compound															
			Pigmented Liquid	2.1.5.1	G	DO												
			Membrane-Forming Compound															
			Aggregate Service Record	2.1.9.6	G	DO												
			SD-04 Samples															
			Absorbent Curing Material	3.5.1	G	DO												
			Joint Filler	2.1.7	G	DO												
			Joint Sealant	2.1.6	G	DO												
			SD-05 Design Data															
			Concrete Mix Design	1.3.1	G	DO												
			Concrete Mix Design	2.1.4.1	G	DO												
			SD-06 Test Reports															
			Test Results	1.3.1														
			Gradation	1.3.1.2														
			Gradation	2.1.1.4														

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		32 01 29.61	Cement	1.3.1.1															
			Slump	2.1.4.1															
			Air Content	2.1.4.1															
			Compressive Strength	2.1.9.1															
			Mixer Calibration and Efficiency	1.3.2															
			Concrete Uniformity	1.3.2															
			Bond Strength	2.1.9.2															
			Polymeric Proprietary Repair	2.1.10	G	DO													
			Products																
			SD-07 Certificates																
			Cement	1.3.1.1															
			Aggregate	1.3.1.2															
			Admixtures	2.1.3															
			Absorbent curing material	3.5.1															
			Pigmented Liquid	2.1.5.1															
			Membrane-Forming Compound																
			Pigmented Liquid	2.1.5.1															
			Membrane-Forming Compound																
			Joint Filler	2.1.7															
			Joint Sealant	2.1.6															
		32 11 20	SD-03 Product Data																
			Plant, Equipment, and Tools	1.4	G	RO													
			SD-06 Test Reports																
			Initial Tests	2.2.1	G	DO													
			In-Place Tests	3.11.1	G	RO													
		32 11 23	SD-03 Product Data																

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		32 11 23	Plant, Equipment, and Tools	1.4	G	RO													
			SD-06 Test Reports																
			Initial Tests	2.3.1	G	RO													
			In-Place Tests	3.12.1	G	RO													
		32 11 33	SD-03 Product Data																
			Mix Design	2.2	G	DO													
			Aggregate	1.4.3	G	DO													
			SD-06 Test Reports																
			Aggregate	1.4.3	G	DO													
			Compressive Strength	3.7.5	G	DO													
		32 11 33.13	SD-05 Design Data																
			Mix Design	2.2	G	DO													
			SD-06 Test Reports																
			Compressive Strength Of	3.8.5	G	DO													
			Modified Subgrade Material																
			Soil-Cement Weight Loss	2.2	G	DO													
			Optimum Moisture Content And	2.2.1	G	DO													
			Maximum Density																
			SD-07 Certificates																
			Portland Cement	2.1.1.1	G	DO													
			Curing Materials	2.1.4	G	DO													
			Methods Of Installation	3.4	G	DO													
			Equipment	2.3	G	DO													
		32 12 13	SD-06 Test Reports																
			Sampling and Testing	3.7															
		32 12 15.13	SD-01 Preconstruction Submittals																

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		32 12 15.13	Equipment	2.2	G	RO												
			SD-02 Shop Drawings															
			Placement Plan	2.1	G	DO												
			SD-03 Product Data															
			Diamond Grinding Plan	2.2.6	G	DO												
			Mix Design	2.5	G	DO												
			Contractor Quality Control	3.1	G	DO												
			SD-04 Samples															
			Aggregates	2.3														
			Asphalt Binder	2.4														
			SD-06 Test Reports															
			Aggregates	2.3	G	DO												
			QC Monitoring	3.1.3.10														
			Pavement Lots	1.6.3	G	DO												
			SD-07 Certificates															
			Asphalt Binder	2.4	G	DO												
			Testing Laboratory	3.1.2	G	DO												
			Airfield Asphalt Pavement QC Manager	1.5	G	DO												
			Airfield Asphalt Pavement Inspector	1.5	G	DO												
			Airfield Asphalt Pavement Laboratory Technician	1.5	G	DO												
		32 13 14.13	SD-01 Preconstruction Submittals															
			Proposed Techniques	3.1.2	G	DO												

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		32 13 14.13	Preliminary Proposed	2.13.2	G	DO												
			Proportioning															
			Pavement Quality Control Plan	1.4.3.3	G	DO												
			Stringless Technology	3.5.6.3	G	DO												
			SD-03 Product Data															
			Diamond Grinding Plan	2.1.7	G	DO												
			Dowels	2.9.1	G	RO												
			Dowel Bar Assemblies	2.9.2	G	RO												
			Equipment	2.11	G	RO												
			Concrete Patching Mixture	2.1.5	G	DO												
			SD-05 Design Data															
			Proportioning Studies	2.13.2	G	DO												
			SD-06 Test Reports															
			Batch Plant Manufacturer's	1.4.1	G	DO												
			Inspection Report															
			Batch Plant Manufacturer's	1.4.1	G	DO												
			Inspection Report															
			Slipform Paver Manufacturer's	1.4.1	G	DO												
			Inspection Report															
			Sampling and Testing	2.1.4.1	G	RO												
			Diamond Grinding of PCC	2.1.7	G	DO												
			Surfaces															
			Mixer Performance (Uniformity)	2.11.2.1	G	DO												
			Testing															
			Repair Recommendations Plan	3.9.1	G	DO												
			Paving Lot Report	3.12.5	G	RO												

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		32 13 14.13	Test Section Paving Lot Report	1.4.6.1	G	DO													
			Test Section Lot Report	1.4.6.4	G	DO													
			SD-07 Certificates																
			Contractor Quality Control (CQC) Staff	1.4.1	G	DO													
			Laboratory Accreditation and Validation	1.4.3	G	DO													
			Commercial Laboratory	1.4.3	G														
			NRMCA Certificate of Conformance	2.11															
			Petrographer Resume	1.4.2	G	DO													
			Licensed Surveyor	1.4.2	G	RO													
			Concrete Batch Plant Operator	1.4.2	G	DO													
			Profilograph Operator	1.4.2	G	DO													
			Inertial Profiler Operator(S)	1.4.2	G														
		32 13 73.19	SD-03 Product Data																
			Equipment	2.1															
			Manufacturer's Instructions	3.1.1															
			SD-04 Samples																
			Compression Seals	2.2	G	RO													
			SD-06 Test Reports																
			Test Requirements	2.1.3	G	RO													
		32 17 23	SD-03 Product Data																
			Surface Preparation Equipment List	2.1.1	G	RO													
			Application Equipment List	2.1.2	G	RO													

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		32 17 23	Exterior Surface Preparation	3.2															
			Material Safety Data Sheets	1.3.1	G	RO													
			(MSDS)																
			Reflective Media for Airfields	2.2.2.1	G	RO													
			Waterborne Paint	2.2.1	G	RO													
			SD-06 Test Reports																
			Reflective Media for Airfields	2.2.2.1	G	RO													
			Waterborne Paint	2.2.1	G	RO													
			SD-07 Certificates																
			Qualifications	1.3.2	G	RO													
			Waterborne Paint	2.2.1															
			Volatile Organic Compound	1.3.1	G	RO													
			SD-08 Manufacturer’s Instructions																
			Waterborne Paint	2.2.1	G	RO													
		32 31 13.53	SD-02 Shop Drawings																
			Fence Installation Drawings	3.2.1	G	RO													
			SD-03 Product Data																
			Fabric	2.1.1.1	G	RO													
			Posts	2.1.2	G	RO													
			Post Caps	2.1.2.2	G	RO													
			Chain Link Braces	2.1.3	G	RO													
			Line Posts	2.1.2.1	G	RO													
			Sleeves	3.2.3.2															
			Top Rail	2.1.2.2	G	RO													
			Bottom Rail	3.2.4	G	RO													
			Tension Wire	2.2.1.3	G	RO													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION
Repair McGuire Airfield Hazardous Cargo Loading Area

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		32 31 13.53	Barbed Wire	2.2.1.2	G	RO												
			Barbed Wire Supporting Arms	2.1.2.2	G	RO												
			Latches	2.1.4.3	G	RO												
			Hinges	2.1.4.3	G	RO												
			Stops	2.1.4.3	G	RO												
			Keepers	2.1.4.3	G	RO												
			Rollers	2.1.4.3	G	RO												
			Padlocks	2.1.5	G	RO												
			Wire Ties	2.2.1.1	G	RO												
			SD-07 Certificates															
			Chain Link Fence	2.1.2.1	G	RO												
			Fabric	2.1.1.1														
			Barbed Wire	2.2.1.2														
			Concrete	2.2.2	G	RO												
			Operating and maintenance	3.2.7														
			instructions															
		32 92 19	SD-03 Product Data															
			Fertilizer	2.3														
			SD-06 Test Reports															
			Topsoil Composition Tests	2.2.3														
			SD-07 Certificates															
			Seed	2.1														
			SD-08 Manufacturer’s Instructions															
			Erosion Control Materials	2.5														
		33 11 00	SD-01 Preconstruction Submittals															
			Connections	3.1.1	G													

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

Repair McGuire Airfield Hazardous Cargo Loading Area

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAGRAPH #	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		33 11 00	SD-03 Product Data															
			Pipe Restraint	2.1.1	G													
			Precast Concrete Thrust Blocks	2.1.1.2	G													
			Disinfection Procedures	3.2.2	G													
			SD-06 Test Reports															
			Bacteriological Samples	3.3.1.3	G													
			Leakage Test	3.3.1.2														
			Hydrostatic Test	3.3.1.1														
			SD-07 Certificates															
			Fusion Technician Qualifications	1.4.2.1	G													
		33 40 00	SD-03 Product Data															
			Placing Pipe	3.3	G	RO												
			Concrete Pipe	2.1.1	G	DO												
			SD-07 Certificates															
			Determination of Density	3.6.5														
			Frame and Cover for Gratings	2.3.4														
		33 71 02	SD-02 Shop Drawings															
			Precast Underground Structures	1.5.1	G	RO												
			SD-03 Product Data															
			Medium Voltage Cable	2.5	G	RO												
			Medium Voltage Cable Joints	2.7	G	RO												
			Medium Voltage Cable	2.6	G	RO												
			Terminations															
			Precast Concrete Structures	2.12.2.1	G	RO												
			Sealing Material	2.12.2.4														
			Pulling-In Irons	3.4.3														

SUBMITTAL REGISTER

CONTRACT NO.

TITLE AND LOCATION

Repair McGuire Airfield Hazardous Cargo Loading Area

CONTRACTOR

ACTIVITY NO	TRANSMITTAL NO	SPEC SECT	DESCRIPTION ITEM SUBMITTED	PARAG # RAPH	CLASSIFICATION	GOVT OR A/E REVWR	CONTRACTOR: SCHEDULE DATES			CONTRACTOR ACTION			APPROVING AUTHORITY					MAILED TO CONTR/ DATE RCD FRM APPR AUTH	REMARKS
							SUBMIT	APPROVAL NEEDED BY	MATERIAL NEEDED BY	ACTION CODE	DATE OF ACTION	DATE FWD TO APPR AUTH/ DATE RCD FROM CONTR	DATE FWD TO OTHER REVIEWER	DATE RCD FROM OTH REVIEWER	ACTION CODE	DATE OF ACTION		
(a)	(b)	(c)	(d)	(e)	(f)		(g)	(h)	(i)	(j)	(k)	(l)	(m)	(n)	(o)	(p)	(q)	(r)
		33 71 02	Manhole Frames and Covers	2.12.3	G	RO												
			Handhole Frames and Covers	2.12.4	G	RO												
			Frames and Covers for Airfield	2.12.5	G	RO												
			Facilities															
			Composite/Fiberglass Handholes	2.12.7	G	RO												
			Cable Supports	2.13	G	RO												
			Manhole Immersion Heater	2.12.3.1														
			SD-06 Test Reports															
			Medium Voltage Cable	2.15.2	G	RO												
			Qualification and Production Tests															
			Field Acceptance Checks and	3.17.1	G	RO												
			Tests															
			Arc-proofing Test	2.15.1	G	RO												
			Cable Installation Plan and	3.3	G	RO												
			Procedure															
			SD-07 Certificates															
			Cable splicer/terminator	1.5.2	G	RO												
			Cable Installer Qualifications	1.5.3	G	RO												

SECTION 01 35 13

SPECIAL PROJECT PROCEDURES
11/20, CHG 2: 08/25

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. Code (USC)

49 USC 44718	Structures Interfering with Air Commerce or National Security
49 USC 46301	Civil Penalties

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1	(2016; Rev L; Change 2) Obstruction Marking and Lighting
FAA AC 150/5300-13	(2022; Rev B; Change 1; Errata 2025) Airport Design

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

14 CFR 77	Safe, Efficient Use, and Preservation of the Navigable Airspace

1.2 DEFINITIONS

1.2.1 Landing Areas

"Landing Areas" means:

a. The primary surfaces, comprising the surface of the runway, runway shoulders, and lateral safety zones. The length of each primary surface is the same as the runway length. The width of each primary surface is 2000 feet (1000 feet on each side of the runway centerline). Exceptions: Some airfields are based on a primary width of 1500 feet (750 feet on each side of the runway centerline). In such instances, substitute the proper width in the applicable statements.

b. The "clear zone" beyond the ends of each runway is the extension of the primary surface for a distance of 3000 feet in length for fixed wing aircraft and 400 feet in length for helicopter only runways beyond each end of each runway.

c. All taxiways, plus the lateral clearance zones along each side for the length of the taxiways (the outer edge of each lateral clearance zone is laterally 250 feet from the far or opposite edge of the taxiway (example: a 75 foot wide taxiway must have a combined width and lateral clearance zone of 425 feet.)

d. All aircraft parking aprons, plus the area 125 feet in width extending beyond each edge around the aprons.

1.2.2 Safety Precaution Areas

"Safety Precaution Areas" means those portions of approach-departure clearance zones and transitional zones where placement of objects incident to Contract performance might result in vertical projections at or above the approach-departure clearance, or the transitional surface.

a. The "approach-departure clearance surface" is an extension of the primary surface and the clear zone at each end of each runway, for a distance of 50,000 feet, first along an inclined (glide angle) and then along a horizontal plane, both flaring symmetrically about the runway centerline extended.

(1) The inclined plane (glide angle) begins in the clear zone 200 feet past the end of the runway (and primary surface) at the same elevation as the end of the runway. It continues upward at a slope of 50:1 (one foot vertically for each 50 feet horizontally) to an elevation of 500 feet above the established airfield elevation. At that point the plane becomes horizontal, continuing at that same uniform elevation to a point 50,000 feet longitudinally from the beginning of the inclined plane (glide angle) and ending there.

(2) The width of the surface at the beginning of the inclined plane (glide angle) is the same as the width of the clear zone. It then flares uniformly, reaching the maximum width of 16,000 feet at the end.

b. The "approach-departure clearance zone" is the ground area under the approach-departure clearance surface.

c. The "transitional surface" is a sideways extension of all primary surfaces, clear zones, and approach-departure clearance surfaces along inclined planes.

(1) The inclined plane in each case begins at the edge of the surface.

(2) The slope of the incline plane is 7:1 (one foot vertically for each 7 feet horizontally). It continues to the point of intersection with the:

(a) Inner horizontal surface (which is the horizontal plane 150 feet above the established airfield elevation); or

(b) Outer horizontal surface (which is the horizontal plane 500 feet above the established airfield elevation), whichever is applicable.

d. The "transitional zone" is the ground area under the transitional surface. (It adjoins the primary surface, clear zone, and approach-departure clearance zone.)

1.2.3 Federal Aviation Administration (FAA) Notice of Proposed Construction or Alteration

a. FAA Notice of Proposed Construction or Alteration may be required in accordance with 49 USC 44718 and 14 CFR 77, depending on height of construction equipment on site, height of temporary structures, proximity to an airport or heliport, and specific location of equipment or temporary structure. For the purpose of notifying the FAA, proximity is defined as within 5 nautical miles of a Government or civilian airfield, including landing areas, taxiways, runways and helicopter pads.

b. In order to determine if a FAA Notice of Proposed Construction or Alteration is required, refer to 14 CFR 77 Subpart B. Alternately, utilize the FAA's Notice Criteria Tool located at: https://oeaaa.faa.gov/oeaaa/external/portal.jsp. The FAA will determine if the equipment or temporary structure exceeds obstruction standards and may pose a hazard to air navigation.

c. Failure to comply with the provisions of 14 CFR 77 are subject to Civil Penalty under Section 902 of the Federal Aviation Act of 1958, as amended and pursuant to 49 USC 46301 Subpart (a).

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Heavy Equipment and Vehicle List

Existing Conditions Survey

FAA Form 7460-1

FAA Form 7460-2

Construction Operations Plan

PART 2 PRODUCTS

2.1 AIRFIELD OBSTRUCTION LIGHTS

Airfield obstruction lights must be in accordance with FAA AC 70/7460-1 and have red or white lenses.

PART 3 EXECUTION

3.1 HAZARDS TO AIRFIELD OPERATION

In addition to DFARS 252.236-7005 Airfield Safety Precautions, the following paragraphs apply.

3.1.1 Work in Proximity to Landing Areas

Place nothing upon the landing area or applicable portions of safety precaution areas without authority of the Contracting Officer.

Use of landing areas for purposes other than aircraft operation, is prohibited without permission of the Contracting Officer, and the landing area is closed by order of the Contracting Officer and marked as indicated herein.

Accomplish all construction work on the runways, taxiways, and parking aprons and in the end zones of the runways and 75 feet to each side of the runways and taxiways with extreme care regarding the operation of aircraft. ooperate closely, and coordinate with aviation representative (safety officer, Airfield Manager, operations officer, and/or air traffic and airspace (AT&A) officer) the Contracting Officer. Park equipment in an area designated by the Contracting Officer. Parking of equipment, vehicles, or any storage features overnight or for any extended period of time in the proximity of the landing areas or taxiways is strictly prohibited. Leave no material in areas where extreme care is to be taken regarding the operation of aircraft.

During periods of active performance of work on the airfield by the Contractor, govern all operations of mobile equipment in accordance with the safety provisions.

3.1.2 Contractor FAA Notification

When required in accordance with 49 USC 44718 and 14 CFR 77, submit FAA Form 7460-1 and attachments directly to the FAA a minimum of 60 calendar days prior to the start date of the operations that may affect air traffic. Submit supplemental notification FAA Form 7460-2 to the FAA within 48 hours prior to start of the construction. Simultaneous with submission to the FAA, submit both forms to the Contracting Officer for information. It is the Contractor's responsibility to notify the FAA when required.

3.1.3 Schedule of Work/Aircraft Operating Schedules

Schedule work to conform to aircraft operating schedules. The Government will exert every effort to schedule aircraft operations so as to permit the maximum amount of time for the Contractor's activities; however, in the event of emergency, intense operational demands, adverse wind conditions, and other such unforeseen difficulties, the Contractor must cease operations at the specified locations in the aircraft operational area for the safety of the Contractor and military personnel and Government property. Submit a schedule of the work to the Contracting Officer for transmittal to the Operations Officer describing the work to be accomplished; the location of the work, noting distances from the ends of landing areas, taxiways and buildings and other structures as necessary; and dates and hours during which the work is to be accomplished. Keep the approved schedule of work current, and notify the Contracting Officer of changes prior to beginning each day's work.

Where flying is controlled, obtain permission from the control tower operator to enter a landing area unless such area is marked as hazardous to aircraft.

3.1.3.1 Construction Operations Plan

Submit a Construction Operations Plan prior to the start of work that includes a description of the airfield work to be accomplished; the exact location of the work, noting distances from the ends of landing areas, taxiways and buildings and other structures as necessary; and dates and hours during which the work is to be accomplished. Keep the approved schedule of work current and notify the Contracting Officer of changes prior to beginning each day's work.

3.1.3.2 Existing Conditions Survey

Perform an Existing Conditions Survey and submit results to the Government prior to the start of work. As part of this survey, inspect the work site to identify existing conditions located within the vicinity of the contract work. Utilize original as-builts if available showing possible utilities, type of pavement, thickness, airfield lighting, equipment, vehicles, structures, and parked aircraft. Unless already specified in the Contract documents, utilize the RFI process to clarify responsibility for relocating appurtenances that will interfere with work. If the site is opened up (in/under construction), update the existing survey condition to include the actual condition of the underlying conditions such as sub base, base, and pavement thickness.

3.1.4 Daytime Markings

During daylight, mark stationary and mobile equipment with international orange and white checkered flags, mark the material, and work with yellow flags.

Submit a Heavy Equipment and Vehicle List identifying all stationary and mobile equipment and vehicles that will be operating on the airfield. All equipment and vehicles must be identified by means of a flag on a staff attached to and flying above the vehicle. Flag size must be not less than 3 feet square and consist of a checkered pattern of international orange and white squares not less than one foot on each side. Flags varying in any dimension by not more than 10 percent of the specified dimensions are considered to comply with the stated requirements.

3.1.5 Nighttime Markings

During nighttime, which begins 2-hours before sundown and ends 2-hours after sunrise, mark stationary and mobile equipment and material, and work with battery-operated, low-intensity, red flasher lights. Where the Operations Officer determines that the red flasher lights may confuse pilots approaching for landings, the Operations Officer may direct that the red flasher lights be left off or that the color of the lights be changed.

Provide lighting in accordance with FAA AC 70/7460-1. Provide a minimum of two aviation red or high intensity white obstruction lights on temporary structures (including cranes) over 100 feet above ground level. Lights must be operational during periods of reduced visibility, darkness, and as directed by the Contracting Officer.

No separate payments will be made for lighting and protection necessitated by the safety provisions.

3.1.6 Excavation

Open only those trenches for which material is on hand and ready for placing therein. As soon as possible after the material has been placed and work approved, backfill and compact the trenches as specified.

Maintain landing areas at all times free from hazards, holes, material piles, or projecting shoulders that might damage tires or landing gear. Keep paved surfaces clean at all times and free from small stones or other objects which could cause damage to propellers, craft, and personnel.

3.1.7 Contractor Safety Precautions

The Contractor is advised that aircraft operations will produce extremely high noise levels and will induce vibrations in pavements, structures, and equipment in the vicinity, and may result in high velocity flying debris in the area. These anticipated hazards must be appropriately addressed in the Activity Hazard Analysis (AHA) associated with airfield work - the Activity Hazard Analysis must be in accordance with Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. The Contractor is responsible for providing personal protective equipment (PPE) and other safety devices required to ensure protection of contractor personnel and equipment. Schedule the work to eliminate hazards to personnel and equipment and to prevent damage to work performed.

Boundary areas for hazardous work locations and restrictions are defined in FAA AC 150/5300-13. Construction activity within the limits of the boundary areas without approval of the Contracting Officer is prohibited.

3.1.8 Base Civil Engineering (BCE) Work Clearance Request

Obtain an approved BCE Work Clearance Request, AF Form 103, prior to the start of excavation, digging work, or work that disrupts aircraft or vehicular traffic flow, base utility services, fire and intrusion alarm system, or routine activities of the Activity.

3.1.9 Radio Contact

Provide necessary battery powered portable radios, including one radio for the tower. During work within the landing area, have an operator (who speaks fluent English) available for radio contact with the tower at all times. Obtain approval of radio frequency from the tower.

-- End of Section --

A. Access to Military Installations are governed by DoD Directive 5200.8. The airfield taxiways, parking apron and areas directly adjacent to the airfield considered Controlled Areas. Contractor and Contractor Personnel are not allowed in these areas without proper authorization.

B. Personnel Access: Contractor personnel are allowed in the controlled area only if a valid contract is in effect. Entrance to the work site must be coordinated during the preconstruction meeting with the airfield manager and flight safety personnel.

C. Airfield Access:

a. The inclusion of this appendix in this contract is notice to the contractor that the contract includes work to be performed on or in an area(s) adjacent to active runways and taxiways, or that the work may include the use of a crane or other structure that will require clearance.
b. Caution must be used when working in areas adjacent to active runways and taxiways to prevent damage or injury to personnel, equipment or materials, resulting from jet blast caused by aircraft taxiing on/off of the adjacent runways/taxiways. The contractor is required to maintain contact with McGuire Tower Ground Control, (call sign *Ground*). The contractor, when directed by *Ground*, must pull all equipment from the work area when an aircraft approaches on an adjacent runway. All equipment must be a minimum of 100 feet from edge of runway pavement. Contractor must not return to within 100 feet of the runway until permission is received from *Ground*. The contractor may use the airfield pavement for routing his trucks or equipment only when it is clear of moving aircraft. Contractor personnel must wear hearing protection and other appropriate PPE while in the work area.
c. When Airfield access is required, Contractor must comply with all Air Force (AF), Federal Aviation Administration (FAA) and local guidance. Contractor must adhere to the Installation Entry Control Procedures provided by Security Forces. All contractors who need to drive on the airfield must receive an Airfield Driver's Safety briefing from the Airfield Management Office or the applicable Unit Airfield Driving Program Manager and must obtain the appropriate Privately Owned Vehicle (POV) airfield access cones before driving on the airfield. Additional information about access and driving in airfield areas is found in the Installation Entry Control Procedures provided by Security Forces in Annex 1 of Section 1000. Contractor must also comply with 605 Air Mobility Wing Instruction 13-213, Airfield Drivers. Coordination for projects on the Lakehurst portion of the Joint Base must be through the Lakehurst Airfield Management Section.
d. The airfield manager and flight safety office must be kept informed of construction status at all times. The Airfield Manager and Flight Safety must be notified no less than 5 days prior to beginning construction/work on the airfield. Additionally, the Airfield Manager and Flight Safety must be included in the following meetings:

i. Pre-Construction: Contractor's designated POC/Project Manager must

attend a pre-construction meeting with the Airfield Manager (AM) and Flight Safety Officer (FSO) in attendance. If the AM and/or FSO are unable to attend the pre-construction meeting, the contractor must make arrangements for a separate meeting (to include the QAR) to discuss specific Airfield Access and Work requirements (meeting minutes and attendee list are required to be submitted to the Airfield Management Office and included in the project files for all of these meetings).

ii. Once approved by the QAR, the Contractor must provide a copy of the Critical Path Schedule (Section 1000, Para 1.32) to the Airfield Manager and Flight Safety Office. Unless already obtained, the schedule must specifically identify FAA and airfield waiver documents as tasks to be accomplished.

iii. Post-Construction: Contractor's designated POC/Project Manager must coordinate with the QAR and attend a post construction meeting and/or walk through with a representative from Airfield Operations and Safety to ensure construction was completed to proper airfield operational standards. Meeting minutes with who attended are required.

e. Communications with Tower. The contractor is required to maintain contact with McGuire Tower Ground Control, (call-sign *Ground*).

i. The contractor will be required, on a daily basis, to sign out and pick up a transmitting/receiving type radio programmed to the radio frequency used by the Airfield Tower.

ii. The contractor must use the radio to maintain contact with the Airfield Tower so that they can be alerted for movement in case of an emergency.

iii. The contractor may provide his own radio; however, the contractor must coordinate with 87th Communications Squadron to ensure compatibility. For projects managed by the 787th CES, radios may also be available for temporary issue through the project manager either directly from the 787th CES or the 87 CS.

iv. Only the Airfield Manager, or his authorized representative, may waive the radio requirements, and even then, only if the area is closed.

f. Airfield Barricades: see the following drawing.

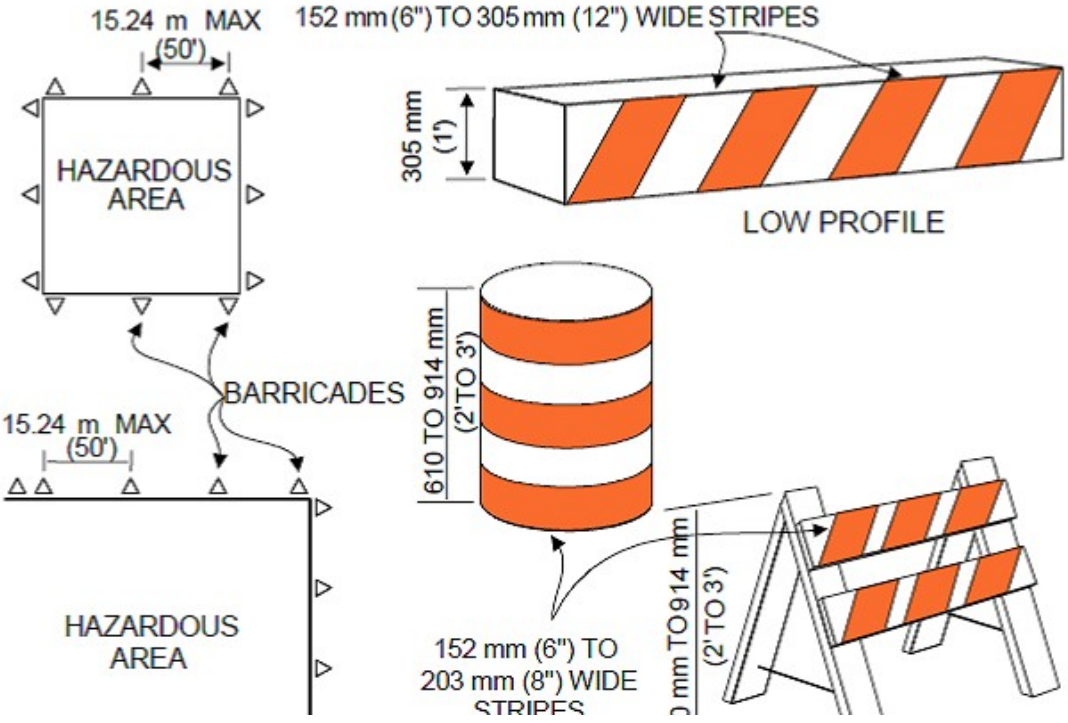
i. The Contractor must clearly identify the boundaries of construction on the airfield. Where pavement markings do not provide adequate definitions of closed or hazardous areas, use reflective orange and white low-profile barricades with securely fastened amber-yellow or red lights. All barricades must be anchored or heavy enough to remain in place. Flashing lights must be at least five candelas effective intensity and flash at a rate of from 55 to 160 flashes per minute. Continuous burning lights must have an effective intensity of 10 candelas. Low-profile barricades are the preferred method for marking construction areas. Examples are

shown in the figure below. Lighted barricades used in close proximity to each other must be of the same type (flash rate) and color.

ii. Contractor must place barricades at maximum intervals of 15.2 meters (50 ft) and use dual barricades and lights on corners and ends.

iii. In the case of a Minimum Operating Strip (MOS), the Contractor must use frangible markers designed and constructed of materials that will collapse if struck by an aircraft. They must be colored to present a sharp contrast to the surrounding terrain.

iv. Contractor must ensure a POC/Project Manager is available after hours to be contacted if barricades/lights are damaged or need servicing. Airfield Management will notify POC as needed to address immediate concerns with a follow up notification to the Project Manager not later than the following duty day.



g. Waivers: Work on the runway and airfield areas require several specific waivers prior to breaking ground, IAW Unified Facilities Criteria 3-260-01, Airfield and Heliport Planning and Design.

i. FAA Form 7460-1 "Notice of Proposed Construction or Alteration" – The Contractor must submit this from no later than 60 days before anticipated construction operations on the airfield are scheduled to begin. This form is submitted through the QAR to the community planning

section, 787 CES/CEN. The community planning section will complete it and submit it to the FAA, if needed. The form is available electronically via the FAA website, or a paper copy will be provided upon request.

1. FAA Form instructions: Contractor must always complete boxes 3, 5, 9, 10, and 21. Complete boxes 6 and 7 if a crane will be used for the project.
2. In box 21, Contractor must provide the project task order number and describe which heavy equipment and/or cranes that will be brought onto the base/airfield area.

h. If a crane is being utilized on base, it must be equipped with a red light and flag and any other appropriate markings as directed by FAA Advisory Circular 70/7460-1L. They must be lowered at night and when not in use.

i. Temporary Construction Waiver – Determination of the need for a waiver is the responsibility of the government. The format of the request is up to the contractor, but the request for a waiver must include the following information as a minimum (depending on the circumstances, the government may request additional information):

1. Contractor's Contact information, including for after-hour issues.
2. Detailed Map of work to be accomplished.
3. Description of work to be accomplished.
4. Any equipment over 25 feet tall that will be onsite.
5. Actual dates anticipated to be onsite and location.

j. All work on the airfield environment not deemed emergency work requires a temporary construction waiver.

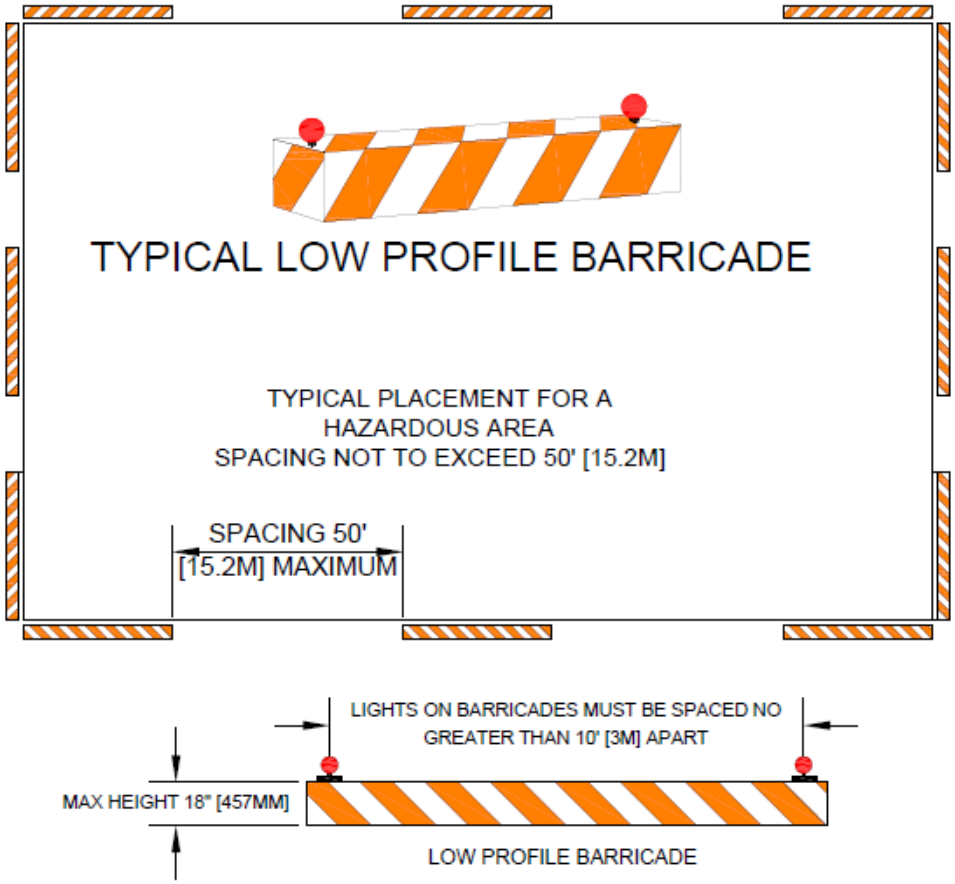
D. UFC 3-260-04, UFC 3-260-01, AFI 13-213 and 305AMWI 13-213, latest versions, are incorporated herein, in their entirety, by reference. Extracts of some key provisions from these publications are provided on the following pages for convenience.

3-1.4 Alternate Visual Aids.
When appropriate, lighted barricades, traffic cones, or portable edge markers are used instead of pavement markings during short periods of construction if addressed in the construction waiver and the construction phasing plan (see Appendix B of UFC 3-260-01). Use edge markers for daytime use or expedient airfield markings such as are used on a minimum operating strip (MOS) or a landing zone (LZ). Lighted visual aids are used for night operations or instrument flight rule (IFR) operations. Fasten or weight down all such devices to prevent them from becoming dislodged by jet blast or prop wash. Use frangible markers designed and constructed of materials that collapse if struck by an aircraft. They are colored to present a sharp contrast with the surrounding terrain.

8-5.3 Temporarily Closed Aprons.
When an apron is closed on an active airfield, taxilane and taxiway centerline markings leading to the closed area are removed. However, hazardous areas on aprons caused by construction or other activities of a temporary nature are delineated using barricades or traffic cones equipped with a red light (see Figure 8-4). The lights are optionally steady burning or flashing but ensure they meet the luminance requirements of the FHWA MUTCD for safety zones. Lights are mounted on barricades and spaced at no more than 10-foot (3-meter) intervals. Lights are operated between sunset and sunrise and during periods of low visibility during operations. They are operated by photocell or manually. Solar-powered lights and light-emitting diode (LED) lights are acceptable as long as they meet the above-stated requirements.

8-6 BARRICADES.
Where pavement markings do not provide adequate definitions of closed or hazardous areas, supplement the markings using retro-reflective orange and white barricades or traffic cones with securely fastened red lights aligned toward aircraft and vehicle ground traffic. All barricades and traffic cones are anchored or weighted to be heavy enough to remain in place during aircraft operations in near proximity. Ensure flashing lights are at least five candelas effective intensity and flash at a rate of from 55 to 160 flashes per minute. Ensure continuous burning lights have an effective intensity of 10 candelas. Low-profile barricades are the preferred method for marking construction areas. Examples are shown in Figure 8-4. Ensure lighted barricades used in close proximity to each other are all of the same type and colors. If flashing lights are used, ensure they have the same flash rates. Place barricades at maximum intervals of 50 feet (15.2 meters) and use dual barricades and lights on each corner and at the ends.

Figure 8-4. Low Profile Barricades



NOTES:

1. BARRICADES MAY NOT EXCEED 18" [457MM} IN HEIGHT(EXCLUSIVE OF SUPPLEMENTARY LIGHTS AND FLAGS) AND SHOULD BE SPACED TO PREVENT BREACH, BUT IN NO CASE GREATER THAN 50' [15.2M] APART. THEY MUST BE OF LOW MASS; EASILY COLLAPSIBLE UPON CONTACT WITH AN AIRCRAFT; AND WEIGHTED OR STURDILY ATTACHED TO THE SURFACE TO PREVENT DISPLACEMENT FROM JET BLAST OR OTHER WIND DISTURBANCE.
2. THE REQUIRED LIGHTS MUST BE RED AND MAY EITHER BE STEADY BURNING OR FLASHING. INTENSITIES AND LUMINANCE MUST BE AT LEAST FIVE CANDELAS EFFECTIVE INTENSITY AND FLASH AT A RATE OF FROM 55 TO 160 FLASHES PER MINUTE.
3. HAZARD LIGHTS MAY NOT BE SPACED GREATER THAN 10' [3M] APART.
4. LIGHTS MUST BE OPERATED BETWEEN SUNSET AND SUNRISE AND DURING PERIODS OF LOW VISIBILITY WHENEVER THE AIRPORT IS OPEN FOR OPERATIONS.
5. BARRICADES MAY BE SUPPLEMENTED WITH ALTERNATING ORANGE AND WHITE FLAGS AT LEAST 20" BY 20" (508MM BY 508MM) SQUARE.

1-10 CONSTRUCTION PHASING PLAN.

A construction phasing plan, as discussed in Appendix B, Section 14, is included in the contract documents. This is a mandatory requirement for USAF and Army installations whether work will

be accomplished by contract or in-house (see Appendix B, Section 14).

B1-1.1.4 Construction Waivers.
A construction waiver (sometimes referred to as temporary construction waivers) is obtained when one or more elements of a construction project (equipment, facilities, personnel, etc.) violate airfield and airspace as defined above. Construction waivers should only be planned for the duration of the construction project unless circumstances dictate otherwise. An FAA Form 7460-1 Notice of Proposed Construction or Alteration must be submitted to the DAR (SPELL OUT DAR) prior to sending the request to the Installation/Garrison commander for approval. Temporary waiver requests for construction projects must be prepared in accordance with paragraphs B1-1.1 and B1-1.2.
NOTE: Emergency maintenance and repair requirements and routine maintenance activities, such as mowing and maintenance of airfield systems, are exempt from this requirement; however, the DPW Airfield Manager will ensure implementation of appropriate safety measures, including Notices to Airmen (NOTAM) or Local NOTAMs.

CONTRACTOR must provide QAR with all information required to develop the construction waiver information. QAR must provide this information to and coordinate with the Community Planner for submission of the construction waiver. Due to the extensive staffing and large number of agencies that must review each Construction Waiver, the process can take up to 4 months, Contractors must account for this time in their schedule. Starting the process as early as possible is prudent to avoid potential delays in projects starting. Projects on the airfield cannot start until the construction waiver is fully approved. Construction waivers are valid for 1 year from the date they are signed, so if projects are delayed or are multi-year projects, the Contractor, through the QAR, must notify the Community Planner to begin processing a new waiver in a timely fashion.

B1-1.2.1 Installation.
The installation's design agent, aviation representative (safety officer, Airfield Manager, operations officer, and/or air traffic and airspace [AT&A] officer), Department of Public Works (DPW) and/or Construction Facilities Management Office (CFMO) master planner will:
 Jointly with DPW prepare/initiate all waiver requests. Project Designers must immediately notify the Airfield Manager when project designs will not meet design criteria listed in this manual.

 Submit requests through the installation to the ACOM/ASCC/DRU/or ARNG.

 Maintain a complete record of all waivers requested and their disposition (approved or disapproved). A list of waivers to be requested and those approved for a project should also be included in the project design analysis prepared by the design agent, aviation/airfield representative, or DPW/CFMO master planner.

 Annual review. All airfield waivers will be annually reviewed to validate if a requirement for the waiver still exists, and all appropriate safety precautions, mitigating measures, and conditions of approval are being effectively implemented. Waivers no longer required will be cancelled through the ACOM/ASCC/DRU/ or ARNG.

1-2.2.2 Objects Affecting Navigable Airspace.
Modifications to existing facilities and construction of new facilities must consider effects on navigable airspace IAW Federal Aviation Regulation (FAR) Part 77 and may require that an FAA Form 7460-1 and/or 7460-2 be filed with the administrator. See Appendix B, Section 5, to determine when the FAA Form 7460-1 must be filed. FAA Form 7460-2 is used to notify the FAA of progress or abandonment, as requested, on the form. The FAA Service Area routinely includes this form with a determination when such information will be required. The information is used for charting purposes, to change affected aeronautical procedures, and to notify pilots of the location of the structure. Go to https://oeaaa.faa.gov/oeaaa/external/portal.jsp for more information on these forms and instructions for using E-file to submit the form to FAA. The criteria for determining obstructions to navigable airspace have been identified in this manual. The designer must consult this manual during the design process to identify obstructions to airspace and file FAA Form 7460-1 when required. The Construction Proponent/Community Planner will coordinate with the airfield/airspace manager and aviation safety officer before filing the form with the FAA. For facilities outside the United States (US) and its trust territories, host nation criteria apply off base. If the criteria in this manual are more stringent, this manual should be used to the maximum extent practical.

Joint Base McGuire-Dix-Lakehurst does not have established Building Restriction Lines (BRL's) as defined in UFC 3-260-01, Appendix B, Section 17. As such, all crane activities on the Joint Base to include adjacent ranges require an Obstacle Evaluation (OE) to be accomplished by the Community Planning office. Requirements for obstacle evaluation include approximate dates of the proposed crane activity, LAT/LONG of the crane activity, and the maximum height of the crane required for project completion. Once information is provided, the Community Planners will load the information into the FAA web site listed in paragraph 1-2.2.2 below. FAA determinations generally take 45 days to complete.

Project Managers must notify Airfield Management 3 days prior to crane activity beginning so Notices-to-Airmen can be sent advising pilots of the hazard.

B14-1 CONTENTS.
A construction phasing plan is included in the contract documents. The purpose of a phasing plan is to establish guidelines and constraints the contractor must follow during construction. It is recommended that the construction phasing plan be submitted for coordination and review at the concept and design stage. At minimum, the plan must be coordinated with airfield management, airfield operations, communications, ground and flight safety, environmental, security forces, contracting and logistics.

B14-3.1 Phasing.
All construction activities will be separated into phases. The phasing plan will show or describe the sequence of construction activity for each phase. The phasing plan will be incorporated into the contractor's management plan and reflected in the progress schedule. The work area limits (to define required aircraft and worker safety and security clearances), barricades, maximum equipment height, and temporary fencing requirements will be clearly delineated for each phase. The work area limits will include identification of restricted areas requiring escorts and free zones with secure areas.

B14-3.2 Aircraft Operational Areas.
The phasing plan will identify active aircraft operational areas and closed pavement areas for each phase.

B14-3.3 Additional Requirements.
If required, the location of flagmen, security guards, and other personnel should be shown. These locations should be supplemented in the specifications.

B14-3.4 Temporary Displaced Thresholds.
Temporary displaced thresholds and temporary displaced threshold lighting requirements should be shown. These details will be presented in the drawings and supplemented in the specifications.

B14-3.5 Access.
Construction vehicle access roads, including access gates and haul routes, will be shown.

B14-3.6 Temporary Marking and Lighting.
Temporary pavement marking and lighting details will be presented on the phasing plan. Marking and lighting details are presented in UFC 3-260-04, UFC 3-535-01, and applicable FAA guidance.

B14-3.7 Safety Requirements and Procedures.
The construction phasing plan must include a section outlining safety requirements and procedures for activities on the airfield during the planned period of construction.

B14-3.8 FOD Checkpoints.
Location of foreign object debris (FOD) checkpoints, when required, should be included in the phasing plan.

B14-4 OTHER ITEMS TO BE SHOWN IN THE CONSTRUCTION SITE PLAN.
The following items are not necessarily a part of the phasing plan, but must be included in the Construction Site Plan. If not included in the contract drawings, the following items will be coordinated by the contractor with Airfield Management through the QAR and show on maps provided by submittal for approval by Airfield Management through the QAR.

B14-4.1 Storage.
The contractor's equipment and material storage locations.

B14-4.2 Parking.
The contractor's personnel vehicle parking area and access routes to the work area.

B14-4.3 Buildings.
Location of the contractor's offices and plants.

B14-4.4 Designated Waste and Disposal Areas.
Off-site disposal should be included in the specifications.

B14-5 MAXIMUM EQUIPMENT HEIGHT.

The maximum height of construction equipment expected to be in use during construction must be included in the Standard Lift Plan and the Critical Lift Plan, the work order project requirements checklist, or other project guidance documents. This information must also be included on FAA Form 7460-1, *Notice of Proposed Construction or Alteration*. This form must be submitted to the FAA 30 days before the start of construction if the maximum equipment height penetrates any of the surfaces described in FAR Part 77.

B14-6.1 General Requirements.

Construction activities on the airfield, in proximity to, or affecting aircraft operational areas or navigable airspace, must be coordinated with all airfield users before initiating such activities. In addition, basic responsibilities must be identified and assigned and procedures developed and disseminated to instruct construction personnel in airport procedures and for monitoring construction activities for conformance with safety requirements. These and other safety considerations must be addressed in the earliest stages of project formulation and incorporated in the contract specifications, the work order project requirements checklist, and/or other project guidance documents developed for in-house construction projects. Construction areas located within the aircraft movement area requiring special attention by the contractor or in-house construction activity must be clearly delineated on the project plans. The quality assurance personnel, airfield manager, and contract administrator should closely monitor construction activity throughout its duration to ensure continual compliance with safety requirements. At minimum, comply with the requirements in paragraphs B14-6.1.1 through B14-6.1.4. Otherwise, alternative safety mitigation plans must be developed and included in the construction waiver request for the installation commander's approval.

B14-6.1.1 Runways.

Activities within the graded areas of the clear zone will require threshold displacement sufficient to protect the approach-departure clearance surface, and adjustment to the departure runway end location to provide a minimum 305-meter (1,000-foot) safety area between the stop end of the runway and construction activities. Construction activities must not be conducted within a distance equal to the normal VFR holding position distance from the near edge of any active segment of a runway.

B14-6.1.2 Taxiways, Taxilanes and Aprons.

Construction activity setback lines must be located at a distance to provide the minimum wingtip clearance required in Table 6-1, items 5 or 6, as appropriate, for the largest aircraft that will use the taxiway, taxilane or apron.

B14-6.1.3 Jet Blast.

Jet blast effects on personnel, equipment, facilities, and other aircraft must be considered. Maintain a distance behind aircraft sufficient to dissipate jet blast to 56 kilometers per hour (35 miles per hour) and temperatures to a maximum of 38 degrees Celsius (100 degrees Fahrenheit), or ambient, whichever is more, or provide jet blast protection with a deflector.

B14-6.1.4 Marking and Lighting.

Threshold displacements and runway end relocation must be marked and lighted in accordance with UFC 3-260-04, and UFC 3-535-01. Additionally, alternate temporary taxi routes on taxiways

or aprons must be marked either with temporary paint markings or with frangible edge markers. They must also be lighted if they will be used during periods of darkness or during instrument flight rule operations. Closed taxiways or taxilanes on aprons must be marked or barricaded and normal lighting circuits disabled. Temporary obstructions, such as cranes, must be marked and lighted in accordance with FAA AC 70/7460-1. All hazardous areas (such as excavations or stockpiled materials) on the airfield must be delineated with lighted barricades on all exposed (visible or accessible) sides.

B14-6.2 Formal Notification of Construction Activities.
Any entity, including the military, proposing any kind of construction or alteration of objects that may affect navigable airspace, including military airspace, as defined in FAR Part 77, is required to notify the FAA. FAA Form 7460-1 is used for this purpose.

B14-6.3 Safety Considerations.
The following is a partial list of safety considerations which experience indicates will require attention during airport construction.
a. Minimum disruption of standard operating procedures for aeronautical activity.

b. Maintain clear routes from firefighting and rescue stations to active airport operations areas.

c. Chain of notification and authority to change safety-oriented aspects of the construction plan.

d. Initiation, currency, and cancellation of Notice to Airmen (NOTAM).

e. Suspension or restriction of aircraft activity on affected airport operations areas.

f. Threshold displacement and appropriate temporary lighting and marking.

g. Installation and maintenance of temporary lighting and marking for closed or diverted aircraft routes and disabling the normal lighting circuits for closed runways, taxiways, and taxilanes.

h. Revised vehicular control procedures or additional equipment and manpower.

i. Marking/lighting of construction equipment.

j. Storage of construction equipment and materials when not in use.

k. Designation of responsible representatives of all involved parties and their availability.

l. Location of construction personnel parking and transportation to and from the work site.

m. Marking/lighting of construction areas.

n. Location of construction offices.

o. Location of contractor's plants.

p. Designation of waste areas and disposal.

q. Debris cleanup responsibilities and schedule.

r. Identification of construction personnel and equipment.

s. Location of haul roads.

t. Security control on temporary gates and relocated fencing.

u. Noise pollution.

v. Blasting regulation and control.

w. Dust control.

x. Location of utilities.

y. Provision for temporary utilities and/or immediate repairs in the event of disruption.

z. Location of power and control lines for electronic/visual navigational aids.

aa. Additional security measures required if AFI 31-101 is impacted (relocation or reconstruction of fences or security sensors).

bb. Marking and lighting of closed airfield pavement areas.

cc. Coordination of winter construction activities with the snow removal plan.

dd. Phasing of work.

ee. Shutdown, relocation and/or protection of airport electronic and or visual navigational aids.

ff. Smoke, steam, vapor, and extraneous light controls.

gg. Notification to crash/fire/rescue and maintenance personnel when working on water lines.

hh. Provide traffic directors/wing walkers, etc., as needed to assure clearance

B14-6.5 Vehicles on the Airfield.
Vehicular activity on the airfield movement areas should be kept to a minimum. Where vehicular traffic on airfield operational areas cannot be avoided, it should be carefully controlled. A basic guiding principle is that the aircraft always has the right-of-way. Some aspects of vehicle control and identification are discussed below. It should be recognized, however, that every airfield presents different vehicle requirements and problems and therefore needs individualized solutions so vehicle traffic does not endanger aircraft operations. Personnel required to drive on the airfield must be knowledgeable of and comply with the procedures outlined in the installation airfield driving program.

B14-6.5.1 Visibility.
Vehicles which routinely operate on airport operations areas should be marked and/or flagged for high daytime visibility and, if appropriate, lighted for nighttime operations. Vehicles which are not marked and lighted may require an escort by one that is equipped with temporary marking and lighting devices. (See Air Force T.O. 36-1-191 and FAA AC 150/5210-5.)

B14-6.5.2 Identification.
It is usually desirable to be able to visually identify specific vehicles from a distance. It is recommended that radio-equipped vehicles which routinely operate on airfields be permanently marked with identifying characters on the sides and roof. Vehicles needing intermittent identification could be marked with tape or magnetically attached markers. Such markers are commercially available. However, select markers that can perhaps be mounted inside the vehicle or tethered to the vehicle so they do not fall off during vehicle operation and present potential foreign object damage (FOD) to aircraft.

B14-6.5.4 Movement.
The control of vehicular activity on airfield operations areas is of the highest importance. Airfield management is responsible for developing procedures and providing training regarding vehicle operations to ensure aircraft safety during construction. This requires coordination with airfield users and air traffic control. Consideration should be given to the use of two-way radio, signal lights, traffic signs, flagman, escorts, or other means suitable for the particular airfield. The selection of a frequency for two-way radio communications between construction contractor vehicles and the Air Traffic Control Tower (ATCT) must be coordinated with the ATC tower chief. It should be remembered that even with the most sophisticated procedures and equipment, systematic training of vehicle operators is necessary to achieve safety. Special consideration should be given to training intermittent operators, such as construction workers, even if escort service is being provided.

B14-6.6 Inspection.
Frequent inspections should be made by the airfield manager, civil engineering contract inspectors, and other representatives during critical phases of the work to ensure the contractor is following the prescribed safety procedures and there is an effective litter control program.

B14-6.7 Special Safety Requirements during Construction.
Use the following guidelines to help develop a safety plan for airfield construction.

B14-6.7.1 Runway Ends.
Construction equipment will not penetrate the approach-departure clearance surface.

B14-6.7.2 Runway Edges.
Construction activities normally will not be permitted within 30 meters (100 feet) of the runway edge. However, construction may be permitted within 30 meters (100 feet) of the runway edge on a case-by-case basis with a temporary waiver approved by the installation commander.

B14-6.7.3 Taxiways and Aprons.
Normally, construction activity setback lines will be located at a distance to provide the minimum wingtip clearance required from Table 6-1, items 5 or 6, as appropriate, plus one-half the wingspan of the largest predominant aircraft that will use the taxi route from the centerline of the

active taxiway or apron. However, construction activity may be permitted up to the taxiway and aprons in use, provided the activity is approved by the installation commander and NOTAMs are issued; marking and lighting provisions are implemented; and it is determined the height of equipment and materials is safely below any part of the aircraft using the airfield operations areas which might overhang those areas. Alternate taxi routes and procedures for wing-walkers should be included in the safety plan if adequate wingtip clearance cannot be provided.

B14-6.7.4 Excavation and Trenches.
Excavations and open trenches may be permitted along runways up to 30 meters (100 feet) from the edge of an active runway, provided they are adequately signed, lighted and marked. In addition, excavation and open trenches may be permitted within 30 meters (100 feet) of the runway edge on a case-by-case basis; that is, cable trenches, pavement tie-ins, etc., with the approval of the installation commander. Along taxiways and aprons, excavation and open trenches may be permitted up to the edge of structural taxiway and apron pavements, provided the drop-off is adequately signed, lighted and marked.

B14-6.7.6 Maximum Equipment Height.
FAA Form 7460-1 must be submitted when equipment is expected to penetrate any of the surfaces described in Appendix B, Section 5, FAR Part 77.9.

B14-6.7.7 Proximity of Construction Activity to Navigational Aids.
Construction activity in the vicinity of navigational aids requires special considerations. The effect of the activity and its permissible distance and direction from the aid must be evaluated in each instance. A coordinated evaluation by the airfield manager, civil engineer, safety, and communications personnel is necessary. Particular attention needs to be given to stockpiling materials as well as to the movement and parking of equipment which may interfere with line-of-sight from the tower or interfere with electronic emissions.

B14-6.7.8 Proximity of Construction to Explosives QD Arc.
Wing Explosive safety must obtain a waiver for any construction falling inside an explosives QD Arc.

B14-6.8 Construction Vehicle Traffic.
With respect to vehicular traffic, aircraft safety during construction is likely to be endangered by four principle causes: increased traffic volume; nonstandard traffic patterns; vehicles without radio communication and marking; and operators untrained in airfield procedures. Because each construction situation differs, airfield management must develop and coordinate a construction vehicle traffic plan with airfield users, air traffic control and the appropriate construction engineers and contractors. The plan, when signed by all participants, should become a part of the contract, the work order project requirements checklist, and/or other project guidance documents developed for in-house projects. Airfield management, quality assurance, and safety are responsible for coordinating and enforcing the plan.

B14-6.10 Marking and Lighting Closed or Hazardous Areas on Airfields.
To ensure adequate marking and lighting is provided for the duration of the project, the construction specifications, the work order project requirements checklist, and/or other project guidance documents must include a provision requiring the contractor or other construction

activity to have a person on-call 24 hours a day for emergency maintenance of airport hazard lighting and barricades. See AFI 32-1042, UFC 3-260-04 and UFC 3-535-01 for marking and lighting requirements for closed pavement areas.

B14-6.11 Temporary Runway Threshold Displacement.
Identification of temporary runway threshold displacements must be provided as indicated in UFC 3-260-04, and UFC 3-535-01. The extent of the marking and lighting should be directly related to the duration of the displacement as well as the type and level of aircraft activity. Temporary visual aids must be placed to provide an unobstructed approach-departure clearance surface with a 3-meter (10-foot) buffer between the surface and the tallest equipment in the construction zone, and a 304.8-meter (1,000-foot) -long overrun safety area beyond the departure end of the runway. Runway threshold displacements must be coordinated with the TERPS office as the displacement will require discontinuation of precision instrument procedures and may affect landing minima for non-precision procedures. Departure procedures will also have to be evaluated to determine the effects of the runway threshold displacements.

Pre-construction meeting minutes are required to be completed, with a copy provided to Airfield Management to comply with AFMAN 13-204 V2, para 2.2.2.33.4.3. Creating meeting minutes ensures the contractor and other government agencies are aware of what was discussed and agreed upon should any potential future issues arise.

All airfield contracts within the airfield environment require all personnel to receive airfield drivers training. Local Airfield Driving Instruction calls for the Project Management Organization Unit Airfield Driving Program Representative to train groups of less than 20 contractors. Groups of 20 or more can/will be trained by Airfield Management personnel. Construction Project Managers will coordinate with the Wing Airfield Driving Program Manager at Airfield Management for time, locations, and requirements

For short term projects, (Airfield Manager/Wing Airfield Manager determines durations) contractors are required to check in at the Airfield Management Operations counter to check out airfield driving cones/placards. This allows Airfield Management to verify the operator is licensed to operate (verifying currency of the IMT 483), and also serves to have the contractor check-in daily, with Airfield Management logging contractor activity in the events log.

For longer term projects, Airfield Management MAY allow CE Project Management or the Corps of Engineers to sign out cones for the contractors to be used for the duration of the project. Project Managers are responsible for ensuring cones are returned to Airfield Management. Contractors will be responsible for replacing cones/placards that are not returned, or not returned in a serviceable condition. The Airfield Management office will determine future serviceability on turn in. 2019 replacement costs are approximately $5 plus shipping). In those cases where cones/placards are signed out for extended periods (defined as other than daily), Contractor must notify Airfield Management Operations at the start and end of each work day so that contractor activity on the airfield can be tracked and logged as required. Notifications may be accomplished either in person by visiting the Airfield Management Operations office or by calling Airfield Operations at 609-754-2712. Contractors not complying with daily notification requirements will have lost the long term waiver for the cones/placards and be required to check out cones and turn them in daily.

AFI 13-213

4.1.1. Personnel driving on the airfield must complete airfield driver's training or be escorted by a vehicle operator assigned to JB MDL and possessing a valid Air Force Form 483 prior to entry to the airfield. **(T-1)**

4.1.2. Units sponsoring temporarily assigned personnel or non-base assigned contractors are responsible for providing training or an escort that possesses a valid Air Force Form 483.

4.28.1. Do not grant temporarily assigned personnel, Inspection/Survey Teams and non-base assigned contractor's access to the Controlled Movement Area unless they have completed all training and testing requirements outlined in this instruction and the local base security supplement.

4.28.2. Temporarily assigned personnel, Inspection/Survey Teams and non-base assigned contractors must possess an Air Force Form 483 and be trained on the wing/base airfield driving procedures to operate a vehicle on the airfield without an escort. **(T-1)**

4.28.2.1. The Wing Airfield Driving Program Manager or as delegated in the local supplement to the unit Airfield Driving Program Manager may provide a local briefing/training when temporarily assigned personnel, Inspection/Survey Teams and non-base assigned contractors driving route(s) do not require access on or across the Controlled Movement Area.

4.29.3. Company/contractor representative passes are limited to those vehicle(s) necessary to fulfill contractual obligations. To the maximum extent possible, requests for vehicle passes by temporarily assigned personnel are facilitated via the host unit Airfield Driving Program Manager.

4.29.5. Request for a vehicle pass/decal are endorsed by the individual's Unit Commander or Company/Contractor representative. At a minimum, the Memorandum for Record or local form/electronic equivalent contains the following information:

4.29.5.1. Owner/User.

4.29.5.2. Organization/Company.

4.29.5.3. Duty Phone.

4.29.5.4. Vehicle Make, Model, Year, Color, and License/State.

4.29.5.5. Pass/Permit number.

4.29.5.6. Area of Operation(s)/location.

4.29.5.7. Justification.

4.29.5.8. Effective period/dates.

4.29.6. Privately Owned Vehicle and Government Leased vehicles passes/decals are differentiated in the local base driving instruction.

4.29.7. Maintain vehicle passes/decals supportive information in accordance with Air Force Records Disposition Schedule, Table 13-01, Rule 01.00.

Airfield Access:

Airfield access is dependent on force protection measures in place, at any given time. Airfield gates may be secured with a lock. If access is coordinated through an unlocked gate, airfield drivers licensing and potentially Line badging or escorts may be needed. 1 person who is issued a line badge may escort up to 10 people.

If access is granted through a locked gate, a CAC card holding member may be able to sign out the key to the gate from the SFS. If the gate is desired to remain open for the duration of the day, a person manning the gate must be a CAC card holder.

There are plans for automating McGuire's airfield access gates. Once that project is executed, SFS will implement and advise CE, Corps of Engineering, and contractors of requirements to obtain airfield access badges.

Construction Site cleanup/Upkeep:

The contractor must provide the capability to keep all operational airfield areas free of FOD. In the event of forecasted inclement weather, contractors must prepare/secure worksites to prevent windblown debris.

SECTION 01 35 26

GOVERNMENTAL SAFETY REQUIREMENTS
05/24, CHG 1: 05/25

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ANSI/ASSP A10.34	(2021) Protection of the Public on or Adjacent to Construction Sites
ANSI/ASSP A10.44	(2020) Control of Energy Sources (Lockout/Tagout) for Construction and Demolition Operations

ASTM INTERNATIONAL (ASTM)

ASTM F855	(2020) Standard Specifications for Temporary Protective Grounds to Be Used on De-energized Electric Power Lines and Equipment

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 1048	(2016) Guide for Protective Grounding of Power Lines
IEEE C2	(2023) National Electrical Safety Code

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA Z89.1	(2014; R 2019) American National Standard for Industrial Head Protection

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 51B	(2024) Standard for Fire Prevention During Welding, Cutting, and Other Hot Work
NFPA 70	(2026; TIA 26-1; ERTA 26-1; TIA 26-2; TIA 26-3; TIA 26-4; TIA 26-5; TIA 26-6; TIA 26-7; ERTA 26-2; ERTA 26-3) National Electrical Code
NFPA 70E	(2024) Standard for Electrical Safety in the Workplace
NFPA 241	(2022; ERTA 22-1) Standard for Safeguarding Construction, Alteration, and Demolition Operations

NFPA 306	(2024) Standard for the Control of Gas Hazards on Vessels

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety -- Safety and Occupational Health (SOH) Requirements

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

10 CFR 20	Standards for Protection Against Radiation
29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1915	Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment
29 CFR 1926	Safety and Health Regulations for Construction
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
CPL 2.100	(1995) Application of the Permit-Required Confined Spaces (PRCS) Standards, 29 CFR 1910.146

1.2 DEFINITIONS

The following definitions are for the convenience of the reader. If there is a referenced document in the text of this specification section, that is the document that should define terms for that paragraph. If further clarification is needed, contact the Contracting Officer.

1.2.1 Site Safety and Health Officer (SSHO)

A Contractor Employee that is responsible for overseeing and ensuring implementation of the prime Contractor's Safety and Occupational Health (SOH) program according to the Contract, EM 385-1-1, applicable federal, state, and local requirements.

1.2.1.1 Level One SSHO

A designated employee with full-time SOH responsibility that meets and follows the requirements of EM 385-1-1.

1.2.1.2 Level Two SSHO

A designated employee with Level Two SSHO responsibility that meets and follows the requirements of EM 385-1-1. Level Two SSHOs cannot be assigned to projects that have a residual Risk Assessment Code (RAC) of high or extremely high.

1.2.1.3 Level Three SSHO

A designated Qualified Person or Competent Person with SOH responsibility that meets and follows the requirements of EM 385-1-1. Level 3 SSHOs cannot be assigned to projects that have a residual RAC of high or

extremely high.

1.2.1.4 Alternate SSHO

An employee that meets the definition of the contract-required level SSHO, but is not the primary SSHO.

1.2.2 Competent Person (CP)

The CP is a person designated in writing, who, through training, knowledge and experience, is capable of identifying, evaluating, and addressing existing and predictable hazards in the working environment or working conditions that are unsanitary, hazardous, or dangerous to personnel, and who has authorization to take prompt corrective measures to eliminate them.

1.2.3 Qualified Person (QP)

The QP is a person designated in writing, who, by possession of a recognized degree, certificate, or professional standing, or extensive knowledge, training, and experience, has successfully demonstrated their ability to solve or resolve problems related to the subject matter, the work, or the project.

1.3 SUBMITTALS

Government Acceptance or Approval does not remove responsibility from the Contractors for their actions or liability.

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Accident Prevention Plan (APP); G, RO

SD-06 Test Reports

Accident Reports; G, RO

LHE Inspection Reports

Monthly Exposure Reports; G, RO

SD-07 Certificates

Activity Hazard Analysis (AHA); G, RO

Certificate of Compliance

Hot Work Permit

License Certificates

Portable Gauge Operations Planning Worksheet; G, RO

Radiography Operation Planning Work Sheet; G, RO

Standard Lift Plan; G, RO

Critical Lift Plan; G, RO

1.4 PUBLIC HEALTH EMERGENCIES

In the event of a declared public health emergency, follow safety precautions as required by the Occupational Safety and Health Administration (OSHA) www.osha.gov, the Centers for Disease Control and Prevention (CDC) www.cdc.gov, and as required by federal, state and local requirements.

1.5 MONTHLY EXPOSURE REPORTS

Provide a Monthly Exposure Report by the fifth day of each month for the previous month. This report is a compilation of employee-hours worked each month for all site workers, both Prime and subcontractor. Failure to submit the report may result in retention of up to 10 percent of the progress payment. Submit the hours via the agency construction management system of record.

1.6 REGULATORY REQUIREMENTS

In addition to the detailed requirements included in the provisions of this Contract, comply with the most recent edition of USACE EM 385-1-1, and the following federal, state, and local laws, ordinances, criteria, rules and regulations at the date of the Solicitation for this Contract. Submit matters of interpretation of standards to the appropriate administrative agency for resolution before starting work. Where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary, the most stringent requirements govern.

1.7 SITE QUALIFICATIONS, DUTIES, AND MEETINGS

1.7.1 Site Safety and Health Officer (SSHO)

1.7.1.1 Qualifications of SSHO

All SSHOs will have met the training, experience requirements identified in the EM 385-1-1 and this Contract.

1.7.1.2 Duties of SSHO

All SSHOs will carry out the roles and responsibilities as identified in this Contract and the EM 385-1-1. All SSHOs will be designated on an ENG Form 6282, provided by the Contracting Officer. Superintendent, QC Manager, and SSHO are subject to dismissal if their required duties are not being effectively carried out. If either the Superintendent, QC Manager, or SSHO are dismissed, project work will be stopped and will not be allowed to resume until a suitable replacement is approved and the above duties are again being effectively carried out.

1.7.1.3 Safety Meetings

Conduct safety meetings to review past activities, plan for new or changed operations, review pertinent aspects of appropriate AHA (by trade), establish safe working procedures for anticipated hazards, and provide pertinent Safety and Occupational Health (SOH) training and motivation. Conduct meetings at least once a month for all supervisors at the project location. The SSHO, supervisors, or foremen must conduct meetings at least once a week for the trade workers. Document meeting minutes to include the date, persons in attendance, subjects discussed, and names of individual(s) who conducted the meeting. Maintain documentation on-site and furnish copies to the Contracting Officer on request. Notify the Contracting Officer of all scheduled meetings 7 calendar days in advance.

1.7.2 Roles and Responsibilities of Prime Contractor and SSHO

The Prime Contractor and SSHO must ensure that the requirements of all applicable OSHA and EM 385-1-1 are met for the project. The Prime Contractor must ensure an SSHO or an equally qualified Alternate SSHO(s) is at the worksite at all times to implement and administer the Contractor's safety program and Government accepted Accident Prevention Plan. If the required SSHO has to temporarily (that is, up to 24 hours / 1 day) leave the site of work due to unforeseen or emergency situations, a Level One, Two, or Three SSHO may be used in the interim and must be on the site of work at all times when work is being performed.

If the SSHO must be off-site for a period longer than 24 hours / 1 day, a qualified alternate that meets the contract requirements must be onsite.

a. Prime contractor must ensure all SSHOs will:

(1) Are designated on an ENG Form 6282.

(2) Meet minimum training and experience requirements identified in EM 385-1-1.

(3) Execute roles and responsibilities identified in EM 385-1-1.

1.7.3 Contract Site Safety And Health Officer(s)(SSHOs) Minimum Requirements

Provide a minimum of one Level One SSHO that meets the requirements of EM 385-1-1 for this project.

1.7.4 Competent Person for Confined Space Entry

Provide a CP for Confined Space Entry who meets the requirements of EM 385-1-1 and herein. The CP for Confined Space Entry must supervise the entry into each confined space in accordance with EM 385-1-1.

Since this work involves operations that handle combustible or hazardous materials, this person must have the ability to understand and follow through on the air sampling, Personal Protective Equipment (PPE), and instructions of a Marine Chemist, Coast Guard authorized persons, or Certified Industrial Hygienist. Confined space and enclosed space work must comply with NFPA 306, 29 CFR 1915, "Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment," or as applicable in 29 CFR 1910 for general industry, 29 CFR 1926 for construction.

1.7.5 Preconstruction Conference

a. Contractor representatives who have a responsibility or significant role in accident prevention on the project must attend the preconstruction conference. This includes the project superintendent, Site Safety and Occupational Health Officer, quality control manager, or any other assigned safety and health professionals who participated in the development of the APP (including the Activity Hazard Analyses (AHAs) and special plans, program and procedures associated with it).

b. Discuss the details of the submitted APP to include incorporated plans, programs, procedures and a listing of anticipated AHAs that will be developed and implemented during the performance of the Contract. This list of proposed AHAs will be reviewed and an agreement will be reached between the Contractor and the Contracting Officer as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, and Government review of AHAs to preclude project delays. The creation of the APP and Schedule will be created after being given Notice to Proceed.

c. Deficiencies in the submitted APP, identified during the Contracting Officer's review, must be corrected, and the APP re-submitted for review prior to the start of construction. Work is not permitted to begin until an APP is established that is acceptable to the Contracting Officer.

1.8 ACCIDENT PREVENTION PLAN (APP)

1.8.1 Accident Prevention Plan (APP)

Submit the Accident Prevention Plan (APP) for review and acceptance by the Government at least 15 calendar days prior to the start, after being given Notice to Proceed. A competent person must prepare the written site-specific APP. Prepare the APP in accordance with the format and requirements of EM 385-1-1, ENG Form 6293, and herein. The APP must be job-specific and address any unusual or unique aspects of the project or activity for which it is written. The APP must interface with the Contractor's overall safety and occupational health program referenced in the APP in the applicable APP element, and made site-specific. Describe the methods to evaluate past safety performance of potential subcontractors in the selection process. Also, describe innovative methods used to ensure and monitor safe work practices of subcontractors. The Government considers the Prime Contractor to be the "controlling employer" for all worksite safety and health of the subcontractors. Contractors are responsible for informing their subcontractors of the safety provisions under the terms of the Contract and the penalties for noncompliance, coordinating the work to prevent one craft from interfering with or creating hazardous working conditions for other crafts, and inspecting subcontractor operations to ensure that accident prevention responsibilities are being carried out. The APP must be signed in accordance with the APP and ENG Form 6293 Accident Prevention Plan Worksheet. The SSHO must provide and maintain the APP and a log of signatures by each subcontractor foreman, attesting that they have read and understand the APP, and make the APP and log available on-site to the Contracting Officer. If English is not the foreman's primary language, the Prime Contractor must provide an interpreter.

Submit the APP to the Contracting Officer within 30 calendar days of Contract award and not less than 10 calendar days prior to the date of the

preconstruction conference for acceptance. Work cannot proceed without an accepted APP. Once reviewed and accepted by the Contracting Officer, the APP and attachments will be enforced as part of the Contract. Disregarding the provisions of this Contract or the accepted APP is cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified. Continuously review and amend the APP, as necessary, throughout the life of the Contract. Changes to the accepted APP must be made with the knowledge and concurrence of the Contracting Officer, project superintendent, SSHO and Quality Control Manager. Incorporate unusual or high-hazard activities not identified in the original APP as they are discovered. Should any severe hazard exposure (i.e., imminent danger) become evident, stop work in the area, secure the area, and develop a plan to remove the exposure and control the hazard. Notify the Contracting Officer within 24 hours of discovery. Eliminate and remove the hazard. In the interim, take all necessary action to restore and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public (as defined by ANSI/ASSP A10.34), and the environment.

1.8.2 Names and Qualifications

Provide plans in accordance with the requirements outlined in EM 385-1-1, including the following:

a. Names and qualifications (resumes including education, training, experience and certifications) of site safety and health personnel designated to perform work on this project to include the designated Site Safety and Health Officer and other competent and qualified personnel to be used. Specify the duties of each position.

b. As a minimum, designate and submit qualifications of Competent Persons (CP) for each of the following major areas: excavation; scaffolding; fall protection; hazardous energy; confined space; health hazard recognition, evaluation and control of chemical, physical and biological agents; and personal protective equipment and clothing to include selection, use and maintenance. Designate and submit qualifications for additional CPs as applicable to the work performed under this Contract.

1.8.3 Plans

Provide plans in the APP in accordance with the requirements outlined in EM 385-1-1, including the following:

1.9 ACTIVITY HAZARD ANALYSIS (AHA)

Before beginning each activity, task or Definable Feature of Work (DFOW) involving a type of work presenting hazards not experienced in previous project operations, or where a new work crew or subcontractor is to perform the work, the Contractor(s) performing that work activity must prepare an AHA. AHAs must be developed by the Prime Contractor, subcontractor, or supplier performing the work, and provided for Prime Contractor review and approval before submitting to the Contracting Officer. AHAs must be signed by the SSHO, Superintendent, QC Manager and the subcontractor Foreman performing the work. Format the AHA in accordance with EM 385-1-1 or as directed by the Contracting Officer. Submit the AHA for review at least 15 working days prior to the start of each activity task, or DFOW. The Government reserves the right to require the Contractor to revise and resubmit the AHA if it fails to effectively

identify the work sequences, specific anticipated hazards, site conditions, equipment, materials, personnel and the control measures to be implemented.

AHAs must identify competent persons required for phases involving high risk activities, including confined entry, crane and rigging, excavations, trenching, electrical work, fall protection, and scaffolding.

1.9.1 AHA Management

Review the AHA list periodically (at least monthly) at the Contractor supervisory safety meeting, and update as necessary when procedures, scheduling, or hazards change. Use the AHA during daily inspections by the SSHO to ensure the implementation and effectiveness of the required safety and health controls for that work activity.

1.9.2 AHA Signature Log

Each employee performing work as part of an activity, task or DFOW must review the AHA for that work and sign a signature log specifically maintained for that AHA prior to starting work on that activity. The SSHO must maintain a signature log on site for every AHA. Provide employees whose primary language is other than English, with an interpreter to ensure a clear understanding of the AHA and its contents.

1.10 Explosives Safety Quantity Distances (QDs)

The ACTIVITY HAZARD ANALYSIS (AHA)must include procedures for working within a hazardous cargo loading area.

Abandoned Fuel Lines

The AHA must include procedures for the removal of existing fuel pits as indicated. The abandoned fuel lines may contain flammable vapors or liquids.1.11 SITE SAFETY REFERENCE MATERIALS

Maintain safety-related references applicable to the project, including those listed in paragraph REFERENCES. Maintain applicable equipment manufacturer's manuals.

1.12 INSTALLATION EMERGENCIES

In case of an installation emergency, the Contracting Officer, Security Forces personnel, McGuire AFB Fire Chief, and Airfield Management, or their representatives, have the authority to order the contractor to stop work and clear the area of personnel and equipment. The contractor must comply with such an order with all possible speed. After clearing the work site as instructed, the contractor shall immediately inform the Contracting Officer of all oral or written stop work orders. In the case of being halted by Security Forces personnel, the Fire Chief or Airfied Management, the contractor must notify the Contracting Officer in writing and provide explanation for the stoppage.

1.13 EMERGENCY MEDICAL TREATMENT

Contractors must arrange for their own emergency medical treatment in accordance with EM 385-1-1. The Government has no responsibility to provide emergency medical treatment.

1.14 NOTIFICATIONS AND REPORTS

1.14.1 Accident Notification

Notify the Contracting Officer in accordance with the EM 385-1-1 Accident Reporting Timeline.

Table
Accident Reporting Required Timeline

Accident Type	Notify KO or COR	Complete Final Accident Report on ENG 3394 and provide to KO or COR
Fatality, in-patient hospitalization, amputation, eye loss, or property damage over $600,000.	Immediately, no later than (NLT) 8 Hours	Within 7 Days
All other accidents and near misses	Immediately, no later than (NLT) 24 Hours	Within 7 Days

Within notification include Contractor name; Contract title; type of Contract; name of activity, installation or location where accident occurred; date and time of accident; names of personnel injured; extent of property damage, if any; extent of injury, if known, and brief description of accident (for example, type of construction equipment used and PPE used). Preserve the conditions and evidence on the accident site until the Government investigation team arrives on-site and Government investigation is conducted. Assist and cooperate fully with the Government's investigation(s) of any accident or near miss.

1.14.2 Accident Reports

a. Conduct an accident investigation for recordable injuries and illnesses, property damage, and near misses as defined in EM 385-1-1, to establish the root cause(s) of the accident. All accidents are reportable, regardless of whether or not it is recordable. Complete the applicable USACE Accident Report, ENG Form 3394, and provide the report to the Contracting Officer within 7 calendar days of the accident. The Contracting Officer will provide copies of any required or special forms. All accidents are reportable, regardless of whether or not it is recordable.

b. Near Misses: For Army projects, report all "Near Misses" to the Contracting Officer, using local accident reporting procedures, within 24 hours. The Contracting Officer will provide the Contractor the required forms. Near miss reports are considered positive and proactive Contractor safety management actions.

1.14.3 LHE Inspection Reports

Submit LHE inspection reports required in accordance with EM 385-1-1 and as specified herein with Daily Reports of Inspections.

1.14.4 Certificate of Compliance and Pre-lift Plan/Checklist for LHE and Rigging

1.14.4.1 Certificate of Compliance

Provide a Certificate of Compliance for LHE utilized to perform work under this Contract in accordance with Section 16-7 of the EM 385-1-1. Post completed certificate on the crane.

1.14.4.2 Pre-Lift Plans

Develop either a Standard Lift Plan (SLP) or Critical Lift Plan (CLP) as required in accordance with EM 385-1-1. Utilize the Standard Lift Plan ENG Form 6203 for routine crane lifts and use the Critical Lift Plan ENR Form 6213 for non-routine crane lifts requiring more detailed planning and additional safety precautions, as defined by Section 16-2j of the EM 385-1-1. Submit lift plans to the Contracting Officer for approval within 15 calendar days in advance of planned lift.

1.15 HOT WORK PERMIT

1.15.1 Permit and Personnel Requirements

Before performing hot work on or near the fuel line, the Contractor should follow the following preparations and procedures to prevent an accidental release of hazardous, flammable, or highly combustible fumes or vapors. The section of the pipeline where the work is being done must have all fluids evacuated. The Contractor must purge all vapors and fumes. The Contractor's personnel must wear the proper PPE when working around any potentially hazardous material.

Submit and obtain a written permit prior to performing "Hot Work" (i.e., welding or cutting) or operating other flame-producing/spark producing devices, from the Fire Division. A permit is required from the Explosives Safety Office for work in and around where explosives are processed, stored, or handled. Contractors are required to meet all criteria before a permit is issued. Provide at least two 20 pound 4A:20 BC rated extinguishers for normal "Hot Work". The extinguishers must be current inspection tagged, and contain an approved safety pin and tamper resistant seal. It is also mandatory to have a designated FIRE WATCH for any "Hot Work" done at this activity. The Fire Watch must be trained in accordance with NFPA 51B and remain on-site for a minimum of 1 hour after completion of the task or as specified on the hot work permit.

When starting work in the facility, require personnel to familiarize themselves with the location of the nearest fire alarm boxes and place in memory the emergency Fire Division phone number. Report any fire, no matter how small, to the responsible Fire Division immediately.

1.15.2 Work Around Flammable Materials

Obtain permit approval from a NFPA Certified Marine Chemist, or Certified Industrial Hygienist for "Hot Work" within or around flammable materials (such as fuel systems or welding/cutting on fuel pipes) or confined spaces (such as sewer wet wells, manholes, or vaults) that have the potential for flammable or explosive atmospheres.

Whenever these materials, except beryllium and chromium (VI), are encountered in indoor operations, local mechanical exhaust ventilation

systems that are sufficient to reduce and maintain personal exposures to within acceptable limits must be used and maintained in accordance with manufacturer's instruction and supplemented by exceptions noted in EM 385-1-1.

1.16 RADIATION SAFETY REQUIREMENTS

Submit License Certificates, employee training records, and Leak Test Reports for radiation materials and equipment to the Contracting Officer and Radiation Safety Office (RSO) for all specialized and licensed material and equipment proposed for use on the construction project (excludes portable machine sources of ionizing radiation including moisture density and X-Ray Fluorescence (XRF)). Maintain on-site records whenever licensed radiological materials or ionizing equipment are on Government property.

Protect workers from radiation exposure in accordance with 10 CFR 20, ensuring any personnel exposures are maintained As Low As Reasonably Achievable.

1.16.1 Radiography Operation Planning Work Sheet

Submit a Gamma and X-Ray Radiography Operation Planning Work Sheet to Contracting Officer 14 days prior to commencement of operations involving radioactive materials or radiation generating devices. For portable machine sources of ionizing radiation, including moisture density and XRF, use and submit the Portable Gauge Operations Planning Worksheet instead. The Contracting Officer will review the submitted worksheet and provide questions and comments.

Contractors must use primary dosimeters process by a National Voluntary Laboratory Accreditation Program (NVLAP) accredited laboratory.

1.16.2 Site Access and Security

Coordinate site access and security requirements with the Contracting Officer for all radiological materials and equipment containing ionizing radiation that are proposed for use on a government facility. For gamma radiography materials and equipment, a Government escort is required for any travels on the Installation. The Government authorized representative will meet the Contractor at a designated location outside the Installation, ensure safety of the materials being transported, and will escort the Contractor for gamma sources onto the Installation, to the job site, and off the Installation. For portable machine sources of ionizing radiation, including moisture density and XRF, the Government authorized representative will meet the Contractor at the job site.

Provide a copy of all calibration records, and utilization records for radiological operations performed on the site.

1.16.3 Loss or Release and Unplanned Personnel Exposure

Loss or release of radioactive materials, and unplanned personnel exposures must be reported immediately to the Contracting Officer, RSO, and Base Security Department Emergency Number.

1.16.4 Site Demarcation and Barricade

Properly demark and barricade an area surrounding radiological operations

to preclude personnel entrance, in accordance with EM 385-1-1, Nuclear Regulatory Commission, and Applicable State regulations and license requirements, and in accordance with requirements established in the accepted Radiography Operation Planning Work Sheet.

Do not close or obstruct streets, walks, and other facilities occupied and used by the Government without written permission from the Contracting Officer.

1.16.5 Security of Material and Equipment

Properly secure the radiological material and ionizing radiation equipment at all times, including keeping the devices in a properly marked and locked container, and secondarily locking the container to a secure point in the Contractor's vehicle or other approved storage location during transportation and while not in use. While in use, maintain a continuous visual observation on the radiological material and ionizing radiation equipment. In instances where radiography is scheduled near or adjacent to buildings or areas having limited access or one-way doors, make no assumptions as to building occupancy. Where necessary, the Contracting Officer will direct the Contractor to conduct an actual building entry, search, and alert. Where removal of personnel from such a building cannot be accomplished and it is otherwise safe to proceed with the radiography, position a fully instructed employee inside the building or area to prevent exiting while external radiographic operations are in process.

1.16.6 Transportation of Material

Comply with 49 CFR 173 for Transportation of Regulated Amounts of Radioactive Material. Notify Local Fire authorities and the site Radiation Safety Officer (RSO) of any Radioactive Material use.

1.16.7 Schedule for Exposure or Unshielding

Actual exposure of the radiographic film or unshielding the source must not be initiated until after 5 p.m. on weekdays.

1.16.8 Transmitter Requirements

Adhere to the base policy concerning the use of transmitters, such as radios and cell phones. Obey Emissions control (EMCON) restrictions.

1.17 CONFINED SPACE ENTRY REQUIREMENTS

Confined space entry must comply with EM 385-1-1, 29 CFR 1926, 29 CFR 1910, and Directive CPL 2.100. Any potential for a hazard in the confined space requires a permit system to be used.

1.17.1 Rescue Procedures and Coordination with Local Emergency Responders

Develop and implement an on-site rescue and recovery plan and procedures. The rescue plan must not rely on local emergency responders for rescue from a confined space.

1.18 SEVERE STORM PLAN

In the event of a severe storm warning, the Contractor must comply with the applicable Storm Plan and:

a. Secure outside equipment and materials and place materials that could be damaged in protected areas.

b. Check surrounding area, including roof, for loose material, equipment, debris, and other objects that could be blown away or against existing facilities.

c. Ensure that temporary erosion controls are adequate.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 CONSTRUCTION AND OTHER WORK

Comply with EM 385-1-1, NFPA 70, NFPA 70E, NFPA 241, the APP, the AHA, Federal and State OSHA regulations, and other related submittals and activity fire and safety regulations. The most stringent standard prevails.

PPE is governed in all areas by the nature of the work the employee is performing. Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks. Safety glasses must be worn or carried/available on each person. Mandatory PPE includes:

a. Head Protection that meets ANSI/ISEA Z89.1

b. Long Pants

c. Appropriate Safety Footwear

d. Appropriate Class Reflective Vests

3.1.1 Worksite Communication

Employees working alone in a remote location or away from other workers must be provided an effective means of emergency communications (i.e., cellular phone, two-way radios, land-line telephones or other acceptable means). The selected communication must be readily available (easily within the immediate reach) of the employee and must be tested prior to the start of work to verify that it effectively operates in the area/environment. Develop an employee check-in/check-out communication procedure to ensure employee safety.

3.1.2 Hazardous Material Exclusions

Notwithstanding any other hazardous material used in this Contract, radioactive materials or instruments capable of producing ionizing/non-ionizing radiation (with the exception of radioactive material and devices used in accordance with EM 385-1-1 such as nuclear density meters for compaction testing and laboratory equipment with radioactive sources) as well as materials which contain asbestos, mercury or polychlorinated biphenyls, di-isocyanates, lead-based paint, and hexavalent chromium, are prohibited. The Contracting Officer, upon written request by the Contractor, may consider exceptions to the use of any of the above excluded materials. Low mercury lamps used within

fluorescent lighting fixtures are allowed as an exception without further Contracting Officer approval. Notify the Radiation Safety Officer (RSO) prior to excepted items of radioactive material and devices being brought on base.

3.1.3 Unforeseen Hazardous Material

Contract documents identify materials such as PCB, lead paint, and friable and non-friable asbestos and other OSHA regulated chemicals (i.e., 29 CFR Part 1910.1000). If material(s) that can be hazardous to human health upon disturbance are encountered during demolition, repair, renovation, or construction operations, stop portions of work that would disturb the material and notify the Contracting Officer immediately. Within 14 calendar days the Government will determine if the material is hazardous. If material is not hazardous or poses no danger, the Government will direct the Contractor to proceed without change. If material is hazardous and handling of the material is necessary to accomplish the work, the Government will issue a modification.

3.2 UTILITY OUTAGE REQUIREMENTS

Apply for utility outages at least 30 days in advance. At a minimum, the written request must include the location of the outage, utilities being affected, duration of outage, any necessary sketches, and a description of the means to fulfill energy isolation requirements in accordance with EM 385-1-1. In accordance with EM 385-1-1, where outages involve Government or Utility personnel, coordinate with the Government on all activities involving the control of hazardous energy.

These activities include, but are not limited to, a review of Hazardous Energy Control Program (HECP) and HEC procedures, as well as applicable Activity Hazard Analyses (AHAs). In accordance with EM 385-1-1 and NFPA 70E, work on energized electrical circuits must not be performed without prior Government authorization. Government permission is considered through the permit process and submission of a detailed AHA. Energized work permits are considered only when de-energizing introduces additional or increased hazard or when de-energizing is infeasible.

3.3 OUTAGE COORDINATION MEETING

After the utility outage request is approved and prior to beginning work on the utility system requiring shut-down, conduct a pre-outage coordination meeting in accordance with EM 385-1-1. This meeting must include the Prime Contractor, the Prime and subcontractors performing the work, the Contracting Officer, and the Installation representative. All parties must fully coordinate HEC activities with one another. During the coordination meeting, all parties must discuss and coordinate on the scope of work, HEC procedures (specifically, the lock-out/tag-out procedures for worker and utility protection), the AHA, assurance of trade personnel qualifications, identification of competent persons, and compliance with HECP training in accordance with EM 385-1-1. Clarify when personal protective equipment is required during switching operations, inspection, and verification.

3.4 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

Provide and operate a Hazardous Energy Control Program (HECP) in accordance with EM 385-1-1, 29 CFR 1910, 29 CFR 1915, ANSI/ASSP A10.44, NFPA 70E.

3.4.1 Safety Preparatory Inspection Coordination Meeting with the Government or Utility

For electrical distribution equipment that is to be operated by Government or Utility personnel, the Prime Contractor and the subcontractor performing the work must attend the safety preparatory inspection coordination meeting, which will also be attended by the Contracting Officer's Representative, and required by EM 385-1-1. The meeting will occur immediately preceding the start of work and following the completion of the outage coordination meeting. Both the safety preparatory inspection coordination meeting and the outage coordination meeting must occur prior to conducting the outage and commencing with lockout/tagout procedures.

3.4.2 Lockout/Tagout Isolation

Where the Government or Utility performs equipment isolation and lockout/tagout, the Contractor must place their own locks and tags on each energy-isolating device and proceed in accordance with the HECP. Before any work begins, both the Contractor and the Government or Utility must perform energy isolation verification testing while wearing required PPE detailed in the Contractor's AHA and required by EM 385-1-1. Install personal protective grounds, with tags, to eliminate the potential for induced voltage in accordance with EM 385-1-1.

3.4.3 Lockout/Tagout Removal

Upon completion of work, conduct lockout/tagout removal procedure in accordance with the HECP. In accordance with EM 385-1-1, each lock and tag must be removed from each energy isolating device by the authorized individual or systems operator who applied the device. Provide formal notification to the Government (by completing the Government form if provided by Contracting Officer's Representative), confirming that steps of de-energization and lockout/tagout removal procedure have been conducted and certified through inspection and verification. Government or Utility locks and tags used to support the Contractor's work will not be removed until the authorized Government employee receives the formal notification.

3.5 FALL PROTECTION PROGRAM

Establish a fall protection program, for the protection of all employees exposed to fall hazards. Within the program include company policy, identify roles and responsibilities, education and training requirements, fall hazard identification, prevention and control measures, inspection, storage, care and maintenance of fall protection equipment and rescue and evacuation procedures in accordance with EM 385-1-1.

3.5.1 Fall Protection Equipment and Systems

Enforce use of personal fall protection equipment and systems designated (to include fall arrest, restraint, and positioning) for each specific work activity in the Site Specific Fall Protection and Prevention Plan and AHA at all times when an employee is exposed to a fall hazard. Protect employees from fall hazards as specified in EM 385-1-1.

Provide personal fall protection equipment, systems, subsystems, and components that comply with EM 385-1-1 and 29 CFR 1926.

3.5.1.1 Additional Personal Fall Protection Measures

In addition to the required fall protection systems, other protective measures such as safety skiffs, personal floatation devices, and life rings, are required when working above or next to water in accordance with EM 385-1-1. Personal fall protection systems and equipment are required when working from an articulating or extendible boom, swing stages, or suspended platform. In addition, personal fall protection systems are required when operating other equipment such as scissor lifts. The need for tying-off in such equipment is to prevent ejection of the employee from the equipment during raising, lowering, travel, or while performing work.

3.5.1.2 Personal Fall Protection Equipment

Only a full-body harness with a shock-absorbing lanyard or self-retracting lanyard is an acceptable personal fall arrest body support device. The use of body belts is not acceptable. Harnesses must have a fall arrest attachment affixed to the body support (usually a Dorsal D-ring) and specifically designated for attachment to the rest of the system. Snap hooks and carabineers must be self-closing and self-locking, capable of being opened only by at least two consecutive deliberate actions and have a minimum gate strength of 3,600 lbs in all directions. Use webbing, straps, and ropes made of synthetic fiber. The maximum free fall distance when using fall arrest equipment must not exceed 6 feet, unless the proper energy absorbing lanyard is used. Always take into consideration the total fall distance and any swinging of the worker (pendulum-like motion), that can occur during a fall, when attaching a person to a fall arrest system. Equip all full body harnesses with Suspension Trauma Preventers such as stirrups, relief steps, or similar in order to provide short-term relief from the effects of orthostatic intolerance in accordance with EM 385-1-1.

3.6 USE OF EXPLOSIVES

Explosives must not be used or brought to the project site without prior written approval from the Contracting Officer. Such approval does not relieve the Contractor of responsibility for injury to persons or for damage to property due to blasting operations.

3.7 ELECTRICAL

Perform electrical work in accordance with EM 385-1-1.

3.7.1 Electrical Work

As described in EM 385-1-1, electrical work is to be conducted in a de-energized state unless there is no alternative method for accomplishing the work. In those cases obtain an energized work permit from the Contracting Officer. The energized work permit application must be accompanied by the AHA and a summary of why the equipment/circuit needs to be worked energized. Underground electrical spaces must be certified safe for entry before entering to conduct work. Cables that will be cut must be positively identified and de-energized prior to performing each cut. Attach temporary grounds in accordance with ASTM F855 and IEEE 1048. Perform all high voltage cable cutting remotely using hydraulic cutting

tool. When racking in or live switching of circuit breakers, no additional person other than the switch operator is allowed in the space during the actual operation. Plan so that work near energized parts is minimized to the fullest extent possible. Use of electrical outages clear of any energized electrical sources is the preferred method.

When working in energized substations, only qualified electrical workers are permitted to enter. When work requires work near energized circuits as defined by NFPA 70, high voltage personnel must use personal protective equipment that includes, as a minimum, electrical hard hat, safety footwear, insulating gloves and electrical arc flash protection for personnel as required by NFPA 70E. Insulating blankets, hearing protection, and switching suits may also be required, depending on the specific job and as delineated in the Contractor's AHA. Ensure that each employee is familiar with and complies with these procedures and 29 CFR 1910.

3.7.2 Qualifications

Electrical work must be performed by QP with verifiable credentials who are familiar with applicable code requirements. Verifiable credentials consist of State, National and Local Certifications or Licenses that a Master or Journeyman Electrician may hold, depending on work being performed, and must be identified in the appropriate AHA. Journeyman/Apprentice ratio must be in accordance with State, Local requirements applicable to where work is being performed.

3.7.3 Arc Flash

Conduct a hazard analysis/arc flash hazard analysis whenever work on or near energized parts greater than 50 volts is necessary, in accordance with NFPA 70E.

All personnel entering the identified arc flash protection boundary must be QPs and properly trained in NFPA 70E requirements and procedures. Unless permitted by NFPA 70E, no Unqualified Person is permitted to approach nearer than the Limited Approach Boundary of energized conductors and circuit parts. Training must be administered by an electrically qualified source and documented.

3.7.4 Grounding

Ground electrical circuits, equipment and enclosures in accordance with NFPA 70 and IEEE C2 to provide a permanent, continuous and effective path to ground unless otherwise noted by EM 385-1-1.

3.7.5 Testing

Temporary electrical distribution systems and devices must be inspected, tested and found acceptable for Ground-Fault Circuit Interrupter (GFCI) protection, polarity, ground continuity, and ground resistance before initial use, before use after modification and at least monthly. Monthly inspections and tests must be maintained for each temporary electrical distribution system, and signed by the electrical CP or QP.

-- End of Section --

SECTION 01 35 29.13

HEALTH, SAFETY, AND EMERGENCY RESPONSE PROCEDURES FOR CONTAMINATED SITES
11/15, CHG 1: 08/22

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN PETROLEUM INSTITUTE (API)

API RP 2219	(2024) Safe Operation of Vacuum Trucks Handling Flammable and Combustible Liquids in Petroleum Service

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA Z358.1	(2014; R 2020) American National Standard for Emergency Eyewash and Shower Equipment

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH 85-115	(1985) Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety -- Safety and Occupational Health (SOH) Requirements

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1904	Recording and Reporting Occupational Injuries and Illnesses
29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.120	Hazardous Waste Operations and Emergency Response
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.65	Hazardous Waste Operations and Emergency Response
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements

1.2 PRECONSTRUCTION SAFETY CONFERENCE

Conduct a preconstruction safety conference prior to the start of site activities and after submission of the Accident Prevention Plan/Site Safety And Health Plan (APP/SSHP). The objective of the meeting is to discuss health and safety concerns related to the impending work, discuss project health and safety organization and expectations, review and answer comments and concerns regarding the APP/SSHP or other health and safety concerns . Ensure that those individuals responsible for health and safety at the project level are available and attend this meeting.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Work Zones; G

Decontamination Facilities; G

SD-03 Product Data

Amendments to the APP/SSHP; G

Exposure Monitoring/Air Sampling Program

Site Control Log

SSHO's Daily Inspection Logs

SD-07 Certificates

Certificate Of Worker/Visitor Acknowledgement

SD-11 Closeout Submittals

Safety And Health Phase-Out Report; G

1.4 ACCIDENT PREVENTION PLAN/SITE SAFETY AND HEALTH PLAN (APP/SSHP)

Develop and implement a Site Safety and Health Plan in accordance with Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS, and attach to the Accident Prevention Plan (APP) as an appendix (APP/SSHP). Address all occupational safety and health hazards (traditional construction as well as contaminant-related hazards) associated with cleanup operations within the APP/SSHP. Cover each SSHP element in sections 28.A.01 and 33.B of EM 385-1-1 and each APP element in Appendix A of EM 385-1-1. There are overlapping elements in Section 28.A.01 and Appendix A of EM 385-1-1. SSHP appendix elements that overlap with APP elements need not be duplicated in the APP/SSHP provided each safety and occupational health (SOH) issue receives adequate attention and is documented in the APP/SSHP. The APP/SSHP is a dynamic document, subject to change as project operations/execution change. Modify the APP/SSHP to address changing and previously unidentified health and safety conditions. Ensure

that the APP/SSHP is updated accordingly. Submit amendments to the APP/SSHP to the Contracting Officer as the APP/SSHP is updated. For long duration projects resubmit the APP/SSHP to the Contracting Officer annually for review. The APP/SSHP must contain all updates.

1.4.1 Acceptance and Modifications

Prior to submittal, the APP/SSHP must be signed and dated by the Safety and Health Manager and the Site Superintendent. Submit for review 14 days prior to the Preconstruction Safety Conference. Deficiencies in the APP/SSHP will be discussed at the preconstruction safety conference, and must be revised to correct the deficiencies and resubmitted for acceptance. Onsite work must not begin until the plan has been accepted. Maintain a copy of the written APP/SSHP onsite. Changes and modifications to the APP/SSHP must be made with the knowledge and concurrence of the Safety and Health Manager, the Site Superintendent, and the Contracting Officer. Bring to the attention of the Safety and Health Manager, the Site Superintendent, and the Contracting Officer any unforeseen hazard that becomes evident during the performance of the work, through the Site Safety and Health Officer (SSHO) for resolution as soon as possible. In the interim, take necessary action to re-establish and maintain safe working conditions in order to safeguard onsite personnel, visitors, the public, and the environment. Disregard for the provisions of this specification or the accepted APP/SSHP is cause for stopping work until the matter has been rectified.

1.4.2 Availability

Make available the APP/SSHP in accordance with 29 CFR 1910.120, (b)(1)(v) and 29 CFR 1926.65, (b)(1)(v).

1.5 STAFF ORGANIZATION, QUALIFICATION AND RESPONSIBILITIES

Provide hazardous waste operations and emergency response organization in accordance with EM 385-1-1, Section 33.

1.5.1 Safety and Health Manager

Safety and Health Manager must be an Industrial Hygienist certified by the American Board of Industrial Hygiene, a safety professional certified by the Board of Certified Safety Professionals, or a health physicist certified by the American Board of Health Physicists, dependent upon contaminant-related hazards on the project.

Apply the following in conjunction with the required qualifications and responsibilities stated in EM 385-1-1, Section 33.C.01.

1.5.1.1 Additional Qualifications

The Safety and Health Manager must have the following qualifications:

a. A minimum of 3 years experience in developing and implementing safety and occupational health programs at HTRW sites.

b. Documented experience in supervising professional and technician level personnel.

c. Documented experience in developing worker exposure assessment

programs and air monitoring programs and techniques.

d. Documented experience in managing personal protective equipment (PPE) programs and conducting PPE hazard evaluations for the types of activities and hazards likely to be encountered on the project.

e. Working knowledge of state and Federal occupational safety and health regulations.

1.5.1.2 Responsibilities and Duties

a. Development, implementation, oversight, and enforcement of the APP/SSHP.

b. Provide onsite consultation as needed to ensure the APP/SSHP is fully implemented.

c. Conduct initial site-specific training.

d. Be available for consultation during the first 3 days of remedial activities and at the startup of each new major phase of work.

e. Visit the site as needed and at least once per month for the duration of activities, to audit the effectiveness of the APP/SSHP.

f. Be available for emergencies.

g. Coordinate any modifications to the APP/SSHP with the Site Superintendent, the SSHO, and the Contracting Officer.

h. Be responsible for evaluating air monitoring data and recommending changes to engineering controls, work practices, and PPE.

i. Provide continued support for upgrading/downgrading of the level of personal protection.

j. Serve as a member of the quality control staff.

k. Review accident reports and results of daily inspections.

l. Sign and date the APP/SSHP prior to submittal.

1.5.2 Site Safety and Health Officer

Designate an individual and one alternate as the Site Safety and Health Officer (SSHO). Include the name, qualifications (education and training summary and documentation), and work experience of the Site Safety and Health Officer and alternate in the APP/SSHP.

The Apply the following in conjunction with the required qualifications and responsibilities stated in EM 385-1-1, Section 33.C.02.

1.5.2.1 Qualifications

The following requirements are in addition to those in Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS.

a. A minimum of 1 year experience in implementing SOH programs at HTRW sites where Level C personal protective equipment was required.

b. Meet 29 CFR 1910.120/29 CFR 1926.65 requirements for 40-hour initial and 8-hour supervisor training and, maintain 8-hour refresher training requirements.

c. Specific training in personal and respiratory protective equipment, confined space entry and in the proper use of air monitoring instruments and air sampling methods including monitoring for ionizing radiation.

d. Documented experience in construction techniques and construction safety procedures.

e. Working knowledge of Federal and state occupational SOH regulations.

1.5.2.2 Responsibilities and Duties

The following requirements are in addition to those in Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS.

a. Assist and represent the Safety and Health Manager in onsite training and the day to day onsite implementation and enforcement of the accepted APP/SSHP.

b. Be assigned to the site on a full time basis for the duration of field activities. The SSHO can have collateral duties in addition to SOH related duties. If operations are performed during more than 1 work shift per day, a site Safety and Health Officer must be present for each shift and when applicable, act as the radiation safety officer (RSO) as defined in paragraph 06.F.02 of EM 385-1-1 on radioactive waste cleanup projects.

c. Have authority to stop work if unacceptable health or safety conditions exist, and take necessary action to re-establish and maintain safe working conditions.

d. Have authority to ensure site compliance with specified SOH requirements, Federal, state and OSHA regulations and all aspects of the APP/SSHP including, but not limited to, activity hazard analyses, air monitoring, monitoring for ionizing radiation, use of PPE, decontamination, site control, standard operating procedures used to minimize hazards, safe use of engineering controls, the emergency response plan, confined space entry procedures, spill containment program, and preparation of records by performing a daily SOH inspection and documenting results on the Daily Safety Inspection Log in accordance with 29 CFR 1904.

e. In coordination with site management and the Safety and Health Manager, recommend corrective actions for identified deficiencies and oversee the corrective actions.

f. Consult with and coordinate any modifications to the APP/SSHP with the Safety and Health Manager, the Site Superintendent, and the Contracting Officer.

g. Conduct daily safety inspection and document SOH findings into the Daily Safety Inspection Log. Track noted SOH deficiencies to ensure that they are corrected.

h. Conduct accident investigations and prepare accident reports.

i. Serve as a member of the quality control staff on matters relating to SOH.

1.5.3 Additional Certified Health and Safety Support Personnel

Retain safety support from a safety professional certified by the Board of Certified Safety professionals to develop written occupational safety procedures for the APP/SSHP and, when necessary, visit the site to help implement APP/SSHP requirements.

1.5.4 Occupational Physician

Utilize the services of a licensed physician, who is certified in occupational medicine by the American Board of Preventative Medicine, or who, by necessary training and experience is Board eligible. The physician must be familiar with the site's hazards and the scope of this project. Include the medical consultant's name, qualifications, and knowledge of the site's conditions and proposed activities in the APP/SSHP. The physician is responsible for the determination of medical surveillance protocols and for review of examination/test results performed in compliance with 29 CFR 1910.120, (f) and 29 CFR 1926.65, (f) and paragraph MEDICAL SURVEILLANCE PROGRAM.

1.5.5 Persons Certified in First Aid and CPR

At least two persons who are currently certified in first aid and CPR by the American Red Cross or other approved agency must be onsite at all times during site operations. They must be trained in universal precautions and the use of PPE as described in the Bloodborne Pathogens Standard of 29 CFR 1910, Section .1030. These persons may perform other duties but must be immediately available to render first aid when needed.

1.5.6 Safety and Health Technicians

For each work crew in the exclusion zone, one person, designated as a Safety and Health technician, must perform activities such as air monitoring, decontamination, and safety oversight on behalf of the SSHO. They must have appropriate training equivalent to the SSHO in each specific area for which they have responsibility and report to and be under the supervision of the SSHO.

1.6 EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES

Develop and implement an Emergency Response Plan, that meets the requirements of EM 385-1-1 Section 33.G, 29 CFR 1910.120 (l) and 29 CFR 1926.65 (l), as a section of the APP/SSHP. In the event of any emergency associated with remedial action, without delay, alert all onsite employees and as necessary offsite emergency responders that there is an emergency situation; take action to remove or otherwise minimize the cause of the emergency; alert the Contracting Officer; and institute measures necessary to prevent repetition of the conditions or actions leading to, or resulting in, the emergency. Train employees that are required to respond to hazardous emergency situations to their level of responsibility according to 29 CFR 1910.120 (q) and 29 CFR 1926.65 (q) requirements. Rehearse the plan regularly as part of the overall training program for site operations. Review the plan periodically and revised as necessary to reflect new or changing site conditions or information. Provide copies of

the Emergency Response Portion of the accepted APP/SSHP to the affected local emergency response agencies. Address, as a minimum, the following elements in the plan:

a. Pre-emergency planning. Coordinate with local emergency response providers during preparation of the Emergency Response Plan. At a minimum, coordinate with local fire, rescue, hazardous materials response teams, police and emergency medical providers to assure all organizations are capable and willing to respond to and provide services for on-site emergencies. Ensure the Emergency Response Plan for the site is compatible and integrated with the local fire, rescue, medical and police security services available from local emergency response planning agencies.

b. Personnel roles, lines of authority, communications for emergencies.

c. Emergency recognition and prevention.

d. Site topography, layout, and prevailing weather conditions.

e. Criteria and procedures for site evacuation (emergency alerting procedures, employee alarm system, emergency PPE and equipment, safe distances, places of refuge, evacuation routes, site security and control).

f. Route maps to nearest prenotified medical facility. Site-support vehicles must be equipped with maps. At the beginning of project operations, drivers of the support vehicles must become familiar with the emergency route and the travel time required.

g. Specific procedures for decontamination and medical treatment of injured personnel.

h. Emergency alerting and response procedures including posted instructions and a list of names and telephone numbers of emergency contacts (physician, nearby medical facility, fire and police departments, ambulance service, Federal, state, and local environmental agencies; as well as Safety and Health Manager, the Site Superintendent, the Contracting Officer and their alternates).

i. Criteria for initiating community alert program, contacts, and responsibilities.

j. Procedures for reporting incidents to appropriate government agencies. In the event that an incident such as an explosion or fire, or a spill or release of toxic materials occurs during the course of the project, the appropriate government agencies must be immediately notified. In addition, verbally notify the Contracting Officer and the local district safety office immediately and submit a written notification within 24 hours. Include within the report the following items:

(1) Name, organization, telephone number, and location of the Contractor.

(2) Name and title of the person(s) reporting.

(3) Date and time of the incident.

(4) Location of the incident, i.e., site location, facility name.

(5) Brief summary of the incident giving pertinent details including type of operation ongoing at the time of the incident.

(6) Cause of the incident, if known.

(7) Casualties (fatalities, disabling injuries).

(8) Details of any existing chemical hazard or contamination.

(9) Estimated property damage, if applicable.

(10) Nature of damage, effect on contract schedule.

(11) Action taken to ensure safety and security.

(12) Other damage or injuries sustained, public or private.

k. Procedures for critique of emergency responses and follow-up.

1.7 CERTIFICATE OF WORKER/VISITOR ACKNOWLEDGEMENT

A copy of a certificate of worker/visitor acknowledgement must be completed and submitted for each visitor allowed to enter contamination reduction or exclusion zones, and for each employee, following the Example Certificate Of Worker/Visitor Acknowledgement at the end of this section.

1.8 INSPECTIONS

Attach to and submit with the Daily Quality Control reports the SSHO's Daily Inspection Logs. Include with each entry the following: date, work area checked, employees present in work area, PPE and work equipment being used in each area, special SOH issues and notes, and signature of preparer.

1.9 SAFETY AND HEALTH PHASE-OUT REPORT

Submit a Safety and Health Phase-Out Report in conjunction with the project close out report, prior to final acceptance of the work. Include the following minimum information :

a. Summary of the overall performance of SOH (e.g., accidents or incidents including near misses, unusual events, lessons learned).

b. Final decontamination documentation including procedures and techniques used to decontaminate equipment, vehicles, and on site facilities.

c. Summary of exposure monitoring and air sampling accomplished during the project.

d. Signatures of Safety and Health Manager and SSHO.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

Comply with EM 385-1-1, 29 CFR 1926.65, 29 CFR 1910.120, OSHA requirements in 29 CFR 1910 and 29 CFR 1926 with work performed under this contract,

and state specific OSHA requirements where applicable. Submit to the Contracting Officer for resolution matters of interpretation of standards before starting work. The most stringent requirements apply where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary.

2.2 PERSONAL PROTECTIVE EQUIPMENT

2.2.1 Site Specific PPE Program

Provide onsite personnel exposed to contaminants with appropriate personal protective equipment. Components of levels of protection (B, C, D and modifications) must be relevant to site-specific conditions, including heat and cold stress potential and safety hazards. Use only respirators approved by NIOSH.

Keep protective equipment and clothing clean and well maintained. Include site-specific procedures to determine PPE program effectiveness and for onsite fit-testing of respirators, cleaning, maintenance, inspection, cartridge change out, and storage of PPE within the PPE section of the APP/SSHP.

2.2.2 Levels of Protection

The Safety and Health Manager must establish and evaluate as the work progresses the levels of protection for each work activity. Also establish action levels for upgrade or downgrade in levels of PPE. Describe in the SSHP the protocols and the communication network for changing the level of protection. Address air monitoring results, potential for exposure, changes in site conditions, work phases, job tasks, weather, temperature extremes, and individual medical considerations within the PPE evaluation protocol.

2.2.2.1 Initial PPE Components

The following items constitute initial minimum protective clothing and equipment ensembles.

Level D	Standard work uniform (long pants and shirt), steel-toed or composite boots, hard hat, and safety glasses as applicable. Hearing protection as needed.
Modified Level D	Level D components plus: Nitrile gloves, flame-resistant coveralls (FRC) or chemical splash resistant disposable coveralls (Refer to Table 1 of Attachment 1 for approved PPE usage for PFAS sampling)
Level C	Full-face, air-purifying respirator (APR) with Organic Vapor/P100 combination cartridges, chemical-resistant suit, outer nitrile gloves, inner nitrile gloves, chemical-resistant steel-toed boots, and hard hat.

Level B	Positive pressure, full-facepiece self-contained breathing apparatus (SCBA) or supplied-air respirator (SAR) with escape SCBA, chemical-resistant suit, outer nitrile gloves, inner nitrile gloves, chemical-resistant steel-toed boots, and hard hat.

2.2.3 PPE for Government Personnel

Three clean sets of personal protective equipment and personal dosimeters for work on radioactive waste cleanup sites and clothing (excluding air-purifying negative-pressure respirators and safety shoes, which will be provided by individual visitors), as required for entry into the Exclusion Zone and Contamination Reduction Zone, must be available for use by the Contracting Officer or official visitors. The items must be cleaned, maintained and stored and clearly marked: "FOR USE BY GOVERNMENT ONLY." Provide basic training in the use and limitations of the PPE provided.

2.3 EMERGENCY EQUIPMENT AND FIRST AID REQUIREMENTS

Maintain, as a minimum, the following items onsite and available for immediate use:

a. First aid equipment and supplies approved by the consulting physician.

b. Emergency eyewashes and showers that comply with ANSI/ISEA Z358.1.

c. Emergency-use respirators. For escape purposes, supply necessary number of 5- to 15-minute emergency escape masks. For rescue purposes, Supply 2 positive pressure self-contained breathing apparatus (SCBA). Dedicate these for emergency use only and maintained onsite in the Contamination Reduction Zone.

d. Provide fire extinguishers of sufficient size and type at site facilities and in all vehicles and at any other site locations where flammable or combustible materials present a fire risk.

PART 3 EXECUTION

3.1 SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION

3.1.1 Project/Site Conditions

Refer to the following reports and information for the site description and contamination characterization. They are located at the base's Environmental office.

3.1.1.1 CERCLA Documents

3.1.1.2 RCRA Documents

3.1.1.3 UST Documents

3.1.2 Ordnance and Explosives (OE)

Stop work and contact the Contracting Officer if ordnance and explosives

(OE), explosive media or chemical agent contaminated media (CACM) are discovered during HTRW site cleanup activities.

3.2 TASK SPECIFIC HAZARDS, INITIAL PPE, HAZWOPER MEDICAL SURVEILLANCE AND TRAINING APPLICABILITY

Task specific occupational hazards, task specific HAZWOPER medical surveillance and training applicability and task specific initial PPE requirements for the project are listed on the Task Hazard and Control Sheets at the end of this section. Reevaluate occupational safety and health hazards as the work progresses and to adjust the PPE and onsite operations, if necessary, so that the work is performed safely and in compliance with occupational safety and health regulations.

3.3 TRAINING

In conjunction with EM 385-1-1, Section 33D, meet the training program requirements for workers performing cleanup operations and who will be exposed to contaminants.

3.3.1 General HTRW Operations Training

All Personnel performing duties with potential for exposure to onsite contaminants must meet and maintain the following 29 CFR 1910.120/ 29 CFR 1926.65 (e) training requirements:

a. 40 hours of off site HTRW instruction.

b. 3 days actual on-the-job field experience under the direct supervision of a trained, experienced supervisor.

c. 8 hours refresher training annually.

Onsite supervisors must have an additional 8 hours management and supervisor training specified in 29 CFR 1910.120/29 CFR 1926.65 (e) (4).

3.3.2 Pre-Entry Briefing

Prior to commencement of onsite field activities, all site employees, including those assigned only to the Support Zone, must attend a site-specific SOH training session. This session will be conducted by the Safety and Health Manager and the Site Safety and Health Officer to ensure that all personnel are familiar with requirements and responsibilities for maintaining a safe and healthful work environment. Thoroughly discuss procedures and contents of the accepted APP/SSHP and Sections 01.B.02 and 28.D.03 of EM 385-1-1 . Each employee must sign a training log to acknowledge attendance and understanding of the training. Notify the Contracting Officer at least 5 days prior to the initial site-specific training session so government personnel involved in the project may attend.

3.3.3 Periodic Sessions

Conduct periodic onsite training by the SSHO at least weekly for personnel assigned to work at the site during the following week. Address SOH procedures, work practices, any changes in the APP/SSHP, activity hazard analyses, work tasks, or schedule; results of previous week's air monitoring, review of safety discrepancies and accidents. Convene a meeting prior to implementation of the change should an operational change

affecting onsite field work be made, to explain SOH procedures. Conduct a site-specific training sessions for new personnel, visitors, and suppliers by the SSHO using the training curriculum outlines developed by the Safety and Health Manager. Each employee must sign a training log to acknowledge attendance and understanding of the training.

3.3.4 Other Training

Special site specific training requirements: Refer to FAFB safety office for site specific training requirements.

3.4 MEDICAL SURVEILLANCE PROGRAM

Meet all requirements of 29 CFR 1910.120/29 CFR 1926.65 medical surveillance program and EM 385-1-1, Section 33.G for workers performing cleanup operations and who will be exposed to contaminants. Ensure the Occupational Physician or the physician's designee performs the physical examinations and reviews examination results. Participation in the medical surveillance program is without cost to the employee, without loss of pay and at a reasonable time and place.

3.5 EXPOSURE MONITORING/AIR SAMPLING PROGRAM

Prepare and implement by the Safety and Health Manager an exposure monitoring/air sampling program to identify and quantify SOH hazards and airborne levels of hazardous substances in order to assure proper selection of engineering controls, work practices and personal protective equipment for affected site personnel. Include action levels for upgrading/downgrading PPE in the program. Submit personnel exposure monitoring/sampling results. Monitor for the following gasses and vapors Oxygen (O2), Lower Explosive Limit (LEL), Carbon Monoxide (CO), Hydrogen Sulfide (H2S), and Volatile Organic Compounds (VOCs) with speciation for Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX). Monitor for particulates (dust) and lead fumes (if paint coatings are disturbed).

3.6 HEAT STRESS MONITORING AND MANAGEMENT

Document in the APP/SSHP and implement the procedures and practices in section 06.J. in EM 385-1-1 to monitor and manage heat stress.

3.7 SPILL AND DISCHARGE CONTROL

Develop and implement written spill and discharge containment/control procedures. Address radioactive wastes, shock sensitive wastes, laboratory waste packs, material handling equipment, as well as drum and container handling, opening, sampling, shipping and transport. Describe prevention measures, such as building berms or dikes; spill control measures and material to be used (e.g. booms, vermiculite); location of the spill control material; personal protective equipment required to cleanup spills; disposal of contaminated material; and who is responsible to report the spill. Storage of contaminated material or hazardous materials must be appropriately bermed, diked and contained to prevent any spillage of material on uncontaminated soil. If the spill or discharge is reportable, or human health or the environment are threatened, notify the National Response Center, the state, and the Contracting Officer as soon as possible. Provide control as required by Section 01 57 19 TEMPORARY ENVIRONMENT CONTROLS.

3.8 MATERIALS TRANSFER SAFETY

Remove liquids and residues from the tanks using explosion-proof or air-driven pumps. In accordance with EM 385-1-1, Section 9, electrically bond the tank and ground pump motors and suction hoses to prevent electrostatic ignition hazards. Use of a hand pump will be permitted to remove the last of the liquid from the bottom of the tanks. If a vacuum truck is used for removal of liquids or residues, the area of operation for the vacuum truck must be vapor free. Locate the truck upwind from the tank and outside the path of probable vapor travel. Discharge the vacuum pump exhaust gases through a hose of adequate size and length downwind of the truck and tank area. Vacuum truck operating and safety practices must conform to API RP 2219. Collect tank residues in drums, tanks, or tank trucks labeled according to 49 CFR 171 and 49 CFR 172 and disposed of as specified. Disconnect and drain fittings and lines of their contents after the materials have been transferred and the tanks have been exposed. Do not spill contents into the environment during cutting or disconnecting of tank fittings. Transfer materials drained into DOT-approved drums for storage and transportation. Use only non-sparking or non-heat producing tools to disconnect and drain or to cut through tank fittings. Electrical equipment (e.g., pumps, portable hand tools) used for tank preparation must be explosion-proof. Following cutting or disconnecting of the fittings, plug openings leading to the tanks.

3.9 SITE CONTROL MEASURES

Coordinate site control measures with Section 01 57 19 TEMPORARY ENVIRONMENT CONTROLS.

3.9.1 Work Zones

Initial anticipated work zone boundaries (exclusion zone, contamination reduction zone, support zone, all access points and decontamination areas) are to be clearly delineated on the site drawings. Base delineation of work zone boundaries on the contamination characterization data and the hazard/risk analysis to be performed as described in EM 385-1-1 06.A.02. As work progresses and field conditions are monitored, work zone boundaries may be modified (and site drawings modified) with approval of the Contracting Officer. Clearly identify work zones and mark in the field (using fences, tape, or signs). Submit and post a site map, showing work zone boundaries and locations of decontamination facilities in the onsite office. Work zones must consist of the following:

3.9.1.1 Exclusion Zone (EZ)

The exclusion zone is the area where hazardous contamination is either known or expected to occur and the greatest potential for exposure exists. Control entry into this area and exit may only be made through the Contamination Reduction Zone (CRZ).

3.9.1.2 Contamination Reduction Zone (CRZ)

The CRZ is the transition area between the Exclusion Zone and the Support Zone. The personnel and equipment decontamination areas must be separate and unique areas located in the CRZ.

3.9.1.3 Support Zone (SZ)

The Support Zone is defined as areas of the site, other than exclusion

zones and contamination reduction zones, where workers do not have the potential to be exposed to hazardous substances or dangerous conditions resulting from HTRW operations. Secure the Support Zone against active or passive contamination. Site offices, parking areas, and other support facilities must be located in the Support Zone.

3.9.2 Site Control Log

A log of personnel visiting, entering, or working on the site must be maintained. Include the following: date, name, agency or company, time entering and exiting site, time entering and exiting the exclusion zone (if applicable). Before visitors are allowed to enter the Contamination Reduction Zone or Exclusion Zone, they must show proof of current training, medical surveillance and respirator fit testing (if respirators are required for the tasks to be performed) and fill out a Certificate of Worker or Visitor Acknowledgment. Record this visitor information, including date, in the log.

3.9.3 Communication

Provide and install an employee alarm system that has adequate means of on and off site communication in accordance with 29 CFR 1910 Section .165. The means of communication must be able to be perceived above ambient noise or light levels by employees in the affected portions of the workplace. The signals must be distinctive and recognizable as messages to evacuate or to perform critical operations.

3.9.4 Site Security

Print signs in bold large letters on contrasting backgrounds. Signs must be visible from all points where entry might occur and at such distances from the restricted area that employees may read the signs and take necessary protective steps before entering.

3.10 PERSONAL HYGIENE AND DECONTAMINATION

Personnel entering the Exclusion or Contamination Reduction Zones or otherwise exposed to hazardous chemical vapors, gases, liquids, or contaminated solids must decontaminate themselves and their equipment prior to exiting the contamination reduction zone (CRZ) and entering the support zone. Consult Chapter 10.0 of NIOSH 85-115 when preparing decontamination procedures. Submit a detailed discussion of personal hygiene and decontamination facilities and procedures to be followed by site workers as part of the APP/SSHP. Train employees in the procedures and enforce the procedures throughout site operations.

3.10.1 Decontamination Facilities

Submit drawings showing the layout of the personnel and equipment decontamination areas.

3.10.2 Personnel Decontamination

Initially set up a decontamination line in the CRZ. Employees must exit the exclusion zone through the CRZ and implement the following decontamination procedures and techniques: remove all outer garments. Showers, if needed, must comply with 29 CFR 1910, Section.141 and EM 385-1-1, 02 F, Washing Facilities. It is the Site Safety and Health Officer's responsibility to recommend techniques to improve personnel

decontamination procedures, if necessary.

3.10.3 Equipment Decontamination

Decontaminate the vehicles and equipment used in the EZ in the CRZ prior to leaving the EZ.

3.10.3.1 Facilities for Equipment and Personnel

Provide a vehicle decontamination station within the CRZ for decontaminating vehicles and equipment leaving the EZ. Construct a decontamination station pad, which meets the site decontamination needs for all vehicles and larger equipment decontamination. Construct the pad to capture decontamination water, including overspray, and allow for collection and removal of the decontamination water using sumps, dikes and ditches as required.

3.10.3.2 Procedures

Procedures for equipment decontamination must be developed and utilized to prevent the spread of contamination into the SZ and offsite areas. These procedures must address disposal of contaminated products and spent materials used on the site, including, as a minimum, containers, fluids, and oils. Assume any item taken into the EZ to be contaminated and perform an inspection and decontaminate. Vehicles, equipment, and materials must be cleaned and decontaminated prior to leaving the site. Handle construction material in such a way as to minimize the potential for contaminants being spread or carried offsite. Prior to exiting the site, vehicles and equipment must be monitored to ensure the adequacy of decontamination.

Task Hazard and Control Requirements Sheet	
Task	
Initial Anticipated Hazards	
Initial PPE	
Initial Controls	
Initial Exposure Monitoring	
Yes	HAZWOPER Medical Surveillance Required
Yes	HAZWOPER Training Required

-- End of Section --

SECTION 01 42 00

SOURCES FOR REFERENCE PUBLICATIONS
05/24

PART 1 GENERAL

1.1 REFERENCES

Various publications are referenced in other sections of the specifications to establish requirements for the work. These references are identified in each section by document number, date and title. The document number used in the citation is the number assigned by the standards producing organization (e.g., ASTM B564 Standard Specification for Nickel Alloy Forgings). However, when the standards producing organization has not assigned a number to a document, an identifying number has been assigned for reference purposes.

1.2 ORDERING INFORMATION

The addresses of the standards publishing organizations whose documents are referenced in other sections of these specifications are listed below, and if the source of the publications is different from the address of the sponsoring organization, that information is also provided.

AACE INTERNATIONAL (AACE)
726 East Park Avenue #180
Fairmont, WV 26554 USA
Ph: 304-296-8444
Fax: 304-291-5728
Internet: https://web.aacei.org/

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)
555 12th Street NW, Suite 1000
Washington, DC 20004
Ph: 202-624-5800
Fax: 202-624-5806
E-Mail: info@aashto.org
Internet: https://www.transportation.org/

AMERICAN CONCRETE INSTITUTE (ACI)
38800 Country Club Drive
Farmington Hills, MI 48331-3439
Ph: 248-848-3800
Fax: 248-848-3701
Internet: https://www.concrete.org/

AMERICAN CONCRETE PIPE ASSOCIATION (ACPA)
5605 N. MacArthur Blvd, Suite 340
Irving, TX 75038
Ph: 972-506-7216
Fax: 972-506-7682
E-mail: info@concrete-pipe.org
Internet: https://www.concretepipe.org/

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)
130 East Randolph, Suite 2000

Chicago, IL 60601
Ph: 312-670-2400
Fax: 312-670-5403
Steel Solutions Center: 866-275-2472
E-mail: solutions@aisc.org
Internet: https://www.aisc.org/

AMERICAN PETROLEUM INSTITUTE (API)
200 Massachusetts Avenue NW Suite 1100
Washington, DC 20001-5571
Ph: 202-682-8000
Internet: https://www.api.org/

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)
1801 Alexander Bell Drive
Reston, VA 20191
Ph: 800-548-2723; 703-295-6300
Email: customercare@asce.org
Internet: https://www.asce.org/

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)
180 Technology Parkway NW
Peachtree Corners, GA 30092
Ph: 404-636-8400 or 800-527-4723
Fax: 404-321-5478
E-mail: ashrae@ashrae.org
Internet: https://www.ashrae.org/

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)
Two Park Avenue
New York, NY 10016-5990
Ph: 800-843-2763
Fax: 973-882-1717
E-mail: customercare@asme.org
Internet: https://www.asme.org/

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)
520 N. Northwest Highway
Park Ridge, IL 60068
Ph: 847-699-2929
E-mail: customerservice@assp.org
Internet: https://www.assp.org/

AMERICAN WATER WORKS ASSOCIATION (AWWA)
6666 W. Quincy Avenue
Denver, CO 80235 USA
Ph: 303-794-7711 or 800-926-7337
Fax: 303-347-0804
Internet: https://www.awwa.org/

AMERICAN WELDING SOCIETY (AWS)
8669 NW 36 Street, #130
Miami, FL 33166-6672
Ph: 800-443-9353
Email: customercare@aws.org
Internet: https://www.aws.org/

ASPHALT INSTITUTE (AI)
2696 Research Park Drive
Lexington, KY 40511-8480
Ph: 859-288-4960 or 1-866-540-9577
Fax: 859-288-4999
E-mail: info@asphaltinstitute.org
Internet: http://www.asphaltinstitute.org

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

P.O. Box 58130
Washington, DC 20037
Ph: 205-257-3839
Fax: 205-257-2540
Internet: https://aeic.org/

ASTM INTERNATIONAL (ASTM)
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959
Ph: 610-832-9500
Fax: 610-832-9555
E-mail: service@astm.org
Internet: https://www.astm.org/

CSA GROUP (CSA)
178 Rexdale Blvd.
Toronto, ON, Canada M9W 1R3
Ph: 416-747-4044
Fax: 416-747-2510
E-mail: member@csagroup.org
Internet: https://www.csagroup.org/

ELECTRICAL GENERATING SYSTEMS ASSOCIATION (EGSA)
P.O. Box 73206
Washington, DC 20056
Ph: 561-750-5575
Fax: 561-395-8557
Email: e-mail@egsa.org
Internet: http://www.egsa.org

EUROPEAN UNION (EU)
European Commission
Rue de la Loi 200
1000 Bruxelle
Belgium
Ph: +32 2 299 96 96
Internet: https://commission.europa.eu/index_en

ICC EVALUATION SERVICE, INC. (ICC-ES)
3060 Saturn Street, Suite 100
Brea, CA 92821
Ph: 800-423-6587
Fax: 562-695-4694
E-mail: es@icc-es.org
Internet: https://icc-es.org/

ILLUMINATING ENGINEERING SOCIETY (IES)
120 Wall Street, Floor 17

New York, NY 10005-4001
Ph: 212-248-5000
Fax: 212-248-5018
E-mail: membership@ies.org
Internet: https://www.ies.org/

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)
445 and 501 Hoes Lane
Piscataway, NJ 08854-4141
Ph: 732-981-0060 or 800-701-4333
Fax: 732-981-9667
E-mail: onlinesupport@ieee.org
Internet: https://www.ieee.org/

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)
P.O. Box 493
Miamitown, OH 45041-9998
E-mail: info@icea.net
Internet: https://www.icea.net/

INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA)
800 Place Victoria
PO Box 113
Montréal, Quebec, H4Z 1M1
Ph: 514-390-6726 or 800-716-6326
Fax: 514-874-9659
E-mail: custserv@iata.org
Internet: https://www.iata.org/

INTERNATIONAL CODE COUNCIL (ICC)
200 Massachusetts Ave, NW Suite 250
Washington, DC 20001
Ph: 800-786-4452 or 888-422-7233
Fax: 202-783-2348
E-mail: order@iccsafe.org
Internet: https://www.iccsafe.org/

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)
3050 Old Centre Ave. Suite 101
Portage, MI 49024
Ph: 269-488-6382 or 1-888-300-6382
Fax: 269-488-6383
Internet: https://www.netaworld.org/

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)
3, rue de Varembe, 1st floor
P.O. Box 131
CH-1211 Geneva 20, Switzerland
Ph: 41-22-919-02-11
Fax: 41-22-919-03-00
E-mail: info@iec.ch
Internet: https://www.iec.ch/

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)
ISO Central Secretariat
BIBC II
Chemin de Blandonnet 8
CP 401 - 1214 Vernier, Geneva
Switzerland

Ph: 41-22-749-01-11
E-mail: central@iso.ch
Internet: https://www.iso.org

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)
1101 Wilson Blvd, Suite 1425
Arlington, VA 22209-1762
Ph: 703-525-1695
Fax: 703-528-2148
Internet: https://safetyequipment.org/

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)
127 Park Street, NE
Vienna, VA 22180-4602
Ph: 703-281-6613
E-mail: info@msshq.org
Internet: http://msshq.org

NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)
1201 Pennsylvania Ave. NW, Suite 1200
Washington, DC 20004
Ph: 202-991-6300
Fax: 202-217-4171
Internet: https://www.necanet.org/

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)
1300 North 17th Street, Suite 900
Arlington, VA 22209
Ph: 703-841-3200
Email: communications@nema.org
Internet: https://www.nema.org

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)
1 Batterymarch Park
Quincy, MA 02169-7471
Ph: 800-344-3555
Fax: 800-593-6372
Internet: https://www.nfpa.org

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)
Patriots Plaza 1
395 E Street, SW, Suite 9200
Washington, DC 20201
Ph: 800-232-4636
Fax: 513-533-8347
Internet: https://www.cdc.gov/niosh/

NATIONAL PRECAST CONCRETE ASSOCIATION (NPCA)
1320 City Center Drive, Suite 200
Carmel, IN 46032
Ph: 800 366 7731
Fax: 317-571-0041
Internet: https://precast.org/

NATIONAL READY MIXED CONCRETE ASSOCIATION (NRMCA)
Manager, Customer Service
66 Canal Center Plaza, Suite 250
Alexandria, VA 22314

Ph: 703-706-4800
Fax: 703-706-4809
E-mail: jjenkins@nrmca.org (Jacques Jenkins)
Internet: https://www.nrmca.org/

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)
400 Commonwealth Drive
Warrendale, PA 15096
Ph: 877-606-7323 or 724-776-4841
Fax: 724-776-0790
E-mail: customerservice@sae.org
Internet: https://www.sae.org/

SOCIETY OF CABLE TELECOMMUNICATIONS ENGINEERS (SCTE)
140 Philips Road
Exton, PA 19341-1318
Ph: 800-542-5040 or 610-363-6888
Fax: 610-884-7237
E-Mail: info@scte.org
Internet: https://www.scte.org/

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)
1320 North Courthouse Rosd, Suite 200
Arlington, VA 22201
Ph: 703-907-7700
Fax: 703-907-7727
E-mail: marketing@tiaonline.org
Internet: https://www.tiaonline.org/

U.S. AIR FORCE (USAF)
E-mail: usaf.pentagon.saf-aa.mbx.AFDPO-PPL@mail.mil
Internet: https://www.e-publishing.af.mil/

U.S. ARMY CORPS OF ENGINEERS (USACE)
CRD-C DOCUMENTS available on Internet: https://www.wbdg.org/army
THE CAD/BIM TECHNOLOGY CENTER FOR FACILITIES, INFRASTRUCTURE, AND ENVIRONMENT (USACE)on Internet:
https://cadbimcenter.erdc.dren.mil/
Order Other Documents from:
Official Publications of the Headquarters, USACE
E-mail: hqpublications@usace.army.mil
Internet: http://www.publications.usace.army.mil/
or
https://www.hnc.usace.army.mil/Missions/Engineering-Directorate/TECHINFO/

U.S. CODE (USC)
Office of the Law Revision Counsel
U.S. House of Representatives
H2-308 Ford House Office Building
Washington, DC 20515
Ph: 202-226-2411
E-mail: uscode@mail.house.gov
Internet: http://uscode.house.gov/

U.S. DEPARTMENT OF AGRICULTURE (USDA)
Order AMS Publications from:
AGRICULTURAL MARKETING SERVICE (AMS)
Seed Regulatory and Testing Branch

801 Summit Crossing Place, Suite C
Gastonia, NC 28054-2193
Ph: 704-810-8884
E-mail: PA@usda.gov
Internet: https://www.ams.usda.gov/
Order Other Publications from:
USDA Rural Development
Rural Utilities Service
STOP 1510, Rm 5135
1400 Independence Avenue SW
Washington, DC 20250-1510
Phone: (202) 720-9540
Internet:
https://www.rd.usda.gov/about-rd/agencies/rural-utilities-service

U.S. DEPARTMENT OF DEFENSE (DOD)
Order DOD Documents from:
Room 3A750-The Pentagon
1400 Defense Pentagon
Washington, DC 20301-1400
Ph: 703-571-3343
Fax: 215-697-1462
E-mail: customerservice@ntis.gov
Internet: https://www.ntis.gov/
Obtain Military Specifications, Standards and Related Publications from:
Acquisition Streamlining and Standardization Information System (ASSIST)
Department of Defense Single Stock Point (DODSSP)
Document Automation and Production Service (DAPS)
Building 4/D
700 Robbins Avenue
Philadelphia, PA 19111-5094
Ph: 215-697-6396 - for account/password issues
Internet: https://assist.dla.mil/online/start/; account registration required
Obtain Unified Facilities Criteria (UFC) from:
Whole Building Design Guide (WBDG)
National Institute of Building Sciences (NIBS)
1090 Vermont Avenue NW, Suite 700
Washington, DC 20005
Ph: 202-289-7800
Fax: 202-289-1092
Internet:
https://www.wbdg.org/ffc/dod/unified-facilities-criteria-ufc

U.S. DEPARTMENT OF TRANSPORTATION (DOT)
1200 New Jersey Ave., SE
Washington, DC 20590
Ph: 202-366-4000
Internet: https://www.transportation.gov/

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
1200 Pennsylvania Avenue, N.W.
Washington, DC 20004
Ph: 202-564-4700
Internet: https://www.epa.gov
--- Some EPA documents are available only from:
National Technical Information Service (NTIS)

5301 Shawnee Road
Alexandria, VA 22312
Ph: 703-605-6060 or 1-800-363-2068
Fax: 703-605-6880
TDD: 703-487-4639
E-mail: info@ntis.gov
Internet: https://www.ntis.gov/

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)
Order for sale documents from:
Superintendent of Documents
U.S. Government Publishing Office (GPO)
732 N. Capitol Street, NW
Washington, DC 20401
Ph: 202-512-1800 or 866-512-1800
Bookstore: 202-512-0132
Internet: https://www.gpo.gov/
Order free documents from:
U.S. Department of Transportation
Federal Aviation Administration
800 Independence Avenue, SW
Washington, DC 20591
Ph: 866-835-5322
Internet: https://www.faa.gov/

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)
1200 New Jersey Ave., SE
Washington, DC 20590
Ph: 202-366-4000
E-mail: ExecSecretariat.FHWA@dot.gov
Internet: https://highways.dot.gov/
Order from:
Superintendent of Documents
U.S. Government Publishing Office (GPO)
732 N. Capitol Street, NW
Washington, DC 20401
Ph: 202-512-1800 or 866-512-1800
Bookstore: 202-512-0132
Internet: https://www.gpo.gov/

U.S. GENERAL SERVICES ADMINISTRATION (GSA)
General Services Administration
1800 F Street, NW
Washington, DC 20405
Ph: 1-844-472-4111
Internet: https://www.gsaelibrary.gsa.gov/ElibMain/home.do
Obtain documents from:
Acquisition Streamlining and Standardization Information System (ASSIST)
Internet: https://assist.dla.mil/online/start/; account registration required

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)
8601 Adelphi Road
College Park, MD 20740-6001
Ph: 866-272-6272
Internet: https://www.archives.gov/
Order documents from:
Superintendent of Documents

U.S. Government Publishing Office (GPO)
732 N. Capitol Street, NW
Washington, DC 20401
Ph: 202-512-1800 or 866-512-1800
Bookstore: 202-512-0132
Internet: https://www.gpo.gov/

UL SOLUTIONS (UL)
333 Pfingsten Road
Northbrook, IL 60062
Ph: 877-854-3577 or 360-817-5500
E-mail: CustomerExperienceCenter@ul.com
Internet: https://www.ul.com/
UL Directories available through IHS at https://accuristech.com/

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

-- End of Section --

SECTION 01 45 00.15 10

RESIDENT MANAGEMENT SYSTEM CONTRACTOR MODE (RMS CM)
11/23

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this section to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1 (2024) Safety -- Safety and Occupational Health (SOH) Requirements

1.2 MEASUREMENT AND PAYMENT

The work of this section is not measured for payment. The Contractor is responsible for the work of this section, without any direct compensation other than the payment received for contract items.

1.3 CONTRACT ADMINISTRATION

The Government will use the Resident Management System (RMS) to assist in its monitoring and administration of this contract. The Government accesses the system using the Government Mode of RMS (RMS GM) and the Contractor accesses the system using the Contractor Mode (RMS CM). The term RMS will be used in the remainder of this section for both RMS GM and RMS CM. The joint Government-Contractor use of RMS facilitates electronic exchange of information and overall management of the contract. The Contractor accesses RMS to record, maintain, input, track, and electronically share information with the Government throughout the contract period in the following areas:

Administration
Finances
Quality Control
Submittal Monitoring
Scheduling
Closeout
Import/Export of Data

The Contractor must be prepared to transition from the Resident Management System (RMS) to the new Construction Management Platform (CMP) at any time during the period of performance of this contract, once the USACE enterprise implements this change. The Contractor's obligation to transition from RMS to the CMP system is a requirement of this contract. Therefore, additional time or cost increase to complete this transition will not be considered. In the event of the transition, RMS project information will be migrated to CMP by the government and available in the CMP system. After the transition, the Contractor must utilize the CMP system to perform all contract administration functions previously required in RMS, including all areas listed above. After the transition, “RMS” and “CMP” will be synonymous for all “Resident Management System” and “RMS” references in this contract’s specification. To facilitate the

transition from RMS to CMP, online training for the CMP system will be made available to the Contractor with enough time to train staff, prior to the transition occurring.

1.3.1 Correspondence and Electronic Communications

For ease and speed of communications, exchange correspondence and other documents in electronic format to the maximum extent feasible. Some documents such as correspondence, including pay requests and payrolls, may be required in paper format with original signatures. Paper documents will govern in the event of discrepancy with the electronic version. Contracting Officer will determine which documents require submission of paper copies.

1.3.2 Other Factors

Other portions of this document have a direct relationship to the reporting accomplished through RMS. Particular attention is directed to FAR 52.236-15 Schedules for Construction Contracts; FAR 52.232-27 Prompt Payment for Construction Contracts; FAR 52.232-5 Payments Under Fixed-Priced Construction Contracts; Section 01 32 01.10 18 PROJECT SCHEDULE; Section 01 33 00 SUBMITTAL PROCEDURES; Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS; and Section 01 45 00 QUALITY CONTROL.

1.4 RMS SOFTWARE

RMS is a web based application. Download, install and be able to utilize the latest version of RMS within 7 calendar days of receipt of the Notice to Proceed. RMS software, user manuals, access and installation instructions, program updates and training information are available from the RMS website (https://rms.usace.army.mil). The Government and the Contractor will have different access authorities to the same contract database through RMS. The common database will be updated automatically each time a user finalizes an entry or change.

1.5 CONTRACT DATABASE - GOVERNMENT

The Government will enter the basic contract award data in RMS prior to granting the Contractor access. The Government entries into RMS will generally be related to submittal reviews, correspondence status, and Quality Assurance(QA)comments, as well as other miscellaneous administrative information.

1.6 CONTRACT DATABASE - CONTRACTOR

Contractor entries into RMS establish, maintain, and update data throughout the duration of the contract. Contractor entries generally include prime and subcontractor information, daily reports, submittals, RFI's, schedule updates and payment requests. RMS includes the ability to import attachments and export reports in many of the modules, including submittals. The Contractor responsibilities for entries in RMS typically include the following items:

1.6.1 Administration

1.6.1.1 Contractor Information

Enter all current Contractor administrative data and information into RMS within 7 calendar days of receiving access to the contract in RMS. This

includes, but is not limited to, Contractor's name, address, telephone numbers, management staff, and other required items.

1.6.1.2 Subcontractor Information

Enter all missing subcontractor administrative data and information into RMS CM within seven calendar days of receiving access to the Contract in RMS or within seven calendar days of the signing of the subcontractor agreement for agreements signed at a later date. This includes name, trade, address, phone numbers, and other required information for all subcontractors. A subcontractor is listed separately for each trade to be performed.

1.6.1.3 Correspondence

Identify all Contractor correspondence to the Government with a serial number. Prefix correspondence initiated by the Contractor's site office with "S". Prefix letters initiated by the Contractor's home (main) office with "H". Letters are numbered starting from 0001. (e.g., H-0001 or S-0001). The Government's letters to the Contractor will be prefixed with "C" or "RFP".

1.6.1.4 Equipment

Enter and maintain a current list of equipment planned for use or being used on the jobsite, including the most recent and planned equipment inspection dates in accordance with Section 01 45 00 QUALITY CONTROL.

1.6.1.5 Reports

Track the status of the project using the reports available in RMS. The value of these reports reflects the quality of the data input. These reports include but are not limited to the Progress Payment Request worksheet, Quality Control (QC) comments, Deficiency Tracking Log, Submittal Register Status, and Three-Phase Control worksheets in accordance with Section 01 32 01.10 18 PROJECT SCHEDULE - MILCON, 01 33 00 SUBMITTAL PROCEDURES, and 01 45 00 QUALITY CONTROL.

1.6.1.6 Request For Information (RFI)

Create and track all Requests For Information (RFI) in the RMS Administration Module for Government review and response. Provide status at weekly progress meeting in accordance with Section 01 32 01.10 18 PROJECT SCHEDULE - MILCON.

1.6.2 Finances

1.6.2.1 Pay Activity Data

Develop and enter a list of pay activities in conjunction with the project schedule in accordance with Section 01 32 01.10 18 PROJECT SCHEDULE - MILCON. The sum of pay activities equals the total Contract amount, including modifications. Each pay activity must be assigned to a Contract Line Item Number (CLIN). The sum of the activities assigned to a CLIN equals the amount of each CLIN.

1.6.2.2 Payment Requests

Prepare all progress payment requests using RMS. Update the work

completed under the Contract at least monthly, measured as percent or as specific quantities. After the update, generate a payment request and prompt payment certification using RMS. Submit the signed prompt payment certification and payment request as well as supporting data, either electronically or by hard copy.

1.6.3 Quality Control (QC)

Enter and track implementation of the 3-phase QC Control System, QC testing, transferred and installed property and warranties in RMS. Link each deficiency and QC test to a pay activity. Prepare daily reports, identify and track deficiencies, document progress of work, and support other Contractor QC requirements in RMS. Maintain all data on a daily basis. Ensure that RMS reflects all quality control methods, tests and actions contained within the Contractor Quality Control (CQC) Plan and Government review comments. Provide within seven calendar days of Government acceptance of the CQC Plan.

1.6.3.1 Quality Control (QC) Reports

The Contractor's Quality Control (QC) Daily Report in RMS is the official report. The Contractor can use other supplemental formats to record QC data, but information from any supplemental formats are to be consolidated and entered into the RMS QC Daily Report. Any supplemental information may be entered into RMS as an attachment to the report. QC Daily Reports must be finalized and signed in RMS within 24 hours after the date covered by the report. Provide the Government a printed signed copy of the QC Daily Report, unless waived by the Contracting Officer.

1.6.3.2 Deficiency Tracking

Use the QC Daily Report Module to enter and track deficiencies. Deficiencies identified and entered into RMS by the Contractor or the Government will be sequentially numbered with a QC or QA prefix for tracking purposes. Enter each deficiency into RMS the same day that the deficiency is identified. Monitor, track and resolve all QC and QA entered deficiencies. A deficiency is not considered to be corrected until the Government indicates concurrence in RMS.

1.6.3.3 Three-Phase Control Meetings

Maintain scheduled and actual dates and times of preparatory and initial control meetings in RMS, and upload meeting minutes of the meetings. Worksheets for the three-phase control meetings are generated within RMS.

1.6.3.4 Labor and Equipment Hours

Enter labor and equipment exposure hours on a daily basis. Roll up the labor and equipment exposure data into a monthly exposure report.

1.6.3.5 Accident/Safety Reporting

Both the Contractor and the Government enter safety related comments in RMS as a deficiency. The Contractor must monitor, track and show resolution for safety issues in the QC Daily Report area of the RMS QC Module. In addition, follow all reporting requirements for accidents and incidents as required in EM 385-1-1, Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS and as required by any other applicable Federal, State or local agencies.

1.6.3.6 Definable Features of Work

Enter each feature of work, as defined in the approved CQC Plan, into the RMS QC Module. A feature of work may be associated with a single or multiple pay activities, however a pay activity is only to be linked to a single feature of work.

1.6.3.7 Activity Hazard Analysis

Import activity hazard analysis electronic document files into the RMS QC Module utilizing the document package manager. Prepare activity hazard analysis in accordance with Section 01 35 26 GOVERNMENT SAFETY REQUIREMENTS.

1.6.4 Submittal Management

Enter all current submittal register data and information into RMS within seven calendar days of receiving access to the Contract in RMS. Contractor is responsible for entering Activity Numbers for each submittal item corresponding to their Schedule. The Contractor will import the information shown in the submittal register following the specification Section 01 33 00 SUBMITTAL PROCEDURES unless otherwise directed by the Contracting Officer. Group electronic submittal documents into transmittal packages to send to the Government, except very large electronic files, samples, spare parts, mock ups, color boards, or where hard copies are specifically required. Track transmittals and update the submittal register in RMS on a daily basis throughout the duration of the Contract. Submit hard copies of all submittals unless waived by the Contracting Officer.

Contractor may request submittals to be added to RMS throughout the lifecycle of the project. Approval/disapproval of Contractor requests is at the discretion of the Contracting Officer. Submittals entry into RMS must be updated daily or as practical for performance of the Contract, as approved by the Contracting Officer.

1.6.5 Schedule

Enter and update the contract project schedule in RMS by either manually entering all schedule data or by importing the Standard Data Exchange Format (SDEF) file, based on the requirements in Section 01 32 01.10 18 PROJECT SCHEDULE.

1.6.6 Closeout

Closeout documents, processes and forms are managed and tracked in RMS by both the Contractor and the Government. Ensure that all closeout documents are entered, completed and documented within RMS.

1.7 IMPLEMENTATION

Use of RMS as described in the preceding paragraphs is mandatory. Ensure that sufficient resources are available to maintain contract data within the RMS system. RMS is an integral part of the Contractor's required management of quality control.

1.8 NOTIFICATION OF NONCOMPLIANCE

Take corrective action within seven calendar days after receipt of notice of RMS non-compliance by the Contracting Officer.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

Not Used

-- End of Section --

SECTION 01 45 00

QUALITY CONTROL
08/23, CHG 3: 08/25

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D3740	(2019) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E329	(2025b) Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety -- Safety and Occupational Health (SOH) Requirements

1.2 PAYMENT

Separate payment will not be made for providing and maintaining an effective Quality Control program. Include all associated costs in the applicable Bid Schedule item.

1.3 DEFINITIONS

1.3.1 Definable Feature of Work

A Definable Feature of Work (DFW) is a portion of work consisting of materials, equipment, supplies and procedures which are closely related to each other, have the same control and will be accomplished by the same work crew to completion. A DFW must be sufficiently small so that control of the work (i.e. communication of requirements to workers, inspection of materials and workmanship and correction of deficiencies) will be easily accomplished. Some examples for various types of projects are:

* Concrete reinforcement and formwork

* Concrete mixing, placement, curing and finishing

* Testing Procedure for contaminated soil, materials and storage tank contents

* Storage Tank disassembly and removal

* Setting up of decontamination area, exclusion zones and standard safety procedures for asbestos removal

* Asbestos removal and disposal procedures

* Chemical Data Acquisition

* Preparation, removal and disposal of contaminated material

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES.

SD-01 Preconstruction Submittals

Contractor Quality Control (CQC) Plan; G, RO

SD-06 Test Reports

Verification Statement

1.5 GENERAL REQUIREMENTS

Establish and maintain an effective quality control (QC) system that complies with FAR 52.246-12 Inspection of Construction. QC is comprised of plans, procedures, and organization necessary to produce an end product that complies with the Contract requirements. The QC system covers all construction operations, both onsite and offsite, and must be keyed to the proposed construction sequence. The Quality Control Manager, Superintendent, Site Safety and Health Officer (SSHO), and all on-site supervisors are responsible for the quality of work and are subject to removal by the Contracting Officer for non-compliance with the quality requirements specified in the Contract. The Quality Control Manager must maintain a physical presence at the work site at all times and is the primary individual responsible for all quality control.

1.6 QUALITY CONTROL (QC) PROGRAM REQUIREMENTS

Establish and maintain a QC program as described in this section. The QC program consists of a QC Organization, QC Plan, QC Plan Meeting(s), a Coordination and Mutual Understanding Meeting, QC meetings, three phases of control, submittal review and approval, testing, completion inspections, QC certifications, and documentation necessary to provide materials, equipment, workmanship, fabrication, construction and operations that comply with the requirements of this Contract. The QC program must cover on-site and off-site work and be keyed to the work sequence. No construction work or testing may be performed unless the QC Manager is on the work site. The QC Manager must report to an officer of the firm and not be subordinate to the Project Superintendent or the Project Manager. The QC Manager, Project Superintendent and Project Manager must work together effectively. Although the QC Manager is the primary individual responsible for quality control, all individuals will be held responsible for the quality of work on the job.

1.6.1 Meetings

1.6.1.1 Quality Control Plan Meeting

Prior to submission of the QC Plan, the Contractor may request a meeting with the Contracting Officer to discuss the QC Plan requirements of this Contract.

The purpose of this meeting is to develop a mutual understanding of the QC Plan requirements prior to plan development and submission and to agree on the Contractor's list of Definable Feature of Work (DFOW).

1.6.1.2 Coordination and Mutual Understanding Meeting

After the Preconstruction Conference, before start of construction, and prior to acceptance by the Government of the CQC Plan, meet with the Contracting Officer and discuss the Contractor's quality control system. During the meeting, a mutual understanding of the system details must be developed, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite work, and the interrelationship of Contractor's Management and control with the Government's Quality Assurance. Minutes of the meeting will be prepared by the QC Manager and signed by the Contractor and the Government. Provide a copy of the signed minutes to all attendees and incorporate into the relevant QC Plan. At a minimum the Coordination and Mutual Understanding Meeting must be repeated when a new QC Manager is appointed. There can be other occasions when subsequent conferences will be called by either party to reconfirm mutual understandings or address deficiencies in the CQC system or procedures which can require corrective action by the Contractor.

1.6.1.2.1 Purpose

The purpose of this meeting is to develop a mutual understanding of the QC details, including documentation, administration for on-site and off-site work, design intent, environmental requirements and procedures, coordination of activities to be performed, and the coordination of the Contractor's management, production, and QC personnel. At the meeting, the Contractor must explain in detail how three phases of control will be implemented for each DFOW, as well as how each DFOW will be affected by each management plan or requirement as listed below:

a. Waste Management Plan.

b. Procedures for noise and acoustics management.

c. Environmental Protection Plan.

d. Environmental regulatory requirements.

1.6.1.2.2 Coordination of Activities

Coordinate activities included in various sections to assure efficient and orderly installation of each component. Coordinate operations included under different sections that are dependent on each other for proper installation and operation.

1.6.1.2.3 Attendees

As a minimum, the Contractor's personnel required to attend include an officer of the firm, the Project Manager, Project Superintendent, QC Manager, Alternate QC Manager, QC Specialists, Environmental Manager, and subcontractor representatives. Each subcontractor who will be assigned QC responsibilities must have a principal of the firm at the meeting.

1.6.1.3 Quality Control (QC) Meetings

After the start of construction, conduct weekly QC meetings led by the QC Manager at the work site with the Project Superintendent, the QC Specialists, and the other personnel as necessary. The QC Manager is to prepare the minutes of the meeting and provide a copy to the Contracting Officer within 2 working days after the meeting. The Contracting Officer may attend these meetings. As a minimum, accomplish the following at each meeting:

a. Review the minutes of the previous meeting.

b. Review the schedule and the status of work and deficiencies/rework. Review the most current approved schedule (in accordance with schedule specification) and the status of work and deficiencies/rework.

c. Review the status of submittals and Request For Information (RFIs).

d. Review the work to be accomplished in the next 3 weeks as defined by the schedule section paragraph WEEKLY PROGRESS MEETINGS in Section 01 32 01.10 18 PROJECT SCHEDULE and all quality control documentation required for that work.

e. Review Testing Plan and Log including status of tests performed since last QC Meeting.

f. Resolve QC and production problems. Discuss status of pending change orders.

g. Address items that may require revising the QC Plan.

h. Review Accident Prevention Plan (APP) and effectiveness of the safety program.

i. Review environmental requirements and procedures.

j. Review Environmental Management Plan.

k. Review Waste Management Plan.

l. Review the status of training completion.

1.6.2 Contractor Quality Control (CQC) Plan

Submit no later than 30 days after receipt of notice to proceed, the CQC Plan proposed to implement the requirements FAR 52.246-12 Inspection of Construction. The Government will consider an interim plan for the first 90 days of operation. Construction will be permitted to begin only after acceptance of the CQC Plan and other Contract requirements or acceptance of an interim plan applicable to the particular feature of work to be started. Work outside of the accepted interim plan will not be permitted

to begin until acceptance of a CQC Plan or another interim plan containing the additional work.

1.6.2.1 Content of Contractor Quality Control (CQC) Plan

Provide a CQC Plan, prior to start of construction that includes a table of contents, with major sections identified, pages numbered sequentially, and that documents the proposed methods and responsibilities for accomplishing quality control during the construction of the project. The CQC Plan must at a minimum include the following sections:

a. A description of the quality control organization and acknowledgment that the CQC staff will implement the three phase control system for all aspects of the work specified.

b. An organizational chart showing the quality control organization with individual names and job titles and lines of authority up to an executive of the company at the home office.

c. NAMES AND QUALIFICATIONS: Names and qualifications, in resume format, (including position titles and durations for qualifying experiences) for each person in the QC organization. Include the Construction Quality Management (CQM) for Contractors course certifications for the QC personnel as required by the paragraph CONSTRUCTION QUALITY MANAGEMENT TRAINING.

d. DUTIES, RESPONSIBILITY AND AUTHORITY OF QC PERSONNEL: Duties, responsibilities, and authorities of each person in the QC organization.

e. OUTSIDE ORGANIZATIONS: A listing of outside organizations, such as architectural and consulting engineering firms, that will be employed by the Contractor and a description of the services these firms will provide.

f. APPOINTMENT LETTERS: Letters signed by an officer of the firm appointing the QC Manager and Alternate QC Manager, and stating that they are responsible for implementing and managing the QC program as described in this Contract. Include in this letter the responsibility of the QC Manager and Alternate QC Manager to implement and manage the three phases of control, and their authority to stop work that is not in compliance with the Contract. Letters of direction are to be issued by the QC Manager to all other QC Specialists or quality control representatives outlining their duties, authorities, and responsibilities. Include copies of the letters in the QC Plan.

g. SUBMITTAL PROCEDURES AND INITIAL SUBMITTAL REGISTER: Procedures for reviewing, approving, scheduling, and managing submittals, including those of subcontractors, offsite fabricators, suppliers, and purchasing agents. Provide the name(s) of the person(s) in the QC organization authorized to review and certify submittals prior to approval. Provide the initial submittal of the Submittal Register as specified in Section 01 33 00 SUBMITTAL PROCEDURES.

h. TESTING LABORATORY INFORMATION: Testing laboratory information required by the paragraph ACCREDITATION REQUIREMENTS, as applicable.

i. TESTING PLAN AND LOG: A Testing Plan and Log that includes the tests required, associated feature of work required, referenced by the

specification paragraph number requiring the test, the frequency, and the person responsible for each test.

j. Procedures to complete construction deficiencies from identification through acceptable corrective action. Establish verification procedures that identified deficiencies have been corrected. This phase is performed prior to beginning work on each definable feature of work, after all required plans, documents, materials are approved, and after copies are at the work site.

k. Reporting procedures, including proposed reporting formats.

l. Procedures for submitting and reviewing design changes/variations prior to submission to the Contracting Officer.

m. LIST OF DEFINABLE FEATURES: A Definable Feature of Work (DFOW) is a task that is separate and distinct from other tasks and has control requirements and work crews unique to that task. A DFOW is identified by different trades or disciplines, or it is work by the same trade in a different environment. A DFOW is by definition any item or activity on the construction schedule, and the schedule specification provides direction regarding how the DFOWs are to be structured. Include in the list of DFOWs for all activities on the Construction Schedule. Although each section of the specifications can generally be considered as a definable feature of work, there are frequently more than one definable features under a particular section. Identify the specification section number and schedule activity ID for each DFOW listed. The DFOW list will be reviewed in coordination with the construction schedule and agreed upon during the Coordination and Mutual Understanding Meeting.

n. PROCEDURES FOR PERFORMING AND TRACKING THE THREE PHASES OF CONTROL: Identify procedures used to ensure the three phases of control to manage the quality on this project. For each Definable Feature of Work (DFOW), a Preparatory and Initial phase checklist will be filled out during the Preparatory and Initial phase meetings. Conduct the Preparatory and Initial Phases and meetings with a view towards obtaining quality construction by planning ahead and identifying potential problems for each DFOW.

1.6.3 Acceptance of the Quality Control (QC) Plan

The Contractor Quality Control (QC) Plan, or interim plan applicable to the particular feature of work to be started, is required prior to the start of construction. Work outside of the accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional work. The Contracting Officer reserves the right to require changes in the QC Plan and operations as necessary, including removal or addition of personnel, to ensure the specified quality of work. The Contracting Officer reserves the right to interview any member of the QC organization at any time to verify the submitted qualifications. All QC organization personnel are subject to acceptance by the Contracting Officer. The Contracting Officer may require the removal of any individual for non-compliance with quality requirements specified in the Contract.

1.6.4 Notification of Changes

Notify the Contracting Officer, in writing, of any proposed changes in the QC Plan or changes to the QC organization personnel. Proposed changes are subject to acceptance by the Contracting Officer.

1.7 QUALITY CONTROL (QC) ORGANIZATION

1.7.1 Personnel Requirements

The requirements for the CQC organization are a Site Safety and Health Officer (SSHO), QC Manager, and enough qualified personnel to ensure safety and Contract compliance. The SSHO reports directly to a senior project (or corporate) official independent from the QC Manager. The SSHO will also serve as a member of the CQC Staff Personnel identified in the technical provisions as requiring specialized skills to assure the required work is being performed properly. The CQC staff always maintains a presence at the site during progress of the work and have complete authority and responsibility to take any action necessary to ensure Contract compliance. The CQC staff will be subject to acceptance by the Contracting Officer. Provide adequate office space, filing systems and other resources as necessary to maintain an effective and fully functional CQC organization. Promptly complete and furnish all letters, material submittals, shop drawing submittals, schedules, and all other project documentation to the CQC organization. The CQC organization is responsible for always maintaining these documents and records at the site, except as otherwise acceptable to the Contracting Officer.

1.7.2 Quality Control (QC) Manager

1.7.2.1 Duties

Provide a QC Manager at the work site to implement and manage the QC program. The QC Manager must be employed by the Prime Contractor. The only duties and responsibilities of the QC Manager are to manage and implement the QC program on this Contract. The QC Manager must attend the Coordination and Mutual Understanding Meeting, perform the three phases of control except for those phases of control designated to be performed by QC Specialists, perform submittal review and approval, ensure testing is performed and provide QC certifications and documentation required in this Contract. The QC Manager is responsible for managing and coordinating the three phases of control and documentation performed by the QC Specialists, testing laboratory personnel and any other inspection and testing personnel required by this Contract. The QC Manager is the manager of all QC activities.

1.7.2.2 Qualifications

The QC Manager must possess at least a Bachelor's degree in engineering, architecture, or construction management, with a current professional engineer registration in the state of New Jersey and a minimum of 10 years construction experience as a Project Superintendent, QC Manager, Project Manager, Project Engineer or Construction Manager on similar size and type construction Contracts which included the major trades that are part of this Contract. The individual must have at least 4 years experience as a QC Manager. The individual must be familiar with the requirements of EM 385-1-1 and have experience in the areas of hazard identification, safety compliance, and sustainability.

The QC Manager and all members of the QC organization must be capable of reading, writing, and conversing fluently in the English language.

1.7.2.3 Construction Quality Management Training

In addition to the above experience and education requirements, the QC Manager Alternate QC Manager, Superintendent, QC Specialist, and DQCM must have completed the CQM for Contractors course. If the QC Manager does not have a current certification, obtain the CQM for Contractors course certification within 90 days of award. This course is periodically offered by the Naval Facilities Engineering Systems Command and the Army Corps of Engineers. Contact the Contracting Officer for information on the next scheduled class.

The Construction Quality Management Training certificate expires after 5 years. If the QC Manager's certificate has expired, retake the course to remain current.

1.7.3 Organizational Changes

Maintain the QC staff with personnel as required by the specification section at all times. When it is necessary to make changes to the QC staff, revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer for acceptance.

1.7.4 Alternate Quality Control (QC) Manager Duties and Qualifications

Designate an alternate for the QC Manager at the work site to serve in the event of the designated QC Manager's absence. The qualification requirements for the Alternate QC Manager must be the same as for the QC Manager.

1.7.5 Quality Control (QC) Specialists

Provide a separate QC Specialist at the work site for each of the areas as listed in the Matrix listed below, who must assist and report to the QC Manager and who may perform production related duties but must be allowed sufficient time to perform their assigned quality control duties. These individuals or specialized technical companies are directly employed by the Prime Contractor and cannot be employed by a supplier or subcontractor on this project. A single person can cover more than one area provided that the single person is qualified to perform quality control activities in each designated and that workload allows. QC Specialists must be physically present at the work site with frequency as indicated in the Experience Matrix below, to participate in the QC Meetings, perform the three phases of control, including participation in Preparatory and Initial Phase meetings, and to perform and document Follow-up inspections as an extension of the QC Manager for each definable feature of work in their area of responsibility. QC Specialist must assist and be present for training events, and Critical System Acceptance inspections by the Government. Qualification, experience, Area of Responsibility, and frequency of QC surveillance are provided in Matrix listed herein.

Experience Matrix		
1. Area	**2-1. Qualification** **2-2. Experience**	**3-1. Area of Responsibility** **3-2. Frequency**

Civil	2-1. Graduate Civil Engineer or Construction Manager with a professional engineer registration in the state of NJ, and 2-2. 2 years experience in the type of work being performed on this project or technician with 5 years related experience	3-1. Area of Responsibility: CIVIL 3-2. Frequency of QC surveillance and inspection will be three time during during installation and full week during final inspection.
Electrical	2-1. Graduate Electrical Engineer with a professional engineer registration , and 2-2. 2 years related experience or person 5 years of experience supervising electrical features of work in the field with a construction company	3-1. Area of Responsibility: Electrical 3-2. Frequency of QC surveillance and inspection will be three time during during installation and full week during final inspection.
Environmental	2-1. Graduate Environmental Engineer with a professional engineer registration in the state of NJ, and 2-2. 3 years experience	3-1. Area of Responsibility: Environmental 3-2. Frequency of QC surveillance and inspection will be three time during during installation and full week during final inspection.

1.8 SUBMITTAL AND DELIVERABLES REVIEW AND APPROVAL

Procedures for submission, review and approval of submittals are described in Section 01 33 00 SUBMITTAL PROCEDURES. Procedures must include field verification of relevant dimensions and component characteristics by the QC organization prior to submittal being sent to the Contracting Officer. The CQC organization is responsible for certifying that all submittals and deliverables are in compliance with the Contract.

1.9 THREE PHASES OF CONTROL

CQC enables the Contractor to ensure that the construction, including that of subcontractors and suppliers, complies with the requirements of the Contract. At least three phases of control must be conducted by the QC Manager to adequately cover both on-site and off-site work for each

definable feature of the construction work as follows:

1.9.1 Preparatory Phase

Document the results of the preparatory phase actions by separate minutes prepared by the QC Manager and attach to the daily CQC report. Instruct applicable workers as to the acceptable level of workmanship required to meet Contract specifications.

Notify the Contracting Officer at least 2 business days in advance of each preparatory phase meeting. The meeting will be conducted by the QC Manager and attended by the QC Specialists, the Project Superintendent, and the foreman responsible for the DFOW. When the DFOW will be accomplished by a subcontractor, that subcontractor's foreman must attend the preparatory phase meeting. This phase is performed prior to beginning work on each definable feature of work, after all required plans/documents/materials are approved/accepted, and after copies are at the work site. Perform the following prior to beginning work on each DFOW:

a. Review each paragraph of the applicable specification sections, reference codes, and standards. Make available during the prepatory inspection a copy of those sections of referenced codes and standards applicable to that portion of the work to be accomplished in the field. Maintain and make available in the field for use by Government personnel until final acceptance of the work.

b. Review the Contract drawings.

c. Verify that field measurements are as indicated on construction or shop drawings or both before confirming product orders, to minimize waste due to excessive materials.

d. Verify that appropriate shop drawings and submittals for materials and equipment have been submitted and approved. Verify receipt of approved factory test results, when required.

e. Review the testing plan and ensure that provisions have been made to provide the required QC testing.

f. Examine the work area to ensure that the required preliminary work has been completed and complies with the Contract and ensure any deficiencies/rework items in the preliminary work have been corrected and confirmed by the Contracting Officer.

g. Review coordination of product/material delivery to designated prepared areas to execute the work.

h. Examine the required materials, equipment and sample work to ensure that they are on hand and conform to the approved shop drawings and submitted data and are properly stored.

i. Check to assure that all materials and equipment have been tested, submitted, and approved.

j. Discuss specific controls to be used, construction methods, construction tolerances, workmanship standards, and the approach that will be used to provide quality construction by planning ahead and identifying potential problems for each DFOW. Ensure any portion of the plan requiring separate Contracting Officer acceptance has been

approved.

k. Review the APP and appropriate Activity Hazard Analysis (AHA) to ensure that applicable safety requirements are met, and that required Safety Data Sheets (SDS) are submitted.

l. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards for that feature of work.

m. Discuss schedule and execution of the initial control phase and confirmation or construction quality compliance.

1.9.2 Initial Phase

Notify the Contracting Officer at least 2 business days in advance of each initial phase. When construction crews are ready to start work on a DFOW, conduct the initial phase with the QC Specialists, the Project Superintendent, and the foreman responsible for that DFOW. Observe the initial segment of the DFOW to ensure that the work complies with Contract requirements. Document the results of the initial phase in the daily CQC Report and in the Initial Phase Checklist. Repeat the initial phase for each new crew to work on-site when acceptable levels of specified quality are not being met. Indicate the exact location of initial phase for definable feature of work for future reference and comparison with follow-up phases. Perform the following for each DFOW:

a. Check work to ensure that it is in full compliance with Contract requirements. Review minutes of the preparatory meeting.

b. Verify adequacy of controls to ensure full Contract compliance. Verify required control inspection and testing comply with the Contract.

c. Establish level of workmanship and verify that it meets the minimum acceptable workmanship standards. Compare with required sample panels as appropriate.

d. Resolve any workmanship issues.

e. Ensure that testing is performed by the approved laboratory.

f. Check work procedures for compliance with the APP and the appropriate AHA to ensure that applicable safety requirements are met.

g. Review project specific work plans (i.e., HAZMAT Abatement, Stormwater Management) to ensure all preparatory work items have been completed and documented.

1.9.3 Follow-Up Phase

Perform the following for on-going DFOW daily, or more frequently as necessary, until the completion of each DFOW. The Final Follow-Up for any DFOW will clearly note in the daily report the DFOW is completed, and all deficiencies/rework items have been completed in accordance with the paragraph DEFICIENCY/REWORK ITEMS LIST. Each DFOW that has completed the Initial Phase and has not completed the Final Follow-up must be included on each daily report. If no work was performed on that DFOW for the

period of that daily report, it must be so noted. Document all Follow-Up activities for DFOWs in the daily CQC Report:

a. Ensure the work including control testing complies with Contract requirements until completion of that particular work feature. Record checks in the CQC documentation.

b. Maintain the quality of workmanship required.

c. Ensure that testing is performed by the approved laboratory.

d. Ensure that deficiencies/rework items are being corrected. Conduct final follow-up checks and correct all deficiencies prior to the start of additional features of work which may be affected by the deficient work.

e. Do not build upon nor conceal non-conforming work.

f. Assure manufacturers' representatives have performed necessary inspections if required and perform safety inspections.

1.9.4 Additional Preparatory and Initial Phases

Conduct additional preparatory and initial phases on the same DFOW if the quality of on-going work is unacceptable, if there are changes in the applicable QC organization, if there are changes in the on-site production supervision or work crew, if work on a DFOW has not started within 45 days of the initial preparatory meeting or has resumed after 45 days of inactivity, or if other problems develop.

1.9.5 Notification of Three Phases of Control for Off-Site Work

Notify the Contracting Officer at least 2 weeks prior to the start of the preparatory and initial phases.

1.9.6 Deficiency/Rework Items List

The QC Manager must maintain a list of work that does not comply with the Contract, identifying what items need to be corrected, the activity ID number associated with the item, the date the item was originally discovered, the date the item will be corrected by, and the date the item was corrected.

The QC Manager reviews the list at each weekly QC Meeting:

a. There is no requirement to report a deficiency/rework item that is corrected the same day it is discovered.

b. No successor task may be advanced beyond the preparatory phase meeting until all deficiencies/rework items have been cleared by the QC Manager and concurred with by the Contracting Officer. This must be confirmed as part of the Preparatory Phase activities.

c. Attach a copy of the "Deficiency/Rework Items List" to the last daily CQC Report of each month.

d. The Contractor is responsible for including those items identified by the Contracting Officer.

e. All deficiencies/rework items must be confirmed as corrected by the QC Manager, and concurred by the Contracting Officer, prior to commencement of any completion inspections per paragraph COMPLETION INSPECTIONS unless specifically exempted by the Contracting Officer.

f. Non-Compliance with these requirements is grounds for removal in accordance with paragraph ACCEPTANCE OF THE QUALITY CONTROL (QC) PLAN.

g. All delays, concurrent or related to failure to manage, monitor, control, and correct deficiencies/rework items are entirely the responsibility of the Contractor and can not be made the subject, or any component of any request for additional time or compensation.

1.10 TESTING

Perform specified or required tests to verify that control measures are adequate to provide a product which conforms to Contract requirements. Upon request, furnish to the Government duplicate samples of test specimens for possible testing by the Government. Testing includes operation and acceptance tests when specified. Procure the services of an U.S. Army Corps of Engineers approved testing laboratory or establish an approved testing laboratory. Perform the following activities and record and provide the following data:

a. Verify that testing procedures comply with Contract requirements.

b. Verify that facilities and testing equipment are available and comply with testing standards.

c. Check test instrument calibration data against certified standards.

d. Verify that recording forms and test identification control number system, including all test documentation requirements, have been prepared.

e. Record results of all tests taken, both passing and failing on the CQC report for the date taken. Specification paragraph reference, location where tests were taken, and the sequential control number identifying the test. If approved by the Contracting Officer, actual test reports are submitted later with a reference to the test number and date taken. Provide an information copy of tests performed by an offsite or commercial test facility directly to the Contracting Officer. Failure to submit timely test reports as stated results in nonpayment for related work performed and disapproval of the test facility for this Contract.

1.10.1 Laboratory Accreditation Authorities

All testing laboratories must be validated by the USACE Material Testing Center (MTC) for the tests to be performed. Information on the USACE MTC with web-links to both a list of validated testing laboratories and for the laboratory inspection request for can be found at: https://mtc.erdc.dren.mil

1.10.2 Capability Check

The Contracting Officer retains the right to check laboratory equipment in the proposed laboratory and the laboratory technician's testing procedures, techniques, and other items pertinent to testing, for

compliance with the standards set forth in this Contract. Laboratories utilized for testing soils, concrete, asphalt, and steel must meet criteria detailed in ASTM D3740 and ASTM E329.

1.10.2.1 Capability Recheck

If the selected laboratory fails the capability check, the Contractor will be assessed a charge of recheck to reimburse the Government for each succeeding recheck of the laboratory or the checking of a subsequently selected laboratory. Such costs will be deducted from the Contract amount due the Contractor.

1.10.2.2 Onsite Laboratory

The Government reserves the right to utilize the Contractor's control testing laboratory and equipment to make assurance tests, and to check the Contractor's testing procedures, techniques, and test results at no additional cost to the Government.

1.10.3 Test Results

Cite applicable Contract requirements, tests or analytical procedures used. Provide actual results and include a statement that the item tested or analyzed conforms or fails to conform to specified requirements. If the item fails to conform, notify the Contracting Officer immediately. Conspicuously stamp the cover sheet for each report in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, whichever is applicable. Test results must be signed by a testing laboratory representative authorized to sign certified test reports. Furnish the signed reports, certifications, and other documentation to the Contracting Officer via the QC Manager.

1.11 COMPLETION INSPECTIONS

1.11.1 Punch-Out Inspection

Near the completion of all work or any increment thereof, established by a completion time stated in the Contract Clause entitled "Commencement, Prosecution, and Completion of Work," or stated elsewhere in the specifications, the QC Manager must conduct an inspection of the work and develop a "punch list" of items which do not conform to the approved drawings, specifications, and Contract. Include in the punch list any remaining items on the "Deficiency/Rework Items List", that were not corrected prior to the Punch-Out Inspection as approved by the Contracting Officer in accordance with the paragraph DEFICIENCY/REWORK ITEMS LIST. Include within the punch list the estimated date by which the deficiencies will be corrected. Provide a copy of the punch list to the Contracting Officer.

The QC Manager, or staff, must make follow-on inspections to ascertain that all deficiencies have been corrected. All punch list items must be confirmed as corrected by the QC Manager and concurred by the Contracting Officer. Once this is accomplished, notify the Government that the facility is ready for the Government "Pre-Final Inspection".

1.11.2 Pre-Final Inspection

The Government and QC Manager will perform this inspection to verify that the facility is complete and ready to be occupied. A Government

"Pre-Final Punch List" will be documented by the QC Manager as a result of this inspection. The QC Manager will ensure that all items on this list are corrected and concurred by the Contracting Officer prior to notifying the Government that a "Final" inspection with the Client can be scheduled. All items noted on the "Pre-Final" inspection must be corrected and concurred by the Contracting Officer in a timely manner and be accomplished before the Contract completion date for the work, or any increment thereof, if the project is divided into increments by separate completion dates unless exceptions are directed by the Contracting Officer.

1.11.3 Final Acceptance Inspection

Notify the Contracting Officer at least 14 calendar days prior to the date a final acceptance inspection can be held. State within the notice that all items previously identified on the pre-final punch list will be corrected and acceptable, along with any other unfinished Contract work, by the date of the final acceptance inspection. The Contractor must be represented by the QC Manager, the Project Superintendent, and others deemed necessary. Attendees for the Government will include the Contracting Officer, other Government QA personnel, and personnel representing the Client. Failure of the Contractor to have all Contract work acceptably complete for this inspection will be cause for the Contracting Officer to bill the Contractor for the Government's additional inspection cost in accordance with the Contract Clause entitled "Inspection of Construction."

1.12 QUALITY CONTROL (QC) CERTIFICATIONS

1.12.1 Contractor Quality Control (CQC) Report Certification

Contain the following statement within the CQC Report: "On behalf of the Contractor, I certify that this report is complete and correct and equipment and material used, and work performed during this reporting period is in compliance with the Contract drawings and specifications to the best of my knowledge, except as noted in this report."

1.12.2 Completion Certification

Upon completion of work under this Contract, the QC Manager must furnish a certificate to the Contracting Officer attesting that "the work has been completed, inspected, tested and is in compliance with the Contract." Provide a copy of this final QC Certification for completion to the preparer of the Operation & Maintenance (O&M) documentation.

1.13 DOCUMENTATION AND INFORMATION FOR THE CONTRACTING OFFICER

Maintain current and complete records of on-site and off-site QC program operations and activities.

Contact the Contracting Officer for sample forms or print from RMS-QCS as needed. Prior to commencing work on construction, the Contractor must obtain a copy set of the current report forms. The report forms will consist of the Contractor Quality Control (CQC) Report, CQC Report (Continuation Sheet), Contractor Production Report, Contractor Production Report (Continuation Sheet), Preparatory Phase Checklist, Initial Phase Checklist, Testing Plan and Log, and Rework Items List. Unless otherwise provided by the Contracting Officer, Contractor may use the forms provided as related material located at www.wbdg.org/dod/ufgs/ufgs-01-45-00.

1.13.1 Construction Documentation

Prepare a Construction Production Report and a Contractor Quality Control Report for each day that work is performed. Attach the Construction Production Report to the Contractor Quality Control Report prepared for the same day. Maintain current and complete records of on-site and off-site QC program operations and activities.
Account for each calendar day throughout the life of the Contract.

The Project Superintendent and the QC Manager must prepare and sign the Contractor Production and CQC Reports, respectively. Every space on the forms must be filled in. Use N/A if nothing can be reported in one of the spaces. The reporting of work must be identified by terminology consistent with the construction schedule. In the "Remarks" sections of the reports, enter pertinent information including directions received, problems encountered during construction, work progress and delays, conflicts or errors in the drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered, a record of visitors to the work site, quality control problem areas, deviations from the QC Plan, construction deficiencies encountered, and meetings held. For each entry in the report(s), identify the Schedule Activity No. that is associated with the entered remark.

1.13.2 Quality Control Activities

CQC and Contractor Production reports will be prepared daily to maintain current records providing factual evidence that required quality control activities and tests have been performed. Include in these records the work of subcontractors and suppliers on an acceptable form that includes, as a minimum, the following information:

a. The name and area of responsibility of the Contractors and any subcontractors.

b. Operating plant/equipment with hours worked, idle, or down for repair.

c. Work performed each day, giving location, description, and by whom. When a Network Analysis Schedule (NAS) is used, identify each item of work performed each day by NAS activity number.

d. Control phase activities performed. Preparatory, and Initial phase Checklists associated with the DFOW referenced to the construction schedule. Follow-up phase activities identified to the DFOW. If testing or specific QC Specialist activities are associated with the Follow-up phase activities for a specific DFOW note this and include those reports.

e. Test and control activities performed with results and references to specifications and drawings requirements. Identify the control phase (Preparatory, Initial, Follow-up). List of deficiencies noted, along with corrective action in accordance with the paragraph DEFICIENCY/REWORK ITEMS LIST.

f. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specifications and drawings requirements.

g. Submittals and deliverables reviewed, with Contract reference, by

whom, and action taken.

h. Offsite surveillance activities, including actions taken.

i. Job safety evaluations stating what was checked, results, and instructions or corrective actions.

j. Instructions given/received and conflicts in plans and specifications.

1.13.3 Verification Statement

Indicate a description of trades working on the project; the number of personnel working; weather conditions encountered; and any delays encountered. Cover both conforming and deficient features and include a statement that equipment and materials incorporated in the work and workmanship comply with the Contract.

Furnish the original and one copy of these records in report form to the Government by 10:00 AM the next working day after the date covered by the report. As a minimum, prepare and submit one report for every 7 days of no work and on the last day of a no work period. All calendar days need to be accounted for throughout the life of the Contract. The first report following a day of no work will be for that day only. Reports need to be signed and dated by the QC Manager. Include copies of test reports and copies of reports prepared by all subordinate quality control personnel within the QC Manager Report.

1.13.4 Reports from the Quality Control (QC) Specialist(s)

Document inspection results on a QC specialist report prepared each day work is performed in their area of responsibility. The report must include a description of the visual inspection or observation performed, a written summary of findings, a conclusion on compliance with the Contract documents, and signature of the QC Specialist. In person inspections must be documented with Video/photographs. Video/photographic documentation of deficiencies must include before and after conditions and physical measurements, as necessary. Forward the QC daily report to the QC Manager who must include the report with the submission of their daily QC Report to the Government each day. Every site visit by the QC Specialist must be documented on a QC Specialist daily report.

1.13.5 Quality Control Validation

Establish and maintain the following in an electronic folder. Divide folder into a series of tabbed sections as shown below. Ensure folder is updated at each required progress meeting.

a. CQC Meeting minutes in accordance with paragraph QUALITY CONTROL (QC) MEETINGS.

b. All completed Preparatory and Initial Phase Checklists, arranged by specification section, further sorted by DFOW referenced to the construction schedule. Submit each individual Phase Checklist the day the phase event occurs as part of the CQC daily report.

c. All milestone inspections, arranged by Activity Number referenced to the construction schedule.

d. An up-to-date copy of the Testing Plan and Log with supporting field

test reports, arranged by specification section referenced to the DFOW to which individual reports results are associated. Individual field test reports will be submitted within 2 working days after the test is performed in accordance with the paragraph QUALITY CONTROL ACTIVITIES.

e. Copies of all Contract modifications, arranged in numerical order. Also include documentation that modified work was accomplished.

f. An up-to-date copy of the paragraph DEFICIENCY/REWORK ITEMS LIST.

g. . Upon commencement of Completion Inspections of the entire project or any defined portion, maintain up-to-date copies of all punch lists issued by the QC staff to the Contractor and subcontractors and all punch lists issued by the Government in accordance with the paragraph COMPLETION INSPECTIONS.

1.13.6 Testing Plan and Log

As tests are performed, the QC Manager will record on the "Testing Plan and Log" the date the test was performed and the date the test results were forwarded to the Contracting Officer. Attach a copy of the updated "Testing Plan and Log" to the last daily CQC Report of each month. Provide a copy of the final "Testing Plan and Log" to the preparer of the Operation & Maintenance (O&M) documentation.

1.13.7 As-Built Drawings

The QC Manager must ensure the as-built drawings, required by Section 01 78 00 CLOSEOUT SUBMITTALS are kept current on a daily basis and marked to show deviations which have been made from the Contract drawings. The as-built drawings document commences with the QC Manager ensuring all amendments, or changes to the Contract prior to Contract award are accurately noted in the initial document set creating the accurate baseline of the Contract prior to any work starting. Ensure each deviation has been identified with the appropriate modifying documentation (e.g., PC No., Modification No., Request for Information No.). The QC Manager or QC Specialist assigned to an area of responsibility must initial each revision. Upon completion of work, the QC Manager will furnish a certificate attesting to the accuracy of the as-built drawings prior to submission to the Contracting Officer.

1.14 NOTIFICATION ON NON-COMPLIANCE

The Contracting Officer will notify the Contractor of any detected non-compliance with the Contract. Take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site, is deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders will be made the subject of a claim for extension of time for excess costs or damages by the Contractor.

1.15 DELIVERY, STORAGE, AND HANDLING

Designate receiving/storage areas for incoming material to be delivered according to installation schedule and to be placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. Store and handle materials in a manner as to prevent loss

from weather and other damage. Keep materials, products, and accessories covered and off the ground, and store in a dry, secure area. Prevent contact with material that may cause corrosion, discoloration, or staining. Protect all materials and installations from damage by the activities of other trades.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

-- End of Section --

CONTRACTORS QUALITY CONTROL REPORT (QCR) DAILY LOG OF CONSTRUCTION	REPORT NUMBER Page 1 of 3
	DATE Date - Day of Week
PROJECT	CONTRACT NUMBER
CONTRACTOR	WEATHER Weather Caused No Delay Temperature Min °F Max °F No Precipitation No Wind

QC NARRATIVES

Activities in Progress:

Addtional Activities and Remarks (i.e., Submittal Actions, Misc Remarks)

Delivery of Equipment and Materials

Description & Location of Work (Also Indicate days of no work and reasons)

Follow-Up Phase Inspection Performed, Results & Corrective Action Taken

List Contractors and Subs Working This Day & Area of Responsiblity

CONTRACTORS QUALITY CONTROL REPORT (QCR)
DAILY LOG OF CONSTRUCTION

REPORT NUMBER

DATE

PROJECT

CONTRACT NUMBER

PREP/INITIAL DATES (Preparatory and initial dates held and advance notice)

Preparatory Inspections held today

No preparatory inspections held today

Initial Inspections held today

No initial inspections held today

ACTIVITY START/FINISH

Activity No Description

No activities were started or finished today

QC REQUIREMENTS

Requirement No Type Description Results

No QC requirements were completed today

ISSUED QA/QC DEFICIENCY (Describe QA and QC Deficiency items issued)

Item No Location Description

No QC Deficiency items were issued today

CORRECTED QA/QC DEFICIENCY (Report QC and QA Deficiency items corrected)

Item No Location Description

No QC Deficiency items were corrected today

CONTRACTORS ON SITE (Report first and/or last day contractors were on site)

Name First Day Last Day

No Contractors had their first or last day on the site

LABOR HOURS

Employer	Labor Classification	Number of Employees	Hours Worked
	FLOOR-COVERING-TILE LAYER		
	LABORERS		
	CONCRETING SUPERVISOR		

CONTRACTORS QUALITY CONTROL REPORT (QCR)
DAILY LOG OF CONSTRUCTION

REPORT NUMBER

DATE

PROJECT

CONTRACT NUMBER

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LABORERS
PAINTERS
CARPENTER
CONSTRUCTION INSPECTOR
LABORERS
IRONWORKER
IRON & STEEL WORK SUPERVSR
PIPE FITTER
DUCT INSTALLER
SPRINKLER FITTER
ELECTRICIAN
CARPENTER
CARPENTER FOREMAN

Total hrs worked to date:	XXXXXX	Hrs worked MTD:	XXXXXXX	Total:	XXXX	XXXX

EQUIPMENT HOURS

Serial Number	Description	Idle Hours	Operating Hours

No equipment hours reported today

Total operating hrs to date:	XXXX	Idle hrs MTD:	0.0	Opr hrs MTD:	XX	Total:

MISHAP REPORTING (Describe mishaps)

No mishaps reported today

CONTRACTOR CERTIFICATION **On behalf of the contractor, I certify that this Report is complete and correct and all equipment and material used and work performed during this Reporting period are in compliance with the contract plans and specifications, to the best of my knowledge, except as noted above.**

QC REPRESENTATIVE'S SIGNATURE	DATE	SUPERINTENDENT'S INITIALS	DATE

US Army Corps of Engineers

Deficiency Items Issued - by QC

Date of Report

Project Name

RMS Contract ID

Resident Office Name

Item Number	Description	Location	Status	Date Issued	Age (days)

SECTION 01 50 00

TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS
11/20, CHG 2: 08/22

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C511	(2017; R 2021) Reduced-Pressure Principle Backflow Prevention Assembly

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2020; TIA 22-1; ERTA 1 2022) National Electrical Code
NFPA 241	(2022) Standard for Safeguarding Construction, Alteration, and Demolition Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety -- Safety and Health Requirements Manual

U.S. FEDERAL HIGHWAY ADMINISTRATION (FHWA)

MUTCD	(2009; Rev 2012) Manual on Uniform Traffic Control Devices

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction Site Plan; G, RO

Traffic Control Plan; G, RO

Haul Road Plan; G, RO

Contractor Computer Cybersecurity Compliance Statements; G, RO

Contractor Temporary Network Cybersecurity Compliance Statements; G,

RO

SD-06 Test Reports

Backflow Preventer Tests

SD-07 Certificates

Backflow Tester Certification

Backflow Preventers Certificate of Full Approval

1.3 CONNECTION WITH WORK OF OTHER CONTRACTS

During the period of this contract, other contracts may be in force for the construction of other features of work on or adjacent to the site of work being accomplished under this contract. The Contractor must arrange his plant and must schedule and perform the work as to cooperate with all other contractors and Government agencies. It is the Contractor's responsibility to know the extent of the limits of his contract. No direct or extra compensation will be allowed because of the cooperation required.

a. At all points of connection with work of other contracts, the Contractor must have weekly coordination meetings until all connections have been completed with the adjoining contractor(s) to insure proper and timely connections.

b. Where the work under this contract is completed before that of the adjoining contractor, the Contractor must terminate his work in an approved manner ready for future connection by the adjoining contractor. Pipes and conduits must be closed with suitable caps or plugs that will prevent entry of dirt or debris, but that are readily removable when final connections are made. For underground lines that are back-filled, approved type markers that extend above the ground surface must be provided to facilitate future location of the lines by the adjoining contract.

c. Where the work of the adjoining contractor is already in place, the Contractor must perform all work required to effect the necessary connection, including locations of underground lines, removing of caps, providing necessary adapters or joining pieces, and all related incidental work for necessary for a proper, secure connection.

1.4 LAYOUT OF WORK

The contractor must lay out his work from the dimensions indicated on the drawings and is responsible for all measurements in connection therewith.

1.5 CONSTRUCTION SITE PLAN

Prior to the start of work, submit for Government approval a site plan showing the locations and dimensions of temporary facilities (including layouts and details, equipment and material storage area (onsite and offsite), and access and haul routes, avenues of ingress/egress to the fenced area and details of the fence installation. Identify any areas which may have to be graveled to prevent the tracking of mud. Indicate if the use of a supplemental or other staging area is desired. Show locations

of safety and construction fences, site trailers, construction entrances, trash dumpsters, temporary sanitary facilities, and worker parking areas.

1.6 BACKFLOW PREVENTERS CERTIFICATE

1.6.1 Backflow Tester Certificate

Prior to testing, submit to the Contracting Officer certification issued by the State or local regulatory agency attesting that the backflow tester has successfully completed a certification course sponsored by the regulatory agency. Tester must not be affiliated with a company participating in other phases of this Contract.

1.6.2 Backflow Prevention Training Certificate

Submit a certificate recognized by the State or local authority that states the Contractor has completed at least 10 hours of training in backflow preventer installations. The certificate must be current.

1.7 DOD CONDITION OF READINESS (COR)

DOD will set the Condition of Readiness (COR) based on the weather forecast for sustained winds 50 knots (58 mph) or greater. Contact the Contracting Officer for the current COR setting.

Monitor weather conditions a minimum of twice a day and take appropriate actions according to the approved Emergency Plan in the accepted Accident Prevention Plan, EM 385-1-1 Emergency Planning and the instructions below.

Unless otherwise directed by the Contracting Officer, comply with:

a. Condition FOUR (Sustained winds of 58 mph or greater expected within 72 hours): Normal daily jobsite cleanup and good housekeeping practices. Collect and store in piles or containers scrap lumber, waste material, and rubbish for removal and disposal at the close of each work day. Maintain the construction site including storage areas, free of accumulation of debris. Stack form lumber in neat piles less than 3.3 feet high. Remove all debris, trash, or objects that could become missile hazards. Review requirements pertaining to "Condition THREE" and continue action as necessary to attain "Condition FOUR" readiness. Contact Contracting Officer for weather and COR updates and completion of required actions.

b. Condition THREE (Sustained winds of 58 mph or greater expected within 48 hours): Maintain "Condition FOUR" requirements and commence securing operations necessary for "Condition ONE" which cannot be completed within 18 hours. Cease all routine activities which might interfere with securing operations. Commence securing and stow all gear and portable equipment. Make preparations for securing buildings. Reinforce or remove formwork and scaffolding. Secure machinery, tools, equipment, materials, or remove from the jobsite. Expend every effort to clear all missile hazards and loose equipment from general base areas. Contact Contracting Officer for weather and COR updates and completion of required actions. Review requirements pertaining to "Condition TWO" and continue action as necessary to attain "Condition THREE" readiness.

c. Condition TWO (Sustained winds of 58 mph or greater expected within 24 hours): Secure the jobsite, and leave Government premises.

d. Condition ONE. (Sustained winds of 58 mph or greater expected within 12 hours): Contractor access to the jobsite and Government premises is prohibited.

1.8 CYBERSECURITY DURING CONSTRUCTION

{For Reference Only: This subpart (and its subparts) relates to AC-18, SA-3, CCI-00258.} Meet the following requirements throughout the construction process.

1.8.1 Contractor Computer Equipment

Contractor owned computers may be used for construction. When used, contractor computers must meet the following requirements:

1.8.1.1 Operating System

The operating system must be an operating system currently supported by the manufacturer of the operating system. The operating system must be current on security patches and operating system manufacturer required updates.

1.8.1.2 Anti-Malware Software

The computer must run anti-malware software from a reputable software manufacturer. Anti-malware software must be a version currently supported by the software manufacturer, must be current on all patches and updates, and must use the latest definitions file. All computers used on this project must be scanned using the installed software at least once per day.

1.8.1.3 Passwords and Passphrases

The passwords and passphrases for all computers must be changed from their default values. Passwords must be a minimum of eight characters with a minimum of one uppercase letter, one lowercase letter, one number and one special character.

1.8.1.4 Contractor Computer Cybersecurity Compliance Statements

Provide a single submittal containing completed Contractor Computer Cybersecurity Compliance Statements for each company using contractor owned computers. Contractor Computer Cybersecurity Compliance Statements must use the template published at http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables. Each Statement must be signed by a cybersecurity representative for the relevant company.

1.8.2 Temporary IP Networks

Provide Government access to Contractor furnished temporary IP networks during construction. When used, temporary contractor-installed IP networks must meet the following requirements:

1.8.2.1 Network Boundaries and Connections

The network must not extend outside the project site and must not connect to any IP network other than IP networks provided under this project or

Government furnished IP networks provided for this purpose. Any and all network access from outside the project site is prohibited.

1.8.3 Government Access to Network

Government personnel, as defined, prescribed, and identified by the Contracting Officer, must be allowed to have complete and immediate access to the network at any time in order to verify compliance with this specification. Or if there is a Government agency that's responsible, identify that agency.

1.8.4 Temporary Wireless IP Networks

In addition to the other requirements on temporary IP networks, temporary wireless IP (WiFi) networks must not interfere with existing wireless network and must use WPA2 security. Network names (SSID) for wireless networks must be changed from their default values.

1.8.5 Passwords and Passphrases

The passwords and passphrases for all network devices and network access must be changed from their default values. Passwords must be a minimum 8 characters with a minimum of one uppercase letter, one lowercase letter, one number and one special character.

1.8.6 Contractor Temporary Network Cybersecurity Compliance Statements

Provide a single submittal containing completed Contractor Temporary Network Cybersecurity Compliance Statements for each company implementing a temporary IP network. Contractor Temporary Network Cybersecurity Compliance Statements must use the template published at http://www.wbdg.org/ffc/dod/unified-facilities-guide-specifications-ufgs/forms-graphics-tables. Each Statement must be signed by a cybersecurity representative for the relevant company. If no temporary IP networks will be used, provide a single copy of the Statement indicating this.

PART 2 PRODUCTS

2.1 TEMPORARY SIGNAGE

2.1.1 Bulletin Board

Prior to the commencement of work activities, provide a clear weatherproof covered bulletin board not less than 36 by 48 inches in size for displaying the Equal Employment Opportunity poster, a copy of the wage decision contained in the Contract, Wage Rate Information poster, Safety and Health Information as required by EM 385-1-1 and other information approved by the Contracting Officer. Coordinate requirements herein with 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. Locate the bulletin board at the project site in a conspicuous place easily accessible to all employees, and in location as approved by the Contracting Officer.

2.1.2 Project Identification Signs

The requirements for the signs, their content, and location are as specified in Section 01 58 00 PROJECT IDENTIFICATION. Erect signs within 15 days after receipt of the notice to proceed. Correct the data required by the safety sign daily, with light colored metallic or non-metallic numerals.

2.1.3 Warning Signs

Post temporary signs, tags, and labels to give workers and the public adequate warning and caution of construction hazards according to the EM 385-1-1. Attach signs to the perimeter fencing every 150 feet warning the public of the presence of construction hazards. Signs must require unauthorized persons to keep out of the construction site. Correct the data required by safety signs daily. Post signs at all points of entry designating the construction site as a hard hat area.

2.2 TEMPORARY TRAFFIC CONTROL

2.2.1 Haul Roads

Construct access and haul roads necessary for proper prosecution of the work under this Contract in accordance with EM 385-1-1. Construct with suitable grades and widths; avoid sharp curves, blind corners, and dangerous cross traffic. Submit haul road plan for approval. Provide necessary lighting, signs, barricades, and distinctive markings for the safe movement of traffic. The method of dust control, although optional, must be adequate to ensure safe operation at all times. Location, grade, width, and alignment of construction and haul roads are subject to approval by the Contracting Officer. Lighting must be adequate to assure full and clear visibility for full width of haul road and work areas during any night work operations.

2.2.2 Barricades

Erect and maintain temporary barricades to limit public access to hazardous areas. Barricades are required whenever safe public access to paved areas such as roads, parking areas or sidewalks is prevented by construction activities or as otherwise necessary to ensure the safety of both pedestrian and vehicular traffic. Securely place barricades clearly visible with adequate illumination to provide sufficient visual warning of the hazard during both day and night.

2.3 FENCING

Provide fencing along the construction site and at all open excavations and tunnels to control access by unauthorized personnel. Safety fencing must be highly visible to be seen by pedestrians and vehicular traffic. All fencing must meet the requirements of EM 385-1-1. Remove the fence upon completion and acceptance of the work.

2.3.1 Post-Driven Chain Link Fencing

Temporary post-driven fencing must be galvanized chain link fencing 6 feet high supported by an tightly secured to galvanized steel posts driven below grade. Fence posts must be located on minimum 10 foot centers. Posts may be set in various surfaces such as sand, soil, asphalt or concrete as necessary. Chain link fencing must remain rigid and taut with a minimum of 200 pounds of force exerted on it from any direction with less than 4 inches of deflection. Completely remove fencing and posts at the completion of construction and restore surfaces disturbed or damaged to its original condition. Locate and identify underground utilities prior to setting fence posts. Equip fence with a lockable gate. Gate must remain locked when construction personnel are not present.

2.4 TEMPORARY WIRING

Provide temporary wiring in accordance with EM 385-1-1, NFPA 241 and NFPA 70. Include monthly inspection and testing of all equipment and apparatus.

2.5 BACKFLOW PREVENTERS

Certificate of Full Approval from FCCCHR List, University of Southern California, attesting that the design, size and make of each backflow preventer has satisfactorily passed the complete sequence of performance testing and evaluation for the respective level of approval. Certificate of Provisional Approval is not acceptable.

Reduced pressure principle type conforming to the applicable requirements AWWA C511. Provide backflow preventers complete with 150 pound flanged cast iron, brass mounted gate valve and strainer, 304 stainless steel or bronze, internal parts.

PART 3 EXECUTION

3.1 EMPLOYEE PARKING

Construction Contract employees must park privately owned vehicles in an area designated by the Contracting Officer. Employee parking must not interfere with existing and established parking requirements of the Government installation.

3.1.1 Parking On The Grass

Parking on the grass is not permitted. The Contractor will not be allowed to drive on grass with his vehicles to gain access to the work sites, unless the grass area is within the construction limits. The Contractor and their personnel must park their vehicles within the construction limits or if additional parking is necessary, in areas assigned or designated by the Contracting Officer. Note that due to the restrictions or limited space, assigned or designated parking area(s) may be remote to the site.

3.2 TEMPORARY BULLETIN BOARD

Locate the bulletin board at the project site in a conspicuous place easily accessible to all employees, as approved by the Contracting Officer.

3.3 AVAILABILITY AND USE OF UTILITY SERVICES

3.3.1 Temporary Utilities

Provide temporary utilities required for construction. Materials may be new or used, must be adequate for the required usage, not create unsafe conditions, and not violate applicable codes and standards.Prior to the contractor using any fire hydrant on base as source of water, the contractor shall obtain a BASE FIRE HYDRANT USE PERMIT.

a. The Government must make all reasonable amounts of utilities available to the Contractor without charge from existing outlets and supplies available to the Government on military installations. Otherwise the contractor must make arrangements with local utility companies for connection, metering and payment for utilities at its expense. The

Contractor must carefully conserve any utilities furnished without charge. If the use of utilities is abused the Contractor will be required to meter and pay for utilities.

b. The Contractor, at its expense and in a workmanlike manner satisfactory to the Contracting Officer, must install and maintain all necessary temporary connections and distribution lines, and all meters where required. The Contractor must furnish to the Contracting Officer Representative a complete system layout drawing showing type of materials to be used and method of installation for all temporary electrical systems. Telephone service is the responsibility of the Contractor. The Contractor must maintain all temporary lines in a workmanlike manner satisfactory to the Contracting Officer Representative. Before final acceptance of the work by the Government, the Contractor must remove all temporary connections, distribution lines, meters and associated paraphernalia. (FAR 52.236-14).

c. Utility Service Interruptions. The Contractor must submit written notification not less than 15 calendar days in advance of each interruption of each utility and communication service to or within existing buildings and facilities being used by others. No single outage will exceed 4 hours unless approved in writing. The time and duration of all outages will be coordinated with the Using Agency by the Contracting Officer Representative. All outages or interruptions must be scheduled during weekends, unless specifically approved by the Contracting Officers Representative.

3.3.2 Sanitation

Provide and maintain within the construction area minimum field-type sanitary facilities in accordance with EM 385-1-1. Locate the facilities behind the construction fence or out of the public view. Clean units and empty wastes at least once a week or more frequently into a municipal, district, or station sanitary sewage system, or remove waste to a commercial facility. Obtain approval from the system owner prior to discharge into a municipal, district, or commercial sanitary sewer system. Penalties or fines associated with improper discharge will be the responsibility of the Contractor. Coordinate with the Contracting Officer and follow station regulations and procedures when discharging into the station sanitary sewer system. Maintain these conveniences at all times. Include provisions for pest control and elimination of odors. Government toilet facilities will not be available to Contractor's personnel.Contractor is not allowed to use any McGuire JB MDL sanitary facilities (lavatories, rest rooms, sanitary sewers, etc.). Contractor to supply at his expense chemical toilets, washrooms, etc. as required.

3.3.3 Telephone

Make arrangements and pay all costs for telephone facilities desired.

3.3.4 Fire Protection

Provide temporary fire protection equipment for the protection of personnel and property during construction. Remove debris and flammable materials daily to minimize potential hazards.

3.4 TRAFFIC PROVISIONS

3.4.1 Maintenance of Traffic

a. Conduct operations in a manner that will not close a thoroughfare or interfere with traffic on railways or highways except with written permission of the Contracting Officer at least 15 calendar days prior to the proposed modification date, and provide a Traffic Control Plan for Government approval detailing the proposed controls to traffic movement for approval. The plan must be in accordance with State and local regulations and the MUTCD, Part VI. Make all notifications and obtain all permits required for modification to traffic movements outside Station's jurisdiction.. Contractor may move oversized and slow-moving vehicles to the worksite provided requirements of the highway authority have been met.

b. Conduct work so as to minimize obstruction of traffic, and maintain traffic on at least half of the roadway width at all times. Obtain approval from the Contracting Officer prior to starting any activity that will obstruct traffic.

c. Provide, erect, and maintain, at Contractor's expense, lights, barriers, signals, passageways, detours, and other items, that may be required by the Life Safety Signage, overhead protection authority having jurisdiction.

d. Provide cones, signs, barricades, lights, or other traffic control devices and personnel required to control traffic. Do not use foil-backed material for temporary pavement marking because of its potential to conduct electricity during accidents involving downed power lines.

3.4.2 Protection of Traffic

Maintain and protect traffic on all affected roads during the construction period except as otherwise specifically directed by the Contracting Officer. Measures for the protection and diversion of traffic, including the provision of watchmen and flagmen, erection of barricades, placing of lights around and in front of equipment the work, and the erection and maintenance of adequate warning, danger, and direction signs, will be as required by the State and local authorities having jurisdiction. Provide self-illuminated (lighted) barricades during hours of darkness. Brightly-colored (orange) vests are required for all personnel working in roadways. Protect the traveling public from damage to person and property. Minimize the interference with public traffic on roads selected for hauling material to and from the site. Investigate the adequacy of existing roads and their allowable load limit. Contractor is responsible for the repair of damage to roads caused by construction operations.

3.4.3 Rush Hour Restrictions

Do not interfere with the peak traffic flows preceding and during normal operations for Fort Hamiltonwithout notification to and approval by the Contracting Officer.

3.4.4 Dust Control

Dust control methods and procedures must be approved by the Contracting Officer. Coordinate dust control methods with 01 57 19 TEMPORARY

ENVIRONMENTAL CONTROLS.

3.5 REDUCED PRESSURE BACKFLOW PREVENTERS

Provide an approved reduced pressure backflow prevention assembly at each location where the Contractor taps into the Government potable water supply.

Perform backflow preventer tests using test equipment, procedures, and certification forms conforming to those outlined in the latest edition of the Manual of Cross-Connection Control published by the FCCCHR Manual. Test and tag each reduced pressure backflow preventer upon initial installation (prior to continued water use) and quarterly thereafter. Tag must contain the following information: make, model, serial number, dates of tests, results, maintenance performed, and signature of tester. Record test results on certification forms conforming to requirements cited earlier in this paragraph.

3.6 CONTRACTOR'S TEMPORARY FACILITIES

Contractor-owned or -leased trailers must be identified by Government assigned numbers. Size and location of the number will comply with Fort Hamilton Regulation. Apply the number to the trailer within 14 calendar days of notification, or sooner, if directed by the Government. Temporary facilities must meet requirements as identified in EM 385-1-1.

Contractor is responsible for security of their property. Provide adequate outside security lighting at the temporary facilities. Trailers must be anchored to resist high winds and meet applicable state or local standards for anchoring mobile trailers. Coordinate anchoring with EM 385-1-1. The Contract Clause entitled "FAR 52.236-10, Operations and Storage Areas" and the following apply:

3.6.1 Administrative Field Offices

Provide and maintain administrative field office facilities within the construction area at the designated site. Government office and warehouse facilities will not be available to the Contractor's personnel.

3.6.2 Storage Area

Construct a temporary 6 foot high chain link fence around trailers and materials. Include plastic strip inserts, colored green, so that visibility through the fence is obstructed. Fence posts may be driven, in lieu of concrete bases, where soil conditions permit. Do not place or store trailers, materials, or equipment outside the fenced area unless such trailers, materials, or equipment are assigned a separate and distinct storage area by the Contracting Officer away from the vicinity of the construction site but within the installation boundaries. Trailers, equipment, or materials must not be open to public view with the exception of those items which are in support of ongoing work on the current day. Do not stockpile materials outside the fence in preparation for the next day's work. Park mobile equipment, such as tractors, wheeled lifting equipment, cranes, trucks, and like equipment within the fenced area at the end of each work day.

Keep fencing in a state of good repair and proper alignment. If the Contractor elects to traverse grassed or unpaved areas which are not

established roadways with construction equipment or other vehicles, cover the grassed or unpaved areas with a layer of gravel as necessary to prevent rutting and the tracking of mud onto paved or established roadways; gravel gradation must be at the Contractor's discretion.. Mow and maintain grass located within the boundaries of the construction site for the duration of the project. Grass and vegetation along fences, structures, under trailers, and in areas not accessible to mowers must be edged or trimmed neatly.

3.6.3 Stored Material Elevation

All materials, trailers, and storage sheds in staging and construction areas must be elevated and stored a minimum of 3 feet from any structure or fixed object. Trailers must have doors on both ends.

3.6.4 Long Term Storage

Construction equipment may not be stored at work sites long term. If equipment is not used for a period of 21 calendar days, the equipment must be removed from site. The Contracting Officer Representative must approve exceptions to this condition, such as equipment required at a later date.

3.6.5 Supplemental Storage Area

Upon request, and pending availability, the Contracting Officer will designate another or supplemental area for the use and storage of trailers, equipment, and materials. This area may not be in close proximity of the construction site but will be within the installation boundaries. Maintain the area in a clean and orderly fashion and secured if needed to protect supplies and equipment. Utilities will not be provided to this area by the Government.

3.6.6 Color

The color of dumpsters, trailers, and storage sheds and portable latrines must be approved by the Contracting Officer.

3.6.7 Appearance of Trailers

a. Trailers must be roadworthy and comply with all appropriate state and local vehicle requirements. Trailers which are rusted, have peeling paint or are otherwise in need of repair will not be allowed on Installation property. Trailers must present a clean and neat exterior appearance and be in a state of good repair.

b. Maintain the temporary facilities. Failure to do so will be sufficient reason to require their removal at the Contractor's expense.

3.6.8 Safety Systems

Protect the integrity of all installed safety systems or personnel safety devices. Obtain prior approval from the Contracting Officer if entrance into systems serving safety devices is required. If it is temporarily necessary to remove or disable personnel safety devices in order to accomplish Contract requirements, provide alternative means of protection prior to removing or disabling any permanently installed safety devices or equipment and obtain approval from the Contracting Officer.

3.6.9 Weather Protection of Temporary Facilities and Stored Materials

Take necessary precautions to ensure that roof openings and other critical openings in the building are monitored carefully. Take immediate actions required to seal off such openings when rain or other detrimental weather is imminent, and at the end of each workday. Ensure that the openings are completely sealed off to protect materials and equipment in the building from damage.

3.6.9.1 Building and Site Storm Protection

When a warning of gale force winds is issued, take precautions to minimize danger to persons, and protect the work and nearby Government property. Precautions must include, but are not limited to, closing openings; removing loose materials, tools and equipment from exposed locations; and removing or securing scaffolding and other temporary work. Close openings in the work when storms of lesser intensity pose a threat to the work or any nearby Government property.

3.7 GOVERNMENT FIELD OFFICE

3.7.1 Resident Engineer's Office

The Contractor is not required to provide a field office for Government employees.

3.8 PLANT COMMUNICATIONS

Whenever the individual elements of the plant are located so that operation by normal voice between these elements is not satisfactory, install a satisfactory means of communication, such as telephone or other suitable devices and make available for use by Government personnel.

3.9 TEMPORARY PROJECT SAFETY FENCING

As soon as practicable, but not later than 15 days after the date established for commencement of work, furnish and erect temporary project safety fencing at the work site. Maintain the safety fencing during the life of the Contract and, upon completion and acceptance of the work, remove from the work site.

3.10 CLEANUP

Remove construction debris, waste materials, packaging material and the like from the work site daily. Any dirt or mud which is tracked onto paved or surfaced roadways must be cleaned away. Store all salvageable materials resulting from demolition activities within the fenced area described above or at the supplemental storage area. Neatly stack stored materials not in trailers, whether new or salvaged.

3.11 RESTORATION OF STORAGE AREA

Upon completion of the project remove the bulletin board, signs, barricades, haul roads, and all other temporary products from the site. After removal of trailers, materials, and equipment from within the fenced area, remove the fence. Restore areas used during the performance of the Contract to the original or better condition. Remove gravel used to traverse grassed areas and restore the area to its original condition, including top soil and seeding as necessary.

-- End of Section --

SECTION 01 57 19

TEMPORARY ENVIRONMENTAL CONTROLS
08/22, CHG 2: 08/25

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.1053	Respirable Crystalline Silica
29 CFR 1910.1200	Hazard Communication
29 CFR 1926.1153	Respirable Crystalline Silica
40 CFR 50	National Primary and Secondary Ambient Air Quality Standards
40 CFR 60	Standards of Performance for New Stationary Sources
40 CFR 63	National Emission Standards for Hazardous Air Pollutants for Source Categories
40 CFR 64	Compliance Assurance Monitoring
40 CFR 82	Protection of Stratospheric Ozone
40 CFR 112	Oil Pollution Prevention
40 CFR 122.26	Storm Water Discharges (Applicable to State NPDES Programs, see section 123.25)
40 CFR 241	Guidelines for Disposal of Solid Waste
40 CFR 243	Guidelines for the Storage and Collection of Residential, Commercial, and Institutional Solid Waste
40 CFR 258	Subtitle D Landfill Requirements
40 CFR 260	Hazardous Waste Management System: General
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 261.7	Residues of Hazardous Waste in Empty Containers
40 CFR 262	Standards Applicable to Generators of Hazardous Waste

40 CFR 262.11	Hazardous Waste Determination and Recordkeeping
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 266	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 273	Standards for Universal Waste Management
40 CFR 273.2	Standards for Universal Waste Management - Batteries
40 CFR 273.3	Standards for Universal Waste Management - Pesticides
40 CFR 273.4	Standards for Universal Waste Management - Mercury Containing Equipment
40 CFR 273.5	Standards for Universal Waste Management - Lamps
40 CFR 273.6	Applicability - Aerosol Cans
40 CFR 279	Standards for the Management of Used Oil
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan
40 CFR 300.125	National Oil and Hazardous Substances Pollution Contingency Plan - Notification and Communications
40 CFR 355	Emergency Planning and Notification
40 CFR 372	Toxic Chemical Release Reporting
40 CFR 403	General Pretreatment Regulations for Existing and New Sources of Pollution
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements

49 CFR 172.101	Hazardous Material Regulation-Purpose and Use of Hazardous Material Table
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
49 CFR 178	Specifications for Packagings

1.2 DEFINITIONS

1.2.1 Class I and II Ozone Depleting Substance (ODS)

Class I ODS is defined in Section 602(a) of The Clean Air Act. A list of Class I ODS can be found on the EPA website at the following weblink. https://www.epa.gov/ozone-layer-protection/ozone-depleting-substances.

Class II ODS is defined in Section 602(s) of The Clean Air Act. A list of Class II ODS can be found on the EPA website at the following weblink. https://www.epa.gov/ozone-layer-protection/ozone-depleting-substances.

1.2.2 Contractor Generated Hazardous Waste

Contractor generated hazardous waste is materials that, if abandoned or disposed of, may meet the definition of a hazardous waste. These waste streams would typically consist of material brought on site by the Contractor to execute work, but are not fully consumed during the course of construction. Examples include, but are not limited to, excess paint thinners (i.e., methyl ethyl ketone, toluene), waste thinners, excess paints, excess solvents, waste solvents, excess pesticides, and contaminated pesticide equipment rinse water.

1.2.3 Electronics Waste

Electronics waste is discarded electronic devices intended for salvage, recycling, or disposal.

1.2.4 Environmental Pollution and Damage

Environmental pollution and damage is the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; affect other species of importance to humankind; or degrade the environment aesthetically, culturally or historically.

1.2.5 Environmental Protection

Environmental protection is the prevention/control of pollution and habitat disruption that may occur to the environment during construction. The control of environmental pollution and damage requires consideration of land, water, and air; biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive material as well as other pollutants.

1.2.6 Hazardous Debris

As defined in paragraph SOLID WASTE, debris that contains listed hazardous waste (either on the debris surface, or in its interstices, such as pore

structure) in accordance with 40 CFR 261. Hazardous debris also includes debris that exhibits a characteristic of hazardous waste in accordance with 40 CFR 261.

1.2.7 Hazardous Materials

Hazardous material is any material that: Is defined in 49 CFR 171, listed in 49 CFR 172, regulated as a hazardous material in accordance with 49 CFR 173; or requires a Safety Data Sheet (SDS) in accordance with 29 CFR 1910.1200; or during end use, treatment, handling, packaging, storage, transportation, or disposal meets or has components that meet or have potential to meet the definition of a hazardous waste as defined by 40 CFR 261 Subparts A, B, C, or D. Designation of a material by this definition, when separately regulated or controlled by other sections or directives, does not eliminate the need for adherence to that hazard-specific guidance which takes precedence over this section for "control" purposes. Such material includes ammunition, weapons, explosive actuated devices, propellants, pyrotechnics, chemical and biological warfare materials, medical and pharmaceutical supplies, medical waste and infectious materials, bulk fuels, radioactive materials, and other materials such as asbestos, mercury, and polychlorinated biphenyls (PCBs).

1.2.8 Hazardous Waste

Hazardous Waste is any material that meets the definition of a solid waste and exhibits a hazardous characteristic (ignitability, corrosivity, reactivity, or toxicity) as specified in 40 CFR 261, Subpart C, or contains a listed hazardous waste as identified in 40 CFR 261, Subpart D, or meets a state, local, or host nation definition of a hazardous waste.

1.2.9 Land Application

Land Application means spreading or spraying discharge water at a rate that allows the water to percolate into the soil. No sheeting action, soil erosion, discharge into storm sewers, discharge into defined drainage areas, or discharge into the "waters of the United States" must occur. Comply with federal, state, and local laws and regulations.

1.2.10 Municipal Separate Storm Sewer System (MS4) Permit

MS4 permits are those held by municipalities or installations to obtain NPDES permit coverage for their stormwater discharges.

1.2.11 National Pollutant Discharge Elimination System (NPDES)

The NPDES permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States.

1.2.12 Oily Waste

Oily waste are those materials that are, or were, mixed with Petroleum, Oils, and Lubricants (POLs) and have become separated from that POLs. Oily wastes also means materials, including wastewaters, centrifuge solids, filter residues or sludges, bottom sediments, tank bottoms, and sorbents which have come into contact with and have been contaminated by, POLs and may be appropriately tested and discarded in a manner which is in compliance with other state and local requirements.

This definition includes materials such as oily rags, "kitty litter"

sorbent clay and organic sorbent material. These materials may be land filled provided that: It is not prohibited in other state regulations or local ordinances; the amount generated is "de minimus" (a small amount); it is the result of minor leaks or spills resulting from normal process operations; and free-flowing oil has been removed to the practicable extent possible. Large quantities of this material, generated as a result of a major spill or in lieu of proper maintenance of the processing equipment, are a solid waste. As a solid waste, perform a hazardous waste determination prior to disposal. As this can be an expensive process, it is recommended that this type of waste be minimized through good housekeeping practices and employee education.

1.2.13 Regulated Waste

Regulated waste are solid wastes that have specific additional federal, state, or local controls for handling, storage, or disposal.

1.2.14 Sediment

Sediment is soil and other debris that have eroded and have been transported by runoff water or wind.

1.2.15 Solid Waste

Solid waste is a solid, liquid, semi-solid or contained gaseous waste. A solid waste can be a hazardous waste, non-hazardous waste, or non-Resource Conservation and Recovery Act (RCRA) regulated waste. Types of solid waste typically generated at construction sites may include:

1.2.15.1 Debris

Debris is non-hazardous solid material generated during the construction, demolition, or renovation of a structure that exceeds 2.5-inch particle size that is: a manufactured object; plant or animal matter; or natural geologic material (for example, cobbles and boulders), broken or removed concrete, masonry, and rock asphalt paving; ceramics; roofing paper and shingles. Inert materials may not be reinforced with or contain ferrous wire, rods, accessories and weldments. A mixture of debris and other material such as soil or sludge is also subject to regulation as debris if the mixture is comprised primarily of debris by volume, based on visual inspection.

1.2.15.2 Green Waste

Green waste is the vegetative matter from landscaping, land clearing and grubbing, including, but not limited to, grass, bushes, scrubs, small trees and saplings, tree stumps and plant roots. Marketable trees, grasses and plants that are indicated to remain, be re-located, or be re-used are not included.

1.2.15.3 Material Not Regulated As Solid Waste

Material not regulated as solid waste is nuclear source or byproduct materials regulated under the Federal Atomic Energy Act of 1954 as amended; suspended or dissolved materials in domestic sewage effluent or irrigation return flows, or other regulated point source discharges; regulated air emissions; and fluids or wastes associated with natural gas or crude oil exploration or production.

1.2.15.4 Non-Hazardous Waste

Non-hazardous waste is waste that is excluded from, or does not meet, hazardous waste criteria in accordance with 40 CFR 261.

1.2.15.5 Recyclables

Recyclables are materials, equipment and assemblies such as doors, windows, door and window frames, plumbing fixtures, glazing and mirrors that are recovered and sold as recyclable, wiring, insulated/non-insulated copper wire cable, wire rope, and structural components. It also includes commercial-grade refrigeration equipment with Freon removed, household appliances where the basic material content is metal, clean polyethylene terephthalate bottles, cooking oil, used fuel oil, textiles, high-grade paper products and corrugated cardboard, stackable pallets in good condition, clean crating material, and clean rubber/vehicle tires. Metal meeting the definition of "lead contaminated" or "lead based paint contaminated" may be included as recyclable only if the metal is handled and transported in accordance with regulations, and the facility receiving the material is permitted and authorized to accept and process lead contaminated materials. Paint cans that meet the definition of empty containers in accordance with 40 CFR 261.7 may be included as recyclable if sold to a scrap metal company.

1.2.15.6 Surplus Soil

Surplus soil is existing soil that is in excess of what is required for this work, including aggregates intended, but not used, for on-site mixing of concrete, mortars, and paving. Contaminated soil meeting the definition of hazardous material or hazardous waste is not included and must be managed in accordance with paragraph HAZARDOUS MATERIAL MANAGEMENT.

1.2.15.7 Scrap Metal

This includes scrap and excess ferrous and non-ferrous metals such as reinforcing steel, structural shapes, pipe, and wire that are recovered or collected and disposed of as scrap. Scrap metal meeting the definition of hazardous material or hazardous waste is not included.

1.2.15.8 Wood

Wood is dimension and non-dimension lumber, plywood, chipboard, hardboard. Treated or painted wood that meets the definition of lead contaminated or lead based contaminated paint is not included. Treated wood includes, but is not limited to, lumber, utility poles, crossties, and other wood products with chemical treatment.

1.2.16 Surface Discharge

Surface discharge means discharge of water into drainage ditches, storm sewers, or creeks meeting the definition of "waters of the United States". Surface discharges from construction sites are discrete, identifiable sources and require a permit from the governing agency. Comply with federal, state, and local laws and regulations.

1.2.17 Wastewater

Wastewater is the aqueous liquid waste generated by a project, to include both domestic wastewater (sewage) and industrial wastewater.

1.2.17.1 Stormwater

Stormwater is any precipitation in an urban or suburban area that does not evaporate or soak into the ground, but instead collects and flows into storm drains, rivers, and streams.

1.2.18 Waters of the United States

Waters of the United States means Federally jurisdictional waters, including wetlands, that are subject to regulation under Section 404 of the Clean Water Act or navigable waters, as defined under the Rivers and Harbors Act.

1.2.19 Wetlands

Wetlands are those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

1.2.20 Universal Waste

The universal waste regulations streamline collection requirements for certain hazardous wastes in the following categories: batteries, pesticides, mercury-containing equipment (for example, thermostats), and lamps (for example, fluorescent bulbs). The rule is designed to reduce hazardous waste in the municipal solid waste (MSW) stream by making it easier for universal waste handlers to collect these items and send them for recycling or proper disposal. These regulations can be found at 40 CFR 273.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Preconstruction Survey

Regulatory Notifications

Environmental Manager Qualifications

Employee Training Records

Environmental Protection Plan; G, RO

Dirt and Dust Control Plan

Solid Waste Management Permit

Stormwater Pollution Prevention Plan (SWPPP); G, RO

Stormwater Notice of Intent (for NPDES coverage under the general permit for construction activities)

Spill Prevention Control And Countermeasure (SPCC) Plan; G, RO

SD-06 Test Reports

Monthly Solid Waste Disposal Report; G, RO

Inspection Reports

SD-07 Certificates

Employee Training Records; G, RO

Erosion and Sediment Control Inspector Qualifications

SD-11 Closeout Submittals

Regulatory Notifications; G, RO

Assembled Employee Training Records; G, RO

Solid Waste Management Permit; G, RO

Stormwater Pollution Prevention Plan Compliance Notebook; G, RO

Stormwater Notice of Termination (for NPDES coverage under the general permit for construction activities); G, RO

As-Built Topographic Survey

Waste Determination Documentation; G, RO

Project Solid Waste Disposal Documentation Report; G, RO

Sales Documentation; G, RO

Hazardous Waste/Debris Management; G, RO

Disposal Documentation for Hazardous and Regulated Waste; G, RO

1.4 ENVIRONMENTAL PROTECTION REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined. Plan for and provide environmental protective measures to control pollution that develops during construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Protect the environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire duration of this Contract. Comply with federal, state, and local regulations pertaining to the environment, including water, air, solid waste, hazardous waste and substances, oily substances, and noise pollution.

Tests and procedures assessing whether construction operations comply with Applicable Environmental Laws may be required. Analytical work must be performed by qualified laboratories; and where required by law, the laboratories must be certified.

1.4.1 Conformance with the Environmental Management System

Perform work under this contract consistent with the policy and objectives identified in the installation's Environmental Management System (EMS). Perform work in a manner that conforms to objectives and targets of the environmental programs and operational controls identified by the EMS. Support Government personnel when environmental compliance and EMS audits are conducted by escorting auditors at the Project site, answering questions, and providing proof of records being maintained. Provide monitoring and measurement information as necessary to address environmental performance relative to environmental, energy, and transportation management goals. In the event an EMS nonconformance or environmental noncompliance associated with the contracted services, tasks, or actions occurs, take corrective and preventative actions. In addition, employees must be aware of their roles and responsibilities under the installation EMS and of how these EMS roles and responsibilities affect work performed under the contract.

Coordinate with the installation's EMS coordinator to identify training needs associated with environmental aspects and the EMS, and arrange training or take other action to meet these needs. Provide training documentation to the Contracting Officer. The Installation Environmental Office will retain associated environmental compliance records. Make EMS Awareness training completion certificates available to Government auditors during EMS audits and include the certificates in the Employee Training Records. See paragraph EMPLOYEE TRAINING RECORDS.

1.5 QUALITY ASSURANCE

1.5.1 Preconstruction Survey and Protection of Features

This paragraph supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS. Prior to start of any onsite construction activities, perform a Preconstruction Survey of the project site with the Contracting Officer, and take photographs showing existing environmental conditions in and adjacent to the site. Submit a report for the record. Include in the report a plan describing the features requiring protection under the provisions of the Contract Clauses, which are not specifically identified on the drawings as environmental features requiring protection along with the condition of trees, shrubs and grassed areas immediately adjacent to the site of work and adjacent to the Contractor's assigned storage area and access route(s), as applicable. The Contractor and the Contracting Officer will sign this survey report upon mutual agreement regarding its accuracy and completeness. Protect those environmental features included in the survey report and any indicated on the drawings, regardless of interference that their preservation may cause to the work under the Contract.

1.5.2 Regulatory Notifications

Provide regulatory notification requirements in accordance with federal, state and local regulations. In cases where the Government will also provide public notification (such as stormwater permitting), coordinate with the Contracting Officer. Submit copies of regulatory notifications

to the Contracting Officer at least 30 days prior to commencement of work activities. Typically, regulatory notifications must be provided for the following (this listing is not all-inclusive): demolition, renovation, NPDES defined site work, construction, removal or use of a permitted air emissions source, and remediation of controlled substances (asbestos, hazardous waste, lead paint).

1.5.3 Environmental Brief

Attend an environmental brief to be included in the preconstruction meeting. Provide the following information: types, quantities, and use of hazardous materials that will be brought onto the installation; and types and quantities of wastes/wastewater that may be generated during the Contract. Discuss the results of the Preconstruction Survey at this time.

Prior to initiating any work on site, meet with the Contracting Officer and installation Environmental Office to discuss the proposed Environmental Protection Plan (EPP) or equipment local requirement. Develop a mutual understanding relative to the details of environmental protection, including measures for protecting natural and cultural resources, required reports, required permits, permit requirements (such as mitigation measures), and other measures to be taken.

1.5.4 Environmental Manager

Appoint in writing an Environmental Manager for the project site. The Environmental Manager is directly responsible for coordinating contractor compliance with federal, state, local, and installation requirements. The Environmental Manager must ensure compliance with Hazardous Waste Program requirements (including hazardous waste handling, storage, manifesting, and disposal); implement the EPP; ensure environmental permits are obtained, maintained, and closed out; ensure compliance with Stormwater Program requirements; ensure compliance with Hazardous Materials (storage, handling, and reporting) requirements; and coordinate any remediation of regulated substances (lead, asbestos, PCB transformers). This can be a collateral position; however, the person in this position must be trained to adequately accomplish the following duties: ensure waste segregation and storage compatibility requirements are met; inspect and manage Satellite Accumulation areas; ensure only authorized personnel add wastes to containers; ensure Contractor personnel are trained in 40 CFR requirements in accordance with their position requirements; coordinate removal of waste containers; and maintain the Environmental Records binder and required documentation, including environmental permits compliance and close-out. Submit Environmental Manager Qualifications to the Contracting Officer.

1.5.5 Employee Training Records

Prepare and maintain Employee Training Records throughout the term of the contract meeting applicable 40 CFR requirements. Provide Employee Training Records in the Environmental Records Binder. Submit these Assembled Employee Training Records to the Contracting Officer at the conclusion of the project, unless otherwise directed.

Train personnel to meet EPA requirements. Conduct environmental protection/pollution control meetings for personnel prior to commencing construction activities. Conduct additional meetings for new personnel and when site conditions change. Include in the training and meeting agenda: methods of detecting and avoiding pollution; familiarization with

statutory and contractual pollution standards; installation and care of devices, vegetative covers, and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control; anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants; recognition and protection of archaeological sites, artifacts, waters of the United States, and endangered species and their habitat that are known to be in the area. Provide copy of the Erosion and Sediment Control Inspector Qualifications as defined by EPA.

1.5.6 Non-Compliance Notifications

The Contracting Officer will notify the Contractor in writing of any observed noncompliance with federal, state or local environmental laws or regulations, permits, and other elements of the Contractor's EPP. After receipt of such notice, inform the Contracting Officer of the proposed corrective action and take such action when approved by the Contracting Officer. The Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. FAR 52.242-14 Suspension of Work provides that a suspension, delay, or interruption of work due to the fault or negligence of the Contractor allows for no adjustments to the contract for time extensions or equitable adjustments. In addition to a suspension of work, the Contracting Officer may use additional authorities under the contract or law.

1.6 ENVIRONMENTAL PROTECTION PLAN

The purpose of the EPP is to present an overview of known or potential environmental issues that must be considered and addressed during construction. Incorporate construction related objectives and targets from the installation's EMS into the EPP. Include in the EPP measures for protecting natural and cultural resources, required reports, and other measures to be taken. Meet with the Contracting Officer or Contracting Officer Representative to discuss the EPP and develop a mutual understanding relative to the details for environmental protection including measures for protecting natural resources, required reports, and other measures to be taken. Submit the EPP within 30 days after notice to proceed and not less than 10 days before the preconstruction meeting. Revise the EPP throughout the project to include any reporting requirements, changes in site conditions, or contract modifications that change the project scope of work in a way that could have an environmental impact. No requirement in this section will relieve the Contractor of any applicable federal, state, and local environmental protection laws and regulations. During Construction, identify, implement, and submit for approval any additional requirements to be included in the EPP. Maintain the current version onsite.

The EPP includes, but is not limited to, the following elements:

1.6.1 General Overview and Purpose

1.6.1.1 Descriptions

A brief description of each specific plan required by environmental permit or elsewhere in this Contract such as stormwater pollution prevention plan, spill control plan, solid waste management plan, wastewater management plan, air pollution control plan, contaminant prevention plan, a historical, archaeological, cultural resources, biological resources and wetlands plan, traffic control plan Hazardous, Toxic and Radioactive Waste

(HTRW) Plan Non-Hazardous Solid Waste Disposal Plan borrowing material plan.

1.6.1.2 Duties

The duties and level of authority assigned to the person(s) on the job site who oversee environmental compliance, such as who is responsible for adherence to the EPP, who is responsible for spill cleanup and training personnel on spill response procedures, who is responsible for manifesting hazardous waste to be removed from the site (if applicable), and who is responsible for training the Contractor's environmental protection personnel.

1.6.1.3 Procedures

A copy of any standard or project-specific operating procedures that will be used to effectively manage and protect the environment on the project site.

1.6.1.4 Communications

Communication and training procedures that will be used to convey environmental management requirements to Contractor employees and subcontractors.

1.6.1.5 Contact Information

Emergency contact information contact information (office phone number, cell phone number, and e-mail address).

1.6.2 General Site Information

1.6.2.1 Drawings

Drawings showing locations of proposed temporary excavations or embankments for haul roads, stream crossings, jurisdictional wetlands, material storage areas, structures, sanitary facilities, storm drains and conveyances, and stockpiles of excess soil.

1.6.2.2 Work Area

Work area plan showing the proposed activity in each portion of the area and identify the areas of limited use or nonuse. Include measures for marking the limits of use areas, including methods for protection of features to be preserved within authorized work areas and methods to control runoff and to contain materials on site, and a traffic control plan.

Show where any fuels, hazardous substances, solvents, or lubricants will be stored. Provide a spill plan to address any releases of those materials.

1.6.2.3 Documentation

A letter signed by an officer of the firm appointing the Environmental Manager and stating that person is responsible for managing and implementing the Environmental Program as described in this contract. Include in this letter the Environmental Manager's authority to direct the removal and replacement of non-conforming work.

1.6.3 Management of Natural Resources

a. Land resources

b. Tree protection

c. Replacement of damaged landscape features

d. Temporary construction

e. Stream crossings

f. Fish and wildlife resources

g. Wetland areas

1.6.4 Protection of Historical and Archaeological Resources

a. Objectives

b. Methods

1.6.5 Stormwater Management and Control

a. Ground cover

b. Erodible soils

c. Temporary measures

(1) Structural Practices

(2) Temporary and permanent stabilization

d. Effective selection, implementation and maintenance of Best Management Practices (BMPs).

e. Stormwater Pollution Prevention Plan (SWPPP).

1.6.6 Protection of the Environment from Waste Derived from Contractor Operations

This item consists of the management procedures for hazardous waste to be generated. The elements of those procedures will coincide with the Installation Hazardous Waste Management Plan when within an installation. The Contracting Officer will provide a copy of the Installation Hazardous Waste Management Plan as applicable.

As a minimum, include the following:

a. List of the types of hazardous wastes expected to be generated

b. Procedures to ensure a written waste determination is made for appropriate wastes that are to be generated

c. Sampling/analysis plan, including laboratory method(s) that will be used for waste determinations and copies of relevant laboratory certifications

d. Methods and proposed locations for hazardous waste accumulation/storage (that is, in tanks or containers)

e. Management procedures for storage, labeling, transportation, and disposal of waste (treatment of waste is not allowed unless specifically noted)

f. Management procedures and regulatory documentation ensuring disposal of hazardous waste complies with Land Disposal Restrictions (40 CFR 268)

g. Management procedures for recyclable hazardous materials such as lead-acid batteries, used oil, and similar

h. Used oil management procedures in accordance with 40 CFR 279; Hazardous waste minimization procedures

i. Plans for the disposal of hazardous waste by permitted facilities; and Procedures to be employed to ensure required employee training records are maintained.

1.6.7 Prevention of Releases to the Environment

Procedures to prevent releases to the environment

Notifications in the event of a release to the environment

1.6.8 Regulatory Notification and Permits

List what notifications and permit applications must be made. Some permits require up to 180 days to obtain. Demonstrate that those permits have been obtained or applied for by including copies of applicable environmental permits. The EPP will not be approved until the permits have been obtained.

1.6.9 Environmental Compliance

Renee Piatt, Compliance Chief, 787 CES/CEIEC, (609) 754-6166 and Kristen Jicha Environmental Chief, 787 CES/CEIE, (609) 754-6171.

a. The contractor is required to comply with all applicable State and Federal laws, State and Federal regulations, and Air Force instructions in effect at the time of performance of this contract. The laws and regulations include but are not limited to: environmental and occupational safety and health.

b. The contractor is responsible for compliance with construction and operating permits, and also responsible for penalties, fines, or natural resource damage claims that may be required or assessed by the State of New Jersey, Federal or Local Governments resulting from contractor performance, or failure to perform, during the course of this contract. The Government will inspect for environmental compliance at their discretion, and will notify the Contracting Officer (CO) of any discrepancies found. In addition, the contractor may be subject to contractual sanctions including, but not limited to withholding, offset, termination, suspension, and debarment and adverse past performance assessment. Contact numbers (609) 754 6166 or (609) 754 6171.

1.6.10 Clean Air Act Compliance

JB MDL is responsible for obtaining and renewing all air permits for all stationary and mobile sources (e.g. Government vehicles) within the JB MDL boundaries that are owned by the Government. JB MDL is considered a major source facility and holds three Title V permits with some entities containing their own General permits. The contractor shall provide written notification to the CO and Environmental (787 CES/CEIE) Air Quality Program no later than sixty (60) days prior to bringing any of their sources on to JB MDL. It is the contractor's responsibility to obtain any required permits for all contractor-owned and installed sources per the Clean Air Act and in accordance with all applicable State, Federal, and Air Force regulations and instructions. The contractor is responsible for compliance with the Government's existing Title V and General permits and shall maintain all documentation and record keeping and perform all testing and monitoring requirements to support those permits in a format acceptable to and approved by the CO. All required documentation and records must be prepared and maintained by the contractor and readily available for on-site inspection by environmental regulators. All stationary and mobile sources that the contractor brings on JB MDL must go through a permit approval process conducted by the 787 CES/CEIE Air Quality Program. The permit approval process will help to ensure JB MDL maintains overall compliance. Some examples of sources and processes/operations that may require permits or monitoring/record-keeping documentation are as follows: heating/cooling (boilers, furnaces, heaters, heat pumps, chillers, air conditioners, etc.), storage/fuel tanks, generators/fire pumps, fueling operations, painting/coating operations, parts washers/dip tanks/degreasers, woodworking/sanding, laser-cutting/welding, and materials containing Safety Data Sheets. Only sources approved by the 787 CES/CEIE Air Quality Program will be authorized on JB MDL.

POC: Gira Patel (609) 754-1806 and Renee Piatt (609) 754-6166.

1.6.10.1 Haul Route

Submit truck and material haul routes along with a Dirt and Dust Control Plan for controlling dirt, debris, and dust on Installation roadways. As a minimum, identify in the plan the subcontractor and equipment for cleaning along the haul route and measures to reduce dirt, dust, and debris from roadways.

1.6.10.2 Pollution Generating Equipment

Identify air pollution generating equipment or processes that may require federal, state, or local permits under the Clean Air Act. Determine requirements based on any current installation permits and the impacts of the project. Provide a list of all fixed or mobile equipment, machinery or operations that could generate air emissions during the project to the Installation Environmental Office (Air Program Manager). Ensure required permits are obtained prior to installing and operating applicable equipment/processes.

1.6.10.3 Stationary Internal Combustion Engines

Identify portable and stationary internal combustion engines that will be supplied, used or serviced. Comply with 40 CFR 60 Subpart IIII, 40 CFR 60 Subpart JJJJ, 40 CFR 63 Subpart ZZZZ, and local regulations as

applicable. At minimum, include the make, model, serial number, manufacture date, size (engine brake horsepower), and EPA emission certification status of each engine. Maintain applicable records and log hours of operation and fuel use. Logs must include reasons for operation and delineate between maintenance/testing, emergency, and non-emergency operation.

1.6.10.4 Refrigerants

Identify management practices to ensure that heating, ventilation, and air conditioning (HVAC) work involving refrigerants complies with 40 CFR 82 requirements. Technicians must be certified, maintain copies of certification on site, use certified equipment and log work that requires the addition or removal of refrigerant. Any refrigerant reclaimed is the property of the Government, coordinate with the Installation Environmental Office to determine the appropriate turn in location.

1.6.10.5 Air Pollution-engineering Processes

Identify planned air pollution-generating processes and management control measures (including, but not limited to, spray painting, abrasive blasting, demolition, material handling, fugitive dust, and fugitive emissions). Log hours of operations and track quantities of materials used.

1.6.10.6 Compliant Materials

Provide the Government a list of SDSs for all hazardous materials proposed for use on site. Materials must be compliant with all Clean Air Act regulations for emissions including solvent and volatile organic compound contents, and applicable National Emission Standards for Hazardous Air Pollutants requirements. The Government may alter or limit use of specific materials as needed to meet installation permit requirements for emissions.

1.7 LICENSES AND PERMITS

Obtain licenses and permits required for the construction of the project and in accordance with FAR 52.236-7 Permits and Responsibilities. Notify the Government of all equipment that may require permits or special approvals that the Contractor plans to use on site. This paragraph supplements the Contractor's responsibility under FAR 52.236-7 Permits and Responsibilities.

1.7.1 Fire And Flood Hazard Permits

The contractor must obtain all required permits and provide copies of all approved permits to 787 CES/CEIE within seven (7) days of receipt and prior to the start of work. The contractor shall adhere to existing government permits and plans.

POC:Mike Luna (609) 754-1847 and Zach Batren (609) 754-1844.

1.8 ENVIRONMENTAL RECORDS BINDER

Maintain on-site a separate three-ring Environmental Records Binder and submit at the completion of the project. Make separate parts within the

binder that correspond to each submittal listed under paragraph CLOSEOUT SUBMITTALS in this section.

1.9 SOLID WASTE MANAGEMENT PERMIT

Provide the Contracting Officer with written notification of the quantity of anticipated solid waste or debris that is anticipated or estimated to be generated by construction. Include in the report the locations where various types of waste will be disposed or recycled. Include letters of acceptance from the receiving location or as applicable; submit one copy of the receiving location state and local Solid Waste Management Permit or license showing such agency's approval of the disposal plan before transporting wastes off Government property.

1.9.1 Monthly Solid Waste Disposal Report

Monthly, submit a solid waste disposal report to the Contracting Officer. For each waste, the report will state the classification (using the definitions provided in this section), amount, location, and name of the business receiving the solid waste.

1.10 FACILITY HAZARDOUS WASTE GENERATOR STATUS

Joint Base McGuire Dix Lakehurst (JB MDL is designated as a Large Quantity Generator. Meet the regulatory requirements of this generator designation for any work conducted within the boundaries of this Installation. Comply with provisions of federal, state, and local regulatory requirements applicable to this generator status regarding training and storage, handling, and disposal of construction derived wastes.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 PROTECTION OF NATURAL RESOURCES

Minimize interference with, disturbance to, and damage to fish, wildlife, and plants, including their habitats. Prior to the commencement of activities, consult with the Installation Environmental Office as applicable, regarding rare species or sensitive habitats that need to be protected. The protection of rare, threatened, and endangered animal and plant species identified, including their habitats, is the Contractor's responsibility.

Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work that is consistent with the requirements of the Installation Environmental Office or as otherwise specified. Confine construction activities to within the limits of the work indicated or specified.

3.1.1 Flow Ways

Do not alter water flows or otherwise significantly disturb the native habitat adjacent to the project and critical to the survival of fish and wildlife, except as specified and permitted.

3.1.2 LAND USE (LAND RESOURCE PROTECTION), WATERWAYS, AND WETLANDS PERMITS

The contractor shall obtain all required land use (land resource protection) permits and provide copies of all approved permits to 787 CES/CEIE within seven (7) days of receipt and prior to the start of work. Development near or on navigable waterways and designated wetlands requires a permit. Contact 787 CES/CEIE ENV office prior to applying for the wetlands permit for specific information to aid in obtaining a wetland permit from the state of New Jersey. Activities that occur within 150 feet of a wetland may require a permit. The contractor shall obtain all required permits and provide copies of all approved permits to 787 CES/CEIE within seven (7) days of receipt and prior to the start of work. The contractor shall adhere to existing government permits and plans.

POC: Mike Luna (609) 754-1847, Catherine Brunson (609) 754-1729 and Zach Batren (609) 754-1844.

3.1.3 Vegetation

Except in areas to be cleared, do not remove, cut, deface, injure, or destroy trees or shrubs without the Contracting Officer's permission. Do not fasten or attach ropes, cables, or guys to existing nearby trees for anchorages unless authorized by the Contracting Officer. Where such use of attached ropes, cables, or guys is authorized, the Contractor is responsible for any resultant damage.

Protect existing trees and critical root zones (CRZ) that are to remain to ensure they are not injured, bruised, defaced, or otherwise damaged by construction operations. Remove displaced rocks from uncleared areas. Coordinate with the Contracting Officer and Installation Environmental Office to determine appropriate action for trees and other landscape features scarred or damaged by equipment operations.

3.1.4 PLANT VEGETATION, FORESTRY, AND FISH & WILDLIFE

The contractor shall obtain all required permits and provide copies of all approved permits to 787 CES/CEIE within seven (7) days of receipt and prior to the start of work. The contractor shall adhere to existing government permits and plans. The Contractor shall not disturb any plants, trees, fish, or wildlife without 787 CES/CEIE approval.

POC: Mike Luna (609) 754-1847 and Zach Batren (609) 754-1844.

3.2 DRINKING WATER, WASTE WATER, WELL, AND PHYSICAL CONNECTIONS PERMITS

The contractor shall obtain all required permits and provide copies of all approved permits to 787 CES/CEIE within seven (7) days of receipt and prior to the start of work. The contractor shall adhere to existing government permits and plans.

POC: Neil Thornton (609) 754-1809.

3.3 STORMWATER

Do not discharge stormwater from construction sites to the sanitary sewer. If the water is noted or suspected of being contaminated, it may only be released to the storm drain system if the discharge is specifically permitted. Obtain authorization in advance from the Installation Environmental Office for any release of contaminated water.

3.3.1 Construction General Permit

Provide a Construction General Permit as required by 40 CFR 122.26 and the State of New Jersey General Permit. Under the terms and conditions of the permit, install, inspect, maintain BMPs, prepare stormwater erosion and sediment control inspection reports, and submit SWPPP inspection reports. Maintain construction operations and management in compliance with the terms and conditions of the general permit for stormwater discharges from construction activities.

3.3.1.1 STORMWATER AND DISCHARGE PERMITS

It is not permissible to discharge any materials to the navigable waters of the United States without a permit. Accordingly, discharges to or in areas that may reasonably reach or impact wetland areas and all other watercourses, including ditches, is prohibited without a permit. All discharges to storm drains, including but not limited to, soils and sediments contained in water runoff or dewatering operations, are prohibited. An appropriate soil erosion control plan shall be developed and utilized by the contractor for construction projects to ensure that discharges do not occur. See appropriate engineering drawings of this contract for more specific soil erosion and sediment control requirements. Contractor shall comply with JB MDL area specific Storm Water Pollution Prevention Plan, a copy of which is available in 787 CES/CEIE (Building 2404). The contractor shall obtain all required permits and provide copies of all approved permits to 787 CES/CEIE within seven (7) days of receipt and prior to the start of work. The contractor shall adhere to existing government permits and plans.

POC:Matthew Ewald (609) 754-1773 and Michael Luna (609) 754-1847.

3.3.1.2 Stormwater Pollution Prevention Plan

Submit a project-specific Stormwater Pollution Prevention Plan (SWPPP) to the Contracting Officer for approval, prior to the commencement of work. The SWPPP must meet the requirements of 40 CFR 122.26 and the New Jersey State General Permit for stormwater discharges from construction sites.

Include the following:

a. Comply with terms of the NJ State general permit for stormwater discharges from construction activities. Prepare SWPPP in accordance with the State requirements. Use State and the EPA guide Developing your Stormwater Pollution Prevention Plan located at https://www.epa.gov/npdes/developing-stormwater-pollution-prevention-plan-swppp to prepare the SWPPP.

b. Select applicable BMPs from EPA Fact Sheets located at https://www.epa.gov/npdes/national-menu-best-management-practices-bmps-stormwater#constr or in accordance with applicable state or local requirements.

c. Include a completed copy of the Notice of Intent, BMP Inspection Report Template, and Stormwater Notice of Termination, except for the effective date.

3.3.1.3 Stormwater Notice of Intent for Construction Activities

Prepare and submit a Notice of Intent as a co-permittee to the Contracting Officer, for review and approval.

Submit the approved NOI and appropriate permit fees onto the appropriate federal or state agency for approval. No land disturbing activities may commence without permit coverage. Maintain an approved copy of the SWPPP at the onsite construction office, and continually update as regulations require, reflecting current site conditions.

3.3.1.4 Inspection Reports

Submit "Inspection Reports" to the Contracting Officer in accordance with EPA and the State of New Jersey Construction General Permit.

3.3.1.5 Stormwater Pollution Prevention Plan Compliance Notebook

Create and maintain a three ring binder of documents that demonstrate compliance with the Construction General Permit. Include a copy of the permit Notice of Intent, proof of permit fee payment, SWPPP and SWPPP update amendments, inspection reports and related corrective action records, copies of correspondence with the EPA and the State of New Jersey Permitting Agency, and a copy of the permit Notice of Termination in the binder. At project completion, the notebook becomes property of the Government. Provide the compliance notebook to the Contracting Officer.

3.3.1.6 Stormwater Notice of Termination for Construction Activities

Submit a Notice of Termination to the Contracting Officer for approval once construction is complete and final stabilization has been achieved on all portions of the site for which the permittee is responsible. Once approved, submit the Notice of Termination to the appropriate state or federal agency. Prepare as-built topographic survey information required by the permitting agency for certification of the stormwater management system, and provide to the Contracting Officer.

3.3.2 Erosion and Sediment Control Measures

Provide erosion and sediment control measures in accordance with state and local laws and regulations. Preserve vegetation to the maximum extent practicable. Temporary protection shall be provided on side and back slopes when rough grading is complete, or when sufficient soil is exposed, to require protection to prevent erosion. Protection shall be afforded by accelerated growth of permanent vegetation, temporary vegetation, mulching, or netting. Slopes too steep for stabilization by other means shall be stabilized by hydro-seeding, mulch anchored in place, covering with anchored netting, sodding or such combination of these and other methods as may be necessary for effective erosion control and to prevent a point source discharge.

Erosion control inspection reports may be compiled as part of a stormwater pollution prevention plan inspection reports.

3.3.2.1 Protection of Erodible Soils

Earthwork shall be planned and conducted in such a manner as to minimize the duration of exposure of unprotected soils. Earthwork brought to final grade shall be immediately finished as indicated and specified. The rate

of runoff from any construction site shall be mechanically retarded and controlled. Use of hay bale filtration, diversion ditches or other sound engineering device shall be used to retard and divert runoff from entering US waters.

3.3.2.2 Erosion Control

Provide seeding in accordance with Section 32 92 19 SEEDING.

3.3.2.3 Sediment Control Practices

Implement sediment control practices to divert flows from exposed soils, temporarily store flows, or otherwise limit runoff and the discharge of pollutants from exposed areas of the site. Implement sediment control practices prior to soil disturbance and prior to creating areas with concentrated flow, during the construction process to minimize erosion and sediment laden runoff.

3.3.3 Work Area Limits

Mark the areas that need not be disturbed under this Contract prior to commencing construction activities. Mark or fence isolated areas within the general work area that are not to be disturbed. Protect monuments and markers before construction operations commence. Where construction operations are to be conducted during darkness, all markers must be visible in the dark. Personnel must be knowledgeable of the purpose for marking and protecting particular objects.

3.3.4 Contractor Facilities and Work Areas

Place field offices, staging areas, stockpile storage, and temporary buildings in areas designated on the drawings or as directed by the Contracting Officer. Move or relocate the Contractor facilities only when approved by the Government. Provide erosion and sediment controls for onsite borrow and spoil areas to prevent sediment from entering nearby waters. Control temporary excavation and embankments for plant or work areas to protect adjacent areas.

3.3.5 Municipal Separate Storm Sewer System (MS4) Management

Comply with the Installation's MS4 permit requirements.

3.4 SURFACE AND GROUNDWATER

3.4.1 Cofferdams, Diversions, and Dewatering

Construction operations for dewatering, removal of cofferdams, tailrace excavation, and tunnel closure must be constantly controlled to maintain compliance with existing state water quality standards and designated uses of the surface water body. Comply with the State of New Jersey water quality standards and anti-degradation provisions and the Clean Water Act Section 404, Nation Wide Permit. Do not discharge excavation ground water to the sanitary sewer, storm drains, or to surface waters without prior specific authorization in writing from the Installation Environmental Office or Contracting Officer. Discharge of hazardous substances will not be permitted under any circumstances. Use sediment control BMPs to prevent construction site runoff from directly entering any storm drain or surface waters.

If the construction dewatering is noted or suspected of being contaminated, it may only be released to the storm drain system if the discharge is specifically permitted. Obtain authorization for any contaminated groundwater release in advance from the Installation Environmental Officer and the federal or state authority, as applicable. Discharge of hazardous substances will not be permitted under any circumstances.

3.4.2 Waters of the United States

Do not enter, disturb, destroy, or allow discharge of contaminants into waters of the United States.

3.5 PROTECTION OF CULTURAL RESOURCES

3.5.1 Archaeological Resources

If, during excavation or other construction activities, any previously unidentified or unanticipated historical, archaeological, and cultural resources are discovered or found, activities that may damage or alter such resources will be suspended. Resources covered by this paragraph include, but are not limited to: any human skeletal remains or burials; artifacts; shell, midden, bone, charcoal, or other deposits; rock or coral alignments, pavings, wall, or other constructed features; and any indication of agricultural or other human activities. Upon such discovery or find, immediately notify the Contracting Officer so that the appropriate authorities may be notified and a determination made as to their significance and what, if any, special disposition of the finds should be made. Cease all activities that may result in impact to or the destruction of these resources. Secure the area and prevent employees or other persons from trespassing on, removing, or otherwise disturbing such resources. The Government retains ownership and control over archaeological resources.

3.6 AIR RESOURCES

Equipment operation, activities, or processes will be in accordance with 40 CFR 64 and state air emission and performance laws and standards.

3.6.1 Preconstruction Air Permits

Notify the Air Program Manager, through the Contracting Officer, at least 6 months prior to bringing equipment, assembled or unassembled, onto the Installation, so that air permits can be secured. Necessary permitting time must be considered in regard to construction activities. Clean Air Act (CAA) permits must be obtained prior to bringing equipment, assembled or unassembled, onto the Installation.

Confirm that these permits have been obtained.

3.6.2 Oil or Dual-fuel Boilers and Furnaces

Provide product data and details for new, replacement, or relocated fuel fired boilers, heaters, or furnaces to the Installation Environmental Office (Air Program Manager) through the Contracting Officer. Data to be reported include: equipment purpose (water heater, building heat, process), manufacturer, model number, serial number, fuel type (oil type, gas type) size (MMBTU heat input). Provide in accordance with paragraph PRECONSTRUCTION AIR PERMITS.

3.6.3 Burning

Burning is prohibited on the Government premises.

3.6.4 Dust Control

Keep dust down at all times, including during nonworking periods. Sprinkle or treat, with dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. Air blowing will be permitted only for cleaning nonparticulate debris such as steel reinforcing bars. Only wet cutting will be permitted for cutting concrete blocks, concrete, and bituminous concrete. Do not unnecessarily shake bags of cement, concrete mortar, or plaster. Since these products contain Crystalline Silica, comply with the applicable OSHA standard, 29 CFR 1910.1053 or 29 CFR 1926.1153 for controlling exposure to Crystalline Silica Dust.

3.6.4.1 Particulates

Dust particles, aerosols and gaseous by-products from construction activities, and processing and preparation of materials (such as from asphaltic batch plants) must be controlled at all times, including weekends, holidays, and hours when work is not in progress. Maintain excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and other work areas within or outside the project boundaries free from particulates that would exceed 40 CFR 50, state, and local air pollution standards or that would cause a hazard or a nuisance. Sprinkling, chemical treatment of an approved type, baghouse, scrubbers, electrostatic precipitators, or other methods will be permitted to control particulates in the work area. Sprinkling, to be efficient, must be repeated to keep the disturbed area damp. Provide sufficient, competent equipment available to accomplish these tasks. Perform particulate control as the work proceeds and whenever a particulate nuisance or hazard occurs. Comply with state and local visibility regulations.

3.6.4.2 Abrasive Blasting

Blasting operations cannot be performed without prior approval of the Installation Air Program Manager. The use of silica sand is prohibited in sandblasting.

Provide tarpaulin drop cloths and windscreens to enclose abrasive blasting operations to confine and collect dust, abrasive agent, paint chips, and other debris. Perform work involving removal of hazardous material in accordance with 29 CFR 1910.

3.6.5 Odors

Control odors from construction activities. The odors must be in compliance with state regulations and local ordinances and may not constitute a health hazard.

3.7 WASTE MINIMIZATION

Minimize the use of hazardous materials and the generation of waste. Include procedures for pollution prevention/ hazardous waste minimization

in the Hazardous Waste Management Section of the EPP. Obtain a copy of the installation's Pollution Prevention/Hazardous Waste Minimization Plan for reference material when preparing this part of the EPP. If no written plan exists, obtain information by contacting the Contracting Officer. Describe the anticipated types of the hazardous materials to be used in the construction when requesting information.

3.7.1 Salvage, Reuse and Recycle

Identify anticipated materials and waste for salvage, reuse, and recycling. Describe actions to promote material reuse, resale or recycling. To the extent practicable, all scrap metal must be sent for reuse or recycling and will not be disposed of in a landfill.

Include the name, physical address, and telephone number of the hauler, if transported by a franchised solid waste hauler. Include the destination and, unless exempted, provide a copy of the state or local permit (cover) or license for recycling.

3.7.2 Nonhazardous Solid Waste Diversion Report

Maintain an inventory of nonhazardous solid waste diversion and disposal of construction and demolition debris. Submit a report to the Contracting Officer on the first working day after each fiscal year quarter, starting the first quarter that nonhazardous solid waste has been generated. Include the following in the report:

Construction and Demolition (C&D) Debris Disposed	as appropriate
C&D Debris Recycled	as appropriate
C&D Debris Composted	as appropriate
Total C&D Debris Generated	as appropriate
Waste Sent to Waste-To-Energy Incineration Plant (This amount should not be included in the recycled amount)	as appropriate

3.8 WASTE MANAGEMENT AND DISPOSAL

3.8.1 Waste Determination Documentation

Complete a Waste Determination form (provided at the pre-construction conference) for Contractor-derived wastes to be generated. All potentially hazardous solid waste streams that are not subject to a specific exclusion or exemption from the hazardous waste regulations (e.g., scrap metal, domestic sewage) or subject to special rules, (lead-acid batteries and precious metals) must be characterized in accordance with the requirements of 40 CFR 262.11 or corresponding applicable state or local regulations. Base waste determination on user knowledge of the processes and materials used, and analytical data when necessary. Consult with the Installation environmental staff for guidance

on specific requirements. Attach support documentation to the Waste Determination form. As a minimum, provide a Waste Determination form for the following waste (this listing is not exhaustive): oil- and latex -based painting and caulking products, solvents, adhesives, aerosols, petroleum products, and containers of the original materials.

3.8.2 Solid Waste Management

3.8.2.1 Project Solid Waste Disposal Documentation Report

Provide copies of the waste handling facilities' weight tickets, receipts, bills of sale, and other sales documentation. In lieu of sales documentation, a statement indicating the disposal location for the solid waste that is signed by an employee authorized to legally obligate or bind the firm may be submitted. The sales documentation must include the receiver's tax identification number and business, EPA or state registration number, along with the receiver's delivery and business addresses and telephone numbers. For each solid waste retained for the Contractor's own use, submit the information previously described in this paragraph on the solid waste disposal report. Prices paid or received do not have to be reported to the Contracting Officer unless required by other provisions or specifications of this Contract or public law.

3.8.2.2 Control and Management of Solid Wastes

Pick up solid wastes, and place in covered containers that are regularly emptied. Do not prepare or cook food on the project site. Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean. Employ segregation measures so that no hazardous or toxic waste will become co-mingled with non-hazardous solid waste. Transport solid waste off Government property and dispose of it in compliance with 40 CFR 260, state, and local requirements for solid waste disposal. A Subtitle D RCRA permitted landfill is the minimum acceptable offsite solid waste disposal option. Verify that the selected transporters and disposal facilities have the necessary permits and licenses to operate. Haul waste materials to the Government landfill site designated by the Contracting Officer. Solid waste disposal offsite must comply with most stringent local, state, and federal requirements, including 40 CFR 241, 40 CFR 243, and 40 CFR 258.

Manage hazardous material used in construction, including but not limited to, aerosol cans, waste paint, cleaning solvents, contaminated brushes, and used rags, in accordance with 49 CFR 173.

3.8.3 Control and Management of Hazardous Waste

Do not dispose of hazardous waste on Government property. Do not discharge any waste to a sanitary sewer, storm drain, or to surface waters or conduct waste treatment or disposal on Government property without written approval of the Contracting Officer and Installation Hazardous Waste Manager.

3.8.3.1 Hazardous Waste/Debris Management

Identify construction activities that will generate hazardous waste or debris. Provide a documented waste determination for resultant waste streams. Identify, label, handle, store, and dispose of hazardous waste or debris in accordance with federal, state, and local regulations, including 40 CFR 261, 40 CFR 262, 40 CFR 263, 40 CFR 264, 40 CFR 265,

40 CFR 266, and 40 CFR 268.

Manage hazardous waste in accordance with the approved Hazardous Waste Management Section of the EPP. Store hazardous wastes in approved containers in accordance with 49 CFR 173 and 49 CFR 178. Hazardous waste generated within the confines of Government facilities is identified as being generated by the Government. Prior to removal of any hazardous waste from Government property, hazardous waste manifests must be signed by personnel from the Installation Environmental Office. Do not bring hazardous waste onto Government property. Provide the Contracting Officer with a copy of waste determination documentation for any solid waste streams that have any potential to be hazardous waste or contain any chemical constituents listed in 40 CFR 372-SUBPART D.

3.8.3.2 Waste Storage/Satellite Accumulation/90 Day Storage Areas

Accumulate hazardous waste at satellite accumulation points and in compliance with 40 CFR 262 and applicable state or local regulations. Individual waste streams will be limited to 55 gallons of accumulation (or one quart for acutely hazardous wastes). If the Contractor expects to generate hazardous waste at a rate and quantity that makes satellite accumulation impractical, the Contractor may request a temporary 90-day or 180-day, as appropriate, accumulation point be established. Submit a request in writing to the Contracting Officer and provide the following information (Attach Site Plan to the Request):

Contract Number	------
Contractor	------
Haz/Waste or Regulated Waste POC	------
Phone Number	------
Type of Waste	------
Source of Waste	------
Emergency POC	------
Phone Number	------
Location of the Site	------

Attach a Waste Determination form for the expected waste streams. Allow 10 working days for processing this request. Additional compliance requirements (e.g., training and contingency planning) that may be required are the responsibility of the Contractor. Barricade the designated area where waste is being stored and post a sign identifying as follows:

"DANGER - UNAUTHORIZED PERSONNEL KEEP OUT"

3.8.3.3 Hazardous Waste Disposal

3.8.3.3.1 Responsibilities for Contractor's Disposal

Provide hazardous waste manifest to the Installations Environmental Office for review, approval, and signature prior to shipping waste off Government property.

3.8.3.3.1.1 Services

Provide service necessary for the final treatment or disposal of the hazardous material or waste in accordance with 40 CFR 260 - 40 CFR 279, local, and state, laws and regulations, and the terms and conditions of the Contract within 60 days after the materials have been generated. These services include necessary personnel, labor, transportation, packaging, detailed analysis (if required for disposal or transportation, include manifesting or complete waste profile sheets, equipment, and compile documentation).

3.8.3.3.1.2 Samples

Obtain a representative sample of the material generated for each job done to provide waste stream determination.

3.8.3.3.1.3 Analysis

Analyze each sample taken and provide analytical results to the Contracting Officer. See paragraph WASTE DETERMINATION DOCUMENTATION.

3.8.3.3.1.4 Labeling

During waste accumulation label all containers in accordance with 40 CFR 262. Prior to offering a waste for off-site transport, determine the Department of Transportation's (DOT's) proper shipping names for waste in accordance with 49 CFR 172 (each container requiring disposal) and demonstrate to the Contracting Officer how this determination is developed and supported by the sampling and analysis requirements contained herein. Label all containers of hazardous waste with the words "Hazardous Waste" or other words to describe the contents of the container in accordance with 40 CFR 262 and applicable state or local regulations.

3.8.3.3.2 Contractor Disposal Turn-In Requirements

Hazardous waste generated must be disposed of in accordance with the following conditions to meet installation requirements:

a. Drums must be compatible with waste contents and drums must meet DOT requirements for 49 CFR 173 for transportation of materials.

b. Band drums to wooden pallets.

c. No more than three 55 gallon drums or two 85 gallon over packs are to be banded to a pallet.

d. Band using 1-1/4 inch minimum band on upper third of drum.

e. Provide label in accordance with 49 CFR 172.101.

f. Leave 3 to 5 inches of empty space above volume of material.

3.8.3.4 Universal Waste Management

Manage the following categories of universal waste in accordance with federal, state, and local requirements and installation instructions:

a. Batteries as described in 40 CFR 273.2

b. Lamps as described in 40 CFR 273.5

c. Mercury-containing equipment as described in 40 CFR 273.4

d. Aerosol cans as described in 40 CFR 273.6

e. Pesticides as described in 40 CFR 273.3

Mercury is prohibited in the construction of this facility, unless specified otherwise, and with the exception of mercury vapor lamps and fluorescent lamps. Dumping of mercury-containing materials and devices such as mercury vapor lamps, fluorescent lamps, and mercury switches, in rubbish containers is prohibited. Remove without breaking, pack to prevent breakage, and transport out of the activity in an unbroken condition for disposal as directed.

3.8.3.5 Electronics End-of-Life Management

Recycle or dispose of electronics waste, including, but not limited to, used electronic devices such computers, monitors, hard-copy devices, televisions, mobile devices, in accordance with 40 CFR 260-262, state, and local requirements, and installation instructions.

3.8.3.6 Disposal Documentation for Hazardous and Regulated Waste

Contact the Contracting Officer or designated representative for the facility RCRA identification number that is to be used on each manifest.

Submit a copy of the applicable EPA and or state permit(s), manifest(s), or license(s) for transportation, treatment, storage, and disposal of hazardous and regulated waste by permitted facilities. Hazardous or toxic waste manifests must be reviewed, signed, and approved by the Contracting Officer before the Contractor may ship waste. To obtain specific disposal instructions, coordinate with the Installation Environmental Office. Refer to location special requirements for the Installation Point of Contact information.

3.8.4 Releases/Spills of Oil and Hazardous Substances

3.8.4.1 Response and Notifications

The contractor shall be liable for the costs of clean up and remediation of any spills or the release of such substance into the environment.

Exercise due diligence to prevent, contain, and respond to spills of hazardous material, hazardous substances, hazardous waste, sewage, regulated gas, petroleum, lubrication oil, and other substances regulated in accordance with 40 CFR 300. Maintain spill cleanup equipment and materials at the work site. In the event of a spill, take prompt, effective action to stop, contain, curtail, or otherwise limit the amount, duration, and severity of the spill/release. In the event of any releases of oil and hazardous substances, chemicals, or gases; immediately (within 15 minutes) notify the Installation Fire Department, the Installation Command Duty Officer, the Installation Environmental Office, the Contracting Officer.

Submit verbal and written notifications as required by the federal (40 CFR 300.125 and 40 CFR 355), state, local regulations and instructions. Provide copies of the written notification and

documentation that a verbal notification was made within 20 days. Spill response must be in accordance with 40 CFR 300 and applicable state and local regulations. Contain and clean up these spills without cost to the Government.

Craig Fisher (609) 754-6167 and Joshua Piotrowski 609) 754-4528 (McGuire and Dix) and Harold Hornung (732) 323-1011 (Lakehurst).

3.8.4.2 Clean Up

Clean up hazardous and non-hazardous waste spills. Reimburse the Government for costs incurred including sample analysis materials, clothing, equipment, and labor if the Government will initiate its own spill cleanup procedures, for Contractor- responsible spills, when: Spill cleanup procedures have not begun within one hour of spill discovery/occurrence; or, in the Government's judgment, spill cleanup is inadequate and the spill remains a threat to human health or the environment.

3.8.5 Mercury Materials

Immediately report to the Environmental Office and the Contracting Officer instances of breakage or mercury spillage. Clean mercury spill area to the satisfaction of the Contracting Officer.

Do not recycle a mercury spill cleanup; manage it as a hazardous waste for disposal.

3.8.6 Wastewater

3.8.6.1 Disposal of Wastewater

Disposal of wastewater must be as specified below.

3.8.6.1.1 Treatment

Do not allow wastewater from construction activities, such as onsite material processing, concrete curing, foundation and concrete clean-up, water used in concrete trucks, and forms to enter water ways or to be discharged into the stormwater system or sanitary sewer system.. Dispose of the construction- related waste water off-Government property in accordance with 40 CFR 403, state, regional, and local laws and Prior to disposal, submit a WIS to the Installation Environmental Office and have the results reviewed and approved by the Contracting Officer prior to being discharged or disposed of off- Government property.

3.8.6.1.2 Surface Discharge

For discharge of ground water, Surface discharge in accordance with federal, state, and local laws and regulations. Surface discharge in accordance with the requirements of the NPDES or state STORMWATER DISCHARGES FROM CONSTRUCTION SITES permit.

3.8.6.1.3 Land Application

Water generated from the flushing of lines after disinfection or disinfection in conjunction with hydrostatic testing must be land- applied in accordance with federal, state, and local laws and regulations for land application and discharged into the sanitary sewer with prior approval and

notification to the Wastewater Treatment Plant's Operator.

3.9 HAZARDOUS MATERIAL MANAGEMENT

3.9.1 SOLID WASTE, HAZARDOUS MATERIALS, AND HAZARDOUS WASTE PROCESSES AND PERMITS

Hazardous waste: Harold Hornung (Lakehurst) (732) 323-1011 and Joshua Piotrowski (McGuire & Dix) (609) 754-4528. Hazardous materials: Keith Mackey (609) 754-1857. The contractor is responsible for the proper handling, disposal, and costs of solid and hazardous wastes and hazardous materials generated by or utilized during the course of its activities. Proper handling also includes recycling and material recovery. The terms solid and hazardous wastes, and hazardous materials, include, but are not limited to, those defined in the Federal Water Pollution Control Act, the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, the Resource Conservation and Recovery Act (RCRA), the Solid Waste Disposal Act, the Clean Air Act (CAA), and the Toxic Substances Control Act (TSCA), the New Jersey Solid Waste Management Act, the New Jersey Water Pollution Control Act, the New Jersey Air Pollution Control Act and the regulations promulgated pursuant to those Acts. The contractor shall also be responsible for any enforcement action that may be taken by the State of New Jersey, other State or the Federal Government related to handling, transportation and the proper disposal of solid and hazardous waste and hazardous materials. If notification, certifications, documentation, manifests, permits or any other written materials are required by law to be obtained, prepared and/or submitted, the contractor shall prepare same and provide a written copy to the CO, and a copy to Environmental (787 CES/CEIE) within the timeframes set forth in the law and regulations governing the action. Hazardous waste manifests must be signed by Environmental (787 CES/CEIE) Hazardous Waste Program Manager, at Building 2404 for the McGuire and Dix Areas and Building 5 for Lakehurst. JB MDL is not responsible for any hazardous materials brought on JB MDL by the contractor that may become hazardous waste during the course of performance. Contractor shall remove those materials from the base at their own expense and risk.

a. Source Separation of Solid Waste: Wastes shall be placed in closed metal containers that are emptied on a regular schedule. Solid waste shall be separated and placed in individual containers in a manner that facilitates recycling of the various categories of waste. Contractor is responsible for the handling and the associated costs of disposal for all solid wastes generated. Cardboard and all types of metal shall be source separated.

POC: Keith Mackey (609) 754-1857.

b. Cardboard and all types of metal shall be recycled and delivered to the McGuire Recycling Center (Building 2321) for McGuire and Dix and the Recycling Center (Building 669) for Lakehurst. Concrete and asphalt shall be recycled where practicable. Contractor shall deliver concrete and asphalt recyclables to a permitted/authorized off-site facility and report all quantities of materials recycled to the CO and to Environmental (787 CES/CEIE).

POC: Keith Mackey (609) 754-1857.

c. Any hazardous material or chemical to be used or stored by the contractor must be approved, in writing, by the CO prior to the

contractor bringing it on JB MDL. The contractor must utilize an AF Form 3000, Material Approval Submittal, listing each container of hazardous material stored, kept, or utilized, to include Safety Data Sheets (SDS). {Include on Material Approvals Submittal List} SDS sheets must also be displayed on-site for access by contractor employees as well as the Government, per OSHA requirements. All hazardous materials brought onsite must be stored inside containers that meet secondary containment requirements.

POC: Keith Mackey (609) 754-1857.

Include hazardous material control procedures in the Accident Prevention Plan (APP), in accordance with Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. Address procedures and proper handling of hazardous materials, including the appropriate transportation requirements. Do not bring hazardous material onto Government property that does not directly relate to requirements for the performance of this contract. Submit an SDS and estimated quantities to be used for each hazardous material to the Contracting Officer prior to bringing the material on the installation. Typical materials requiring SDS and quantity reporting include, but are not limited to, oil and latex based painting and caulking products, solvents, adhesives, aerosol, and petroleum products. Use hazardous materials in a manner that minimizes the amount of hazardous waste generated. Containers of hazardous materials must have National Fire Protection Association labels or their equivalent. Certify that hazardous materials removed from the site are hazardous materials and do not meet the definition of hazardous waste, in accordance with 40 CFR 261 and state and installation requirements.

3.10 PREVIOUSLY USED EQUIPMENT

Clean previously used construction equipment prior to bringing it onto the project site. Equipment must be free from soil residuals, egg deposits from plant pests, noxious weeds, and plant seeds. Consult with the U.S. Department of Agriculture jurisdictional office for additional cleaning requirements.

3.11 CONTROL AND MANAGEMENT OF LEAD-BASED PAINT (LBP) AND ASBESTOS

If this contract does not contain those Sections, and lead paint and/or asbestos is found or suspected during the execution of this contract, the contractor, at their expense, shall have those substances tested by a certified laboratory in accordance with the protocol set forth in New Jersey and Federal law. If the contractor positively identifies these materials at the action level set forth in the law and regulations, he must notify the CO by providing the laboratory results and cease work in those areas that might disturb those items until abatement issues are addressed and resolved. Send all sampling results to CO and 787 CES/CEIE. Work may only continue as long as the suspected or identified materials are not disturbed.Manifest any lead-contaminated waste and provide the manifest to the Contracting Officer.

POC: Hannah Torres (609) 754-1824.

3.12 MILITARY MUNITIONS

In the event military munitions, as defined in 40 CFR 260, are discovered or uncovered, immediately stop work in that area and immediately inform

the Contracting Officer.

3.13 PETROLEUM, OIL, LUBRICANT (POL) STORAGE AND FUELING

POL products include flammable or combustible liquids, such as gasoline, diesel, lubricating oil, used engine oil, hydraulic oil, mineral oil, and cooking oil. Store POL products and fuel equipment and motor vehicles in a manner that affords the maximum protection against spills into the environment. Manage and store POL products in accordance with EPA 40 CFR 112, and other federal, state, regional, and local laws and regulations. Use secondary containments, dikes, curbs, and other barriers, to prevent POL products from spilling and entering the ground, storm or sewer drains, stormwater ditches or canals, or navigable waters of the United States. Describe in the EPP (see paragraph ENVIRONMENTAL PROTECTION PLAN) how POL tanks and containers must be stored, managed, and inspected and what protections must be provided. Storage of fuel on the project site must be in accordance with EPA, state, and local laws and regulations and paragraph OIL STORAGE INCLUDING FUEL TANKS.

3.13.1 Used Oil Management

Manage used oil generated on site in accordance with 40 CFR 279. Determine if any used oil generated while onsite exhibits a characteristic of hazardous waste. Used oil containing 1,000 parts per million of solvents is considered a hazardous waste and disposed of at the Contractor's expense. Used oil mixed with a hazardous waste is also considered a hazardous waste. Dispose in accordance with paragraph HAZARDOUS WASTE DISPOSAL.

3.13.2 Oil Storage Including Fuel Tanks

Gas or diesel fuels shall not be stored on the construction site, or on JB MDL, without prior written approval from the CO.

Provide secondary containment and overfill protection for oil storage tanks. A berm used to provide secondary containment must be of sufficient size and strength to contain the contents of the tanks plus 5 inches freeboard for precipitation. Construct the berm to be impervious to oil for 72 hours that no discharge will permeate, drain, infiltrate, or otherwise escape before cleanup occurs. Use drip pans during oil transfer operations; adequate absorbent material must be onsite to clean up any spills and prevent releases to the environment. Cover tanks and drip pans during inclement weather. Provide procedures and equipment to prevent overfilling of tanks. If tanks and containers with an aggregate aboveground capacity greater than 1320 gallons will be used onsite (only containers with a capacity of 55 gallons or greater are counted), provide and implement a Spill Prevention Control and Countermeasure (SPCC) plan meeting the requirements of 40 CFR 112. Do not bring underground storage tanks to the installation for Contractor use during a project. Submit the SPCC plan to the Contracting Officer for approval.

Monitor and remove any rainwater that accumulates in open containment dikes or berms. Inspect the accumulated rainwater prior to draining from a containment dike to the environment, to determine there is no oil sheen present.

POC: Craig Fisher (609) 754-6167 and Joshua Piotrowski 609) 754-4528 (McGuire and Dix) and Harold Hornung (732) 323-1011 (Lakehurst).

3.14 INADVERTENT DISCOVERY OF PETROLEUM-CONTAMINATED SOIL OR HAZARDOUS WASTES

If petroleum-contaminated soil, or suspected hazardous waste is found during construction that was not identified in the Contract documents, immediately notify the Contracting Officer. Do not disturb this material until authorized by the Contracting Officer.

3.15 CONTAMINATED MEDIA MANAGEMENT

DOD Policies for destruction and disposal of PFAS-containing material must be followed for material containing PFAS. Follow the applicable DOD policy DOD PFAS MEMO.1.

3.15.1 Soil Sampling and Reporting

Perform representative sampling and analysis for all contaminants identified by the Environmental Restoration Program (ERP). Perform representative PFAS sampling and analysis of every 500 CY of excavated soil using EPA Method 1633 or 1633A, following Table B-24 of DOD QSM 5.4 or later and in accordance with Table 1 on page 08 of the Best Management Practices for Addressing Contaminated Soils on Military Construction and Facilities Sustainment, Restoration, and Modernization Projects memorandum issued by the Secretary of the Air Force (SAF) Infrastructure, Energy, and Environment (IEE). A report will be provided for each sampling event that details the sampling methodology, a map depicting location of the excavated soil sampled, confirmation that the sampling performed was representative, the proposed profile of the soil to be disposed, and laboratory analytical results. No soil shall be moved from nor added to the initial stockpile location depicted on the report map until the government has reviewed and concurred with the proposed profile. Sampling results shall be read and interpreted by an Environmental Engineer, Chemist, Industrial Hygienist (IH). The report submitted should describe sampling locations, including a map, and a statement describing the sampling procedures used and how the representative sampling requirements were met. The report should also include an analysis of results and determination if samples have exceeded DoD screening levels, RCRA, New Jersey State Dangerous Waste levels, and/or MTCA-A limits. The Industrial Hygienist, Environmental Engineer, or Chemist shall send the results and report to the Government. Once soil sampling results and proposed profile have been reviewed and concurred with by the government, soil containing PFAS can be re-used within the project footprint. The existing contract requirements for soil re-use remain unchanged. If soil cannot be re-used on site and is contaminated with any level of PFAS above DoD screening levels, it shall be disposed of at an approved Subtitle C landfill. If PFAS levels are below DoD screening levels, soil may be disposed of at a Subtitle D landfill if the other following conditions also exist:

a. Contaminants listed by the ERP Manager are below RCRA limits.

b. All contaminants other than PFAS listed by the ERP Manager are below the WA State Dangerous waste and WA State MCTA-A levels.

c. The profile sheet for disposal clearly indicates that PFAS is present, but below the RSLs (or non-detect) in the completed sampling and analysis report. Must coordinate with onsite government representative prior to shipping any PFAS waste off the base. This may or may not be a change to the contract if the level of petroleum or chlorinated hydrocarbons

already require disposal at a Subtitle C landfill.

3.15.1.1 Sampling of Stored Materials

Samples of stored material shall be collected at a frequency of once per 500 cubic yards. Samples shall be tested for the contaminants PFAS (PFOS/PFOA), petroleum, and chlorinated hydrocarbon (TCE). Arrangements shall be made by the Construction Contractor with a disposal facility to appropriately characterize and dispose of this material. For any soil that requires disposal off of the project site, the off-site disposal shall be in accordance with Section 02 81 00 TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS. Documentation of all analyses performed shall be furnished to the Contracting Officer. Additional sampling and analyses to the extent required by the approved off-site treatment, storage, or disposal (TSD) facility shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government.

3.15.2 Dewatering Management with Contaminated Groundwater

Groundwater shall not be discharged to the storm system, the sanitary system, or infiltrated on site without proper treatment. The Contractor shall provide analytical results to the government for concurrence prior to discharge. Dispose of treated groundwater at the Fort Dix Waste Water Treatment Plant (WWTP). All groundwater disposed of at the Fort Dix WWTP shall meet DOD required screening levels prior to disposing at the Fort Dix WWTP. Limit the quantity of grounwater sent to the Fort Dix WWTP to 10k gallons per day.

Dewatered groundwater in known areas of contamination will need to be sampled BEFORE and AFTER filtration to verify filtration system adequacy for ERP identified contaminants (PFAS, TPH, TCE, PCBs, Metals, etc.). Upon initial mobilization to the project area that requires treatment of (dewatering) groundwater prior to discharge, containerize up to 60K gallons of dewatered groundwater and then perform sampling for all ERP identified contaminants. Perform PFAS sampling and analysis using EPA Method 1633 and a DoD accredited laboratory on the untreated containerized groundwater. After sampling initial, unfiltered 60K gallons, filter containerized dewatered groundwater and containerize into a clean container for analysis. Water shall not be released until the test results verify one half the Limit of Quanitation for PFAS and all other contaminant levels below MTCA-A, protective of groundwater. Once the initial 60K gallons of containerized groundwater following treatment tests less than half the Limit of Quanitation for PFAS, the contractor shall continue to capture and filter dewatered groundwater, sampling filtered groundwater once per full holding vessel and receiving government concurrence prior to discharge from container. The contractor may consult with their filtration company to propose a less frequent PFAS sampling interval based upon the filtration company's scientific recommendation of the effectiveness of their filtration system and provide a proposal to the government for review and approval. Provide analytical results to government for concurrence prior to discharge.

3.15.3 Requirements for Offsite Soils

Test off-site soils brought in for use as backfill or topsoil for Total Petroleum Hydrocarbons (TPH), Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX), RCRA 8 metals using full Toxicity Characteristic Leaching Procedure (TCLP) and Total Metals. Backfill shall be considered clean and pass the TCLP test. Determine TPH in accordance with NWTPH-HCID. Determine

BTEX concentrations by using EPA 8021. Perform TCLP in accordance with EPA 6020A. Provide Borrow Site Testing for TPH, BTEX and TCLP from a representative composite sample of material from the borrow site, with at least one test from each borrow site. All sample results shall be submitted to 787 CES via the Contracting Officer. Review and approval by 787 CES is required prior to any soil coming on base.

3.16 SOUND INTRUSION

Make the maximum use of low-noise emission products, as certified by the EPA. Blasting or use of explosives are not permitted without written permission from the Contracting Officer, and then only during the designated times.

Keep construction activities under surveillance and control to minimize environment damage by noise. Comply with the provisions of the State of New Jersey rules.

3.17 POST CONSTRUCTION CLEANUP

Clean up areas used for construction in accordance with Contract Clause: "Cleaning Up". Unless otherwise instructed in writing by the Contracting Officer, remove traces of temporary construction facilities such as haul roads, work area, structures, foundations of temporary structures, stockpiles of excess or waste materials, and other vestiges of construction prior to final acceptance of the work. Grade parking area and similar temporarily used areas to conform with surrounding contours.

-- End of Section --

SECTION 01 58 00

PROJECT IDENTIFICATION
08/19, CHG 5: 08/22

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EP 310-1-6a	(2006; 2019 Change 2) Project Operation -- Sign Standards Manual, VOL 1
EP 310-1-6b	(2006) Sign Standards Manual, VOL 2, Appendices

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Sign Legend Orders; G, RO

1.3 PROJECT IDENTIFICATION SIGN

1.3.1 Construction Project Signs

Furnish the construction project sign package, maintain the signs during construction, and remove the signs from the job site upon completion of the project. The construction project sign package consists of three signs: one for project identification, the other to show the on-the-job safety performance of the contractor and publich safety signs. Ensure that the package conforms to the requirements of EP 310-1-6a and EP 310-1-6b, specifically Section 16. Submit the sign legend orders as described in Section 16 of EP 310-1-6a before erecting the signs.

a. Sample sign drawings together with mounting and fabrication details are provided at the end of this section. The signs must be erected within 15 calendar days after the date of Notice to Proceed. The project identification and safety performance signs are to be displayed side-by-side and mounted for reading by passing viewers. The public safety sign shall be the same size as the project signs. The Contracting Officer will designate exact placement locations. Panels are fabricated using HDO (High Density Overlay) plywood with dimensional lumber uprights and bracing. The sign faces are non-reflecting vinyl. All legends are to be die-cut or computer-cut

in the sizes and type-faces specified and applied to the white panel background following the graphic formats shown on the attached sheets. The Communications Red panel on the left side of the construction project sign with Corps signature (reverse version) is screen printed onto the white background.

b. The Contractor must maintain the signs in good condition throughout the construction period. No separate payment will be made for erecting and maintaining the signs and all costs in connection therewith will be considered the obligation of the Contractor. Upon completion of the project, the Contractor shall remove the signs from the project site.

1.3.2 Public Safety Sign

For the public safety sign, refer to the Warning Signs paragraph in section 01 50 00 TEMPORARY CONSTRUCTION FACILITIES AND CONTROLS.

PART 2 PRODUCTS

Not Used

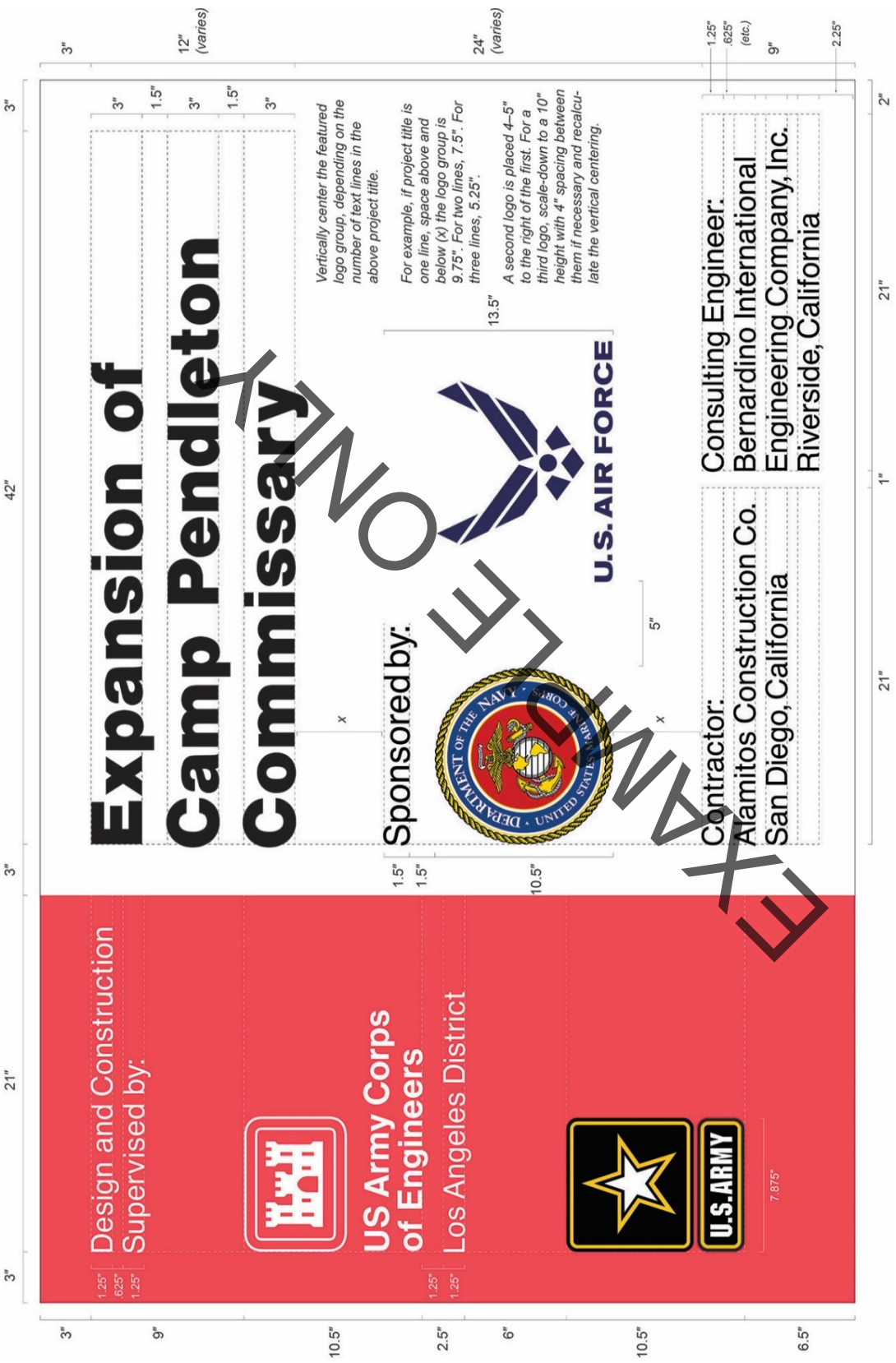
PART 3 EXECUTION

Not Used

-- End of Section --

ECB No. 2020-1
SUBJECT: USACE Construction Project Signs and Use of the Army Star

ATTACHMENT A: Example Graphic of Signage with Dimensions for MILCON Project



SAFETY PERFORMANCE SIGN

The graphic format, color, size and type-faces used on the sign are to be reproduced exactly as specified below. The title with First Aid logo in the top section of the sign, and the performance record captions are standard for all signs of this type. Legend Group 2 and 3 below identify the project and the contractor and are to be placed on the sign as shown. Safety record numbers are mounted on individual metal plates and are screw-mounted to the background to allow for daily revisions to posted safety performance record.

Legend Group1: Standard two-line title "safety is a Job Requirement", with (8" od.) Safety Green First Aid logo. Color: To match PMS 347
Typeface: 3" Helvetica Bold
Color: Black

Legend Group 2: One- to two-line project title legend describes the work being done under this contract and name of host project.
Color: Black
Typeface: 1.5" Helvetica Regular
Maximum line length: 42"

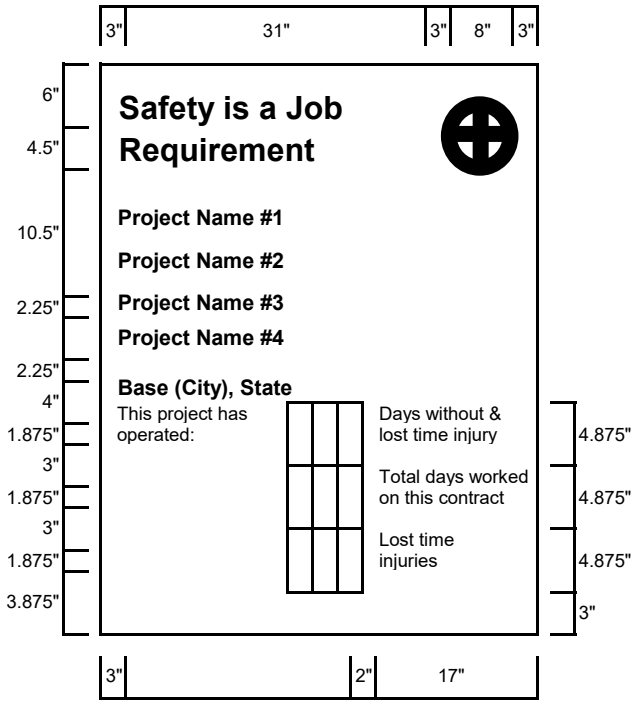
Legend Group 3: One - to two-line identification: name of prime contractor and city, state address.
Color: Black
Typeface: 1.5" Helvetica Regular
Maximum line length: 42"

Legend Group 4: Standard safety record captions as shown.
Color: Black

Typeface: 1.25" Helvetica Regular

Replaceable numbers are to be mounted on white .060: aluminum plates and screw-mounted to background.
Color: Black
Typeface: 3" Helvetica Regular
Plate size: 2.5"x.5"

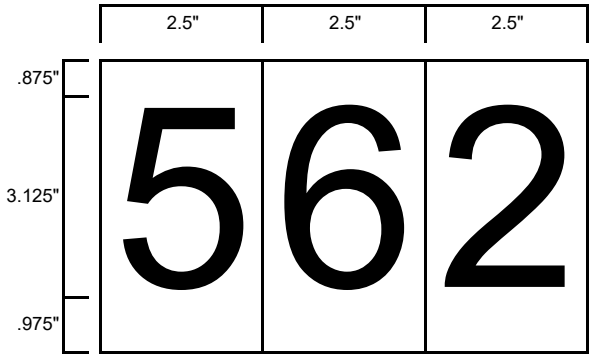
All typography is flush left and rag right, upper and lower case with initial capitals only as shown. Letter- and word-spacing to follow Corps standards as specified in Appendix D. *



Dimensions inches.
See attached sheet for fabrication and mounting guidelines.

* Refer to the U.S. Army Corps of Engineers, "Sign Standards Manual", EPS-310-1-6.

Sign Type	Legend Size	Panel Size	Post Size	Specifications Code	Mounting Height	Color Bkg/Lgd
CID-02	various	4"x4"	4"x4"	HDO-3	48"	WH/BK-GR



US ARMY

CORPS OF ENGINEERS, NEW YORK DISTRICT

Project Name #1 & 2
Project Name #3 & 4
Base (City), State

CONTRACTOR:
FUNDED BY:
COMPLETION DATE:

FOR YOUR SAFETY

1. DO NOT ENTER DESIGNATED WORK AREAS
2. OBEY ALL STATE AND LOCAL REQUIREMENTS CONCERNING PROHIBITED ACTIVITIES

DISTRICT ENGINEER: COL. ALEXANDER YOUNG

Fabrication and Mounting Guidelines

As Construction Project Identification signs and Safety Performance signs are to be fabricated and installed as described below. The signs are to be erected at a location designated by the contracting officer and shall conform to the size, format, and typographic standards shown on the attached sheets.

The sign panels are to be fabricated from .75" High Density Overlay Plywood. Panel preparation to follow HDD specifications provided in Appendix B. **

Sign graphics to be prepared on a white non-reflective vinyl film with positionable adhesive backing.

All graphics except for the Communications Red background with Corps signature on the project sign are to be die-cut or computer-cut non-reflective vinyl, pre-spaced legends prepared in the sizes and typefaces specified and applied to the background panel following the graphic formats shown on the attached sheets.

The 2'x4' Communications Red panel (to match PMS-032) with full Corps signature (reverse version) is to be screen printed on the white background. Identification of the District or Division may be applied under the signature with white cut vinyl letters prepared to Corps standards. Large scale reproduction artwork for the signature is provided on page 4.8 (photographically enlarge from 6.875" to 10.5"). **

Drill and Insert six (6) .375" T-nuts from the front face of the HDD sign panel. Position holes as shown. Flange of T-nut to be flush with sign face.

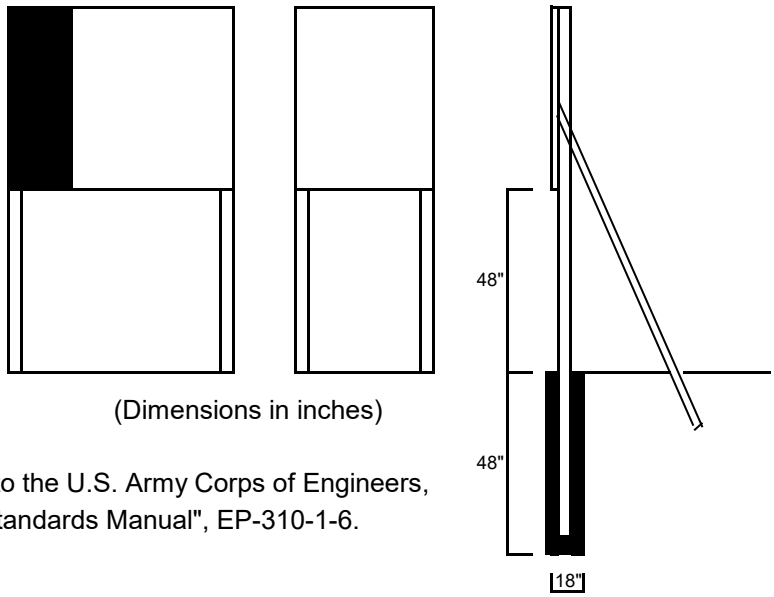
Apply graphic panel to prepared HDD plywood panel following manufacturers' instructions.

Sign uprights to be structural grade 4"x4" treated Douglas Fir or Southern Yellow Pine. No.1 or better. Post to be 12" long. Drill six (6) .375" mounting holes in uprights to align with T-nuts in sign panel. Countersink (.5") back of hole to accept socket head cap screw (4"x.375").

Assemble sign panel and uprights. Imbed assembled sign panel and uprights in 4" hole. Local soil conditions and/or wind loading may require bolting additional 2"x4" struts on inside face of uprights to reinforce installation as shown.

Detailed specifications for HDD plywood panel preparation are provided in Appendix B.**

Shown below the mounting diagram is a panel layout grid with spaces provided for project information. Photocopy this page and use as a worksheet when preparing sign legend orders.



(Dimensions in inches)

** Refers to the U.S. Army Corps of Engineers, "Sign Standards Manual", EP-310-1-6.

Construction Project Sign
Legend Group 1: Corps Relationship

1. _____
2. _____

Legend Group 2: Division/District Name

1. _____
2. _____

Legend Group 3: Project Title

1. _____
2. _____
3. _____

Legend Group 4: Facility Name

1. _____
2. _____

Legend Group 5a: Contractor/A&E

1. _____
2. _____
3. _____
4. _____
5. _____

Legend Group 5b: Contractor /A&E

1. _____
2. _____
3. _____
4. _____
5. _____

Safety Performance Sign
Legend Group 1: Project Title

1. _____
2. _____

Legend Group 2: Contractor/A&E

1. _____
2. _____

SECTION 01 74 19

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL
02/19, CHG 3: 11/21

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Co-mingle

The practice of placing unrelated materials together in a single container, usually for benefits of convenience and speed.

1.1.2 Construction Waste

Waste generated by construction activities, such as scrap materials, damaged or spoiled materials, temporary and expendable construction materials, and other waste generated by the workforce during construction activities.

1.1.3 Demolition Debris/Waste

Waste generated from demolition activities, including minor incidental demolition waste materials generated as a result of Intentional dismantling of all or portions of a building, to include clearing of building contents that have been destroyed or damaged.

1.1.4 Disposal

Depositing waste in a solid waste disposal facility, usually a managed landfill or incinerator, regulated in the US under the Resource Conservation and Recovery Act (RCRA).

1.1.5 Diversion

The practice of diverting waste from disposal in a landfill or incinerator, by means of eliminating or minimizing waste, or reuse of materials.

1.1.6 Final Construction Waste Diversion Report

A written assertion by a material recovery facility operator identifying constituent materials diverted from disposal, usually including summary tabulations of materials, weight in short-ton.

1.1.7 Recycling

The series of activities, including collection, separation, and processing, by which products or other materials are diverted from the solid waste stream for use in the form of raw materials in the manufacture of new products sold or distributed in commerce, or the reuse of such materials as substitutes for goods made of virgin materials, other than fuel.

1.1.8 Salvage

Usable, salable items derived from buildings undergoing demolition or

deconstruction, parts from vehicles, machinery, other equipment, or other components.

1.1.9 Source Separation

The practice of administering and implementing a management strategy to identify and segregate unrelated waste at the first opportunity.

1.2 CONSTRUCTION WASTE (INCLUDES DEMOLITION DEBRIS/WASTE)

Divert a minimum of 60 percent by weight of the project construction waste and demolition debris/waste from the landfill or incinerator. Follow applicable industry standards in the management of waste. Apply sound environmental principles in the management of waste. (1) Practice efficient waste management when sizing, cutting, and installing products and materials and (2) use all reasonable means to divert construction waste and demolition debris/waste from landfills and incinerators and to facilitate the recycling or reuse of excess construction materials.

1.3 CONSTRUCTION WASTE MANAGEMENT

Implement a Construction Waste Management Program for the project. Take a pro-active, responsible role in the management of construction waste, recycling process, disposal of demolition debris/waste, and require all subcontractors, vendors, and suppliers to participate in the Construction Waste Management Program. Establish a process for clear tracking, and documentation of construction waste and demolition debris/waste.

1.3.1 Implementation of Construction Waste Management Program

Develop and document how the Construction Waste Management Program will be implemented in a Construction Waste Management Plan. Submit a Construction Waste Management Plan to the Contracting Officer for approval. Construction waste and demolition debris/waste materials include un-used construction materials not incorporated in the final work, as well as demolition debris/waste materials from demolition activities or deconstruction activities. In the management of waste, consider the availability of viable markets, the condition of materials, the ability to provide material in suitable condition and in a quantity acceptable to available markets, and time constraints imposed by internal project completion mandates.

1.3.2 Oversight

The Quality Control Manager, as specified in Section 01 45 00 QUALITY CONTROL, is responsible for overseeing and documenting results from executing the Construction Waste Management Plan for the project.

1.3.3 Special Programs

Implement special programs involving rebates or similar incentives related to recycling of construction waste and demolition debris/waste materials. Retain revenue or savings from salvaged or recycling, unless otherwise directed. Ensure firms and facilities used for recycling, reuse, and disposal are permitted for the intended use to the extent required by federal, state, and local regulations.

1.3.4 Special Instructions

Provide on-site instruction of appropriate separation, handling, recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the projects. Designation of single source separating or commingling will be clearly marked on the containers.

1.3.5 Waste Streams

Delineate waste streams and characterization, including estimated material types and quantities of waste, in the Construction Waste Management Plan. Manage all waste streams associated with the project. Typical waste streams are listed below. Include additional waste steams not listed:

a. Land Clearing Debris

b. Asphalt

c. Masonry and CMU

d. Concrete

e. Metals (Includes, but is not limited to, banding, stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized, stainless steel, aluminum, copper, zinc, bronze.)

f. Wood (nails and staples allowed)

g. Glass

h. Paper

i. Plastics (PET, HDPE,PVC,LDPE,PP,PS, Other)

j. Gypsum

k. Non-hazardous paint and paint cans

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Construction Waste Management Plan; G, RO

SD-06 Test Reports

Quarterly Reports

Annual Report

SD-11 Closeout Submittals

Final Construction Waste Diversion Report; S

1.5 MEETINGS

Conduct Construction Waste Management meetings. After award of the Contract and prior to commencement of work, schedule and conduct a meeting with the Contracting Officer to discuss the proposed Construction Waste Management Plan and to develop a mutual understanding relative to the management of the Construction Waste Management Program and how waste diversion requirements will be met.

The requirements of this meeting may be fulfilled during the coordination and mutual Understanding meeting outlined in Section 01 45 00 QUALITY CONTROL. At a minimum, discuss and document waste management goals at following meetings:

a. Preconstruction meeting.

b. Regular Quality Control meetings.

c. Work safety meeting (if applicable).

1.6 CONSTRUCTION WASTE MANAGEMENT PLAN

Submit Construction Waste Management Plan within 45 days after notice to proceed. Revise and resubmit Construction Waste Management Plan as necessary, in order for construction to begin. Execute demolition or deconstruction activities in accordance with Section 02 41 00 DEMOLITION. Manage demolition debris/waste or deconstruction materials in accordance with the approved construction waste management plan.

An approved Construction Waste Management Plan will not relieve the Contractor of responsibility for compliance with applicable environmental regulations or meeting project cumulative waste diversion requirement. Ensure all subcontractors receive a copy of the approved Construction Waste Management Plan. The plan demonstrates how to meet the project waste diversion requirement. Also, include the following in the plan:

a. Identify the names of individuals responsible for waste management and waste management tracking, along with roles and responsibilities on the project.

b. Actions that will be taken to reduce solid waste generation, including coordination with subcontractors to ensure awareness and participation.

c. Description of the regular meetings to be held to address waste management.

d. Description of the specific approaches to be used in recycling/reuse of the various materials generated, including the areas on site and equipment to be used for processing, sorting, and temporary storage of materials.

e. Name of landfill and incinerator to be used.

f. Identification of local and regional re-use programs, including non-profit organizations such as schools, local housing agencies, and organization that accept used materials such as material exchange

networks and resale stores. Include the name, location, phone number for each re-use facility identified, and provide a copy of the permit or license for each facility.

g. List of specific materials, by type and quantity, that will be salvaged for resale, salvaged and reused on the current project, salvaged and stored for reuse on a future project, or recycled. Identify the recycling facilities by name, address, and phone number.

h. Identification of materials that cannot be recycled or reused with an explanation or justification, to be approved by the Contracting Officer.

i. Description of the means by which materials identified in item (g) above will be protected from contamination.

j. Description of the means of transportation of the recyclable materials (whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler and removed from the site).

k. Copy of training plan for subcontractors and other services to prevent contamination by co-mingling materials identified for diversion and waste materials.

Distribute copies of the waste management plan to each subcontractor, Quality Control Manager , and the Contracting Officer.

1.7 RECORDS (DOCUMENTATION)

1.7.1 General

Maintain records to document the types and quantities of waste generated and diverted though re-use, recycling and sale to third parties; through disposal to a landfill or incinerator facility. Provide explanations for materials not recycled, reused or sold. Collect and retain manifests, weight tickets, sales receipts, and invoices specifically identifying diverted project waste materials or disposed materials.

1.7.2 Accumulated

Maintain a running record of materials generated and diverted from landfill disposal, including accumulated diversion rates for the project. Make records available to the Contracting Officer during construction or incidental demolition activities. Provide a copy of the diversion records to the Contracting Officer upon completion of the construction, incidental demolitions or minor deconstruction activities.

1.8 REPORTS

1.8.1 General

Maintain current construction waste diversion information on site for periodic inspection by the Contracting Officer. Include in the quarterly reports, annual reports and final reports: the project name, contract information, information for waste generated, diverted and disposed of for the current reporting period and show cumulative totals for the project.

Reports must identify quantifies of waste by type and disposal method. Also include in each report, supporting documentation to include manifests, weigh tickets, receipts, and invoices specifically identifying the project and waste material type and weighted sum.

1.8.2 Quarterly Reporting

Provide cumulative reports at the end of each quarter (December, March, June, and September, corresponding with the federal fiscal year for reporting purposes). Submit quarterly reports not later than 15 calendar days after the preceding quarter has ended. Submit Quarterly Reports to the appropriate office or identified point of contact.

1.8.3 Annual Reporting

Provide a cumulative construction waste diversion report annually. Submit annual report not later than 30 calendar days after the preceding fourth quarter has ended. Provide copy of annual construction waste diversion report to the installation POC.

1.9 FINAL CONSTRUCTION WASTE DIVERSION REPORT

A Final Construction Waste Diversion Report is required at the end of the project. Provide Final Construction Waste Diversion Report 60 days prior to the Project Completion Date.

1.10 COLLECTION

Collect, store, protect, and handle reusable and recyclable materials at the site in a manner which prevents contamination, and provides protection from the elements to preserve their usefulness and monetary value. Provide receptacles and storage areas designated specifically for recyclable and reusable materials and label them clearly and appropriately to prevent contamination from other waste materials. Keep receptacles or storage areas neat and clean.

Train subcontractors and other service providers to either separate waste streams or use the co-mingling method as described in the Construction Waste Management Plan. Handle hazardous waste and hazardous materials in accordance with applicable regulations and coordinate with Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS and Section 02 81 00 TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS. Separate materials by one of the following methods:

1.10.1 Source Separation Method

Separate waste products and materials that are recyclable from trash and sort as described below into appropriately marked separate containers and then transport to the respective recycling facility for further processing. Deliver materials in accordance with recycling or reuse facility requirements (e.g., free of dirt, adhesives, solvents, petroleum contamination, and other substances deleterious to the recycling process). Separate materials into the category types as defined in the Construction Waste Management Plan.

1.10.2 Other Methods

Other methods proposed by the Contractor may be used when approved by the

Contracting Officer.

1.11 DISPOSAL

Control accumulation of waste materials and trash. Recycle or dispose of collected materials off-site at intervals approved by the Contracting Officer and in compliance with waste management procedures as described in the waste management plan. Except as otherwise specified in other sections of the specifications, dispose of in accordance with the following:

1.11.1 Recycle

Recycle non-hazardous construction and demolition/debris materials that are not suitable for reuse. Track rejection of contaminated recyclable materials by the recycling facility. Rejected recyclables materials will not be counted as a percentage of diversion calculation. Recycle all fluorescent lamps, HID lamps, mercury (Hg) -containing thermostats and ampoules, and PCBs-containing ballasts and electrical components as directed by the Contracting Officer. Do not crush lamps on site as this creates a hazardous waste stream with additional handling requirements.

1.11.2 Waste

Dispose by landfill or incineration only those waste materials with no practical use, economic benefit, or recycling opportunity.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used. -- End of Section --

SECTION 01 78 00

CLOSEOUT SUBMITTALS
05/19, CHG 1: 08/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 1110-1-2909	(2012) Engineering and Design -- Geospatial Data and Systems
ERDC/ITL TR-23-1	(2023) A/E/C Graphics Standard, Release 2.2
ERDC/ITL TR-24-3	(2024) A/E/C CAD Standard - Release 6.2

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 1-300-08	(2009; with Change 2, 2011) Criteria for Transfer and Acceptance of DoD Real Property

1.2 DEFINITIONS

1.2.1 As-Built Drawings

As-built drawings are the marked-up drawings, maintained by the Contractor on-site, that depict actual conditions and deviations from the Contract Documents. These deviations and additions may result from coordination required by, but not limited to: contract modifications; official responses to submitted Requests for Information (RFI's); direction from the Contracting Officer; design that is the responsibility of the Contractor, and differing site conditions. Maintain the as-builts throughout construction as red-lined PDF files. These files serve as the basis for the creation of the record drawings.

1.2.2 Record Drawings

The record drawings are the final compilation of actual conditions reflected in the as-built drawings.

Produce the record drawings from the Record Model(s) and do not include annotations indicating revisions.

1.2.3 Record Model

A model reflecting approved changes during construction including red-lines, requests for information (RFI's), and contract modifications. Include updated construction phase facility/site data for components.

1.2.4 Advanced Modeling

A subset of geospatial technologies as defined in EM 1110-1-2909 to include Building Information Modeling (BIM), Civil Information Modeling (CIM), Geographic Information Systems (GIS), and Computer-Aided Design (CAD). Advanced modeling is comprised of models and drawings that form a digital representation of the project, or part thereof, that are comprised of model elements with facility data.

1.2.5 USACE CAD/BIM Technology Center

The USACE CAD/BIM Technology Center hosts all standard content for USACE. This content can be accessed through the CAD/BIM Technology Center website, https://cadbimcenter.erdc.dren.mil/.

1.3 SOURCE DRAWING FILES

Request the full set of electronic drawings, in the source format, for Record Drawing preparation, after award and at least 30 days prior to required use.

1.3.1 Terms and Conditions

Data contained on these electronic files must not be used for any purpose other than as a convenience in the preparation of construction data for the referenced project. Any other use or reuse is at the sole risk of the Contractor and without liability or legal exposure to the Government. The Contractor must make no claim and waives to the fullest extent permitted by law, any claim or cause of action of any nature against the Government, its agents or sub consultants that may arise out of or in connection with the use of these electronic files. The Contractor must, to the fullest extent permitted by law, indemnify and hold the Government harmless against all damages, liabilities or costs, including reasonable attorney's fees and defense costs, arising out of or resulting from the use of these electronic files.

These electronic CAD drawing files are not construction documents. Differences may exist between the CAD files and the corresponding construction documents. The Government makes no representation regarding the accuracy or completeness of the electronic CAD files, nor does it make representation to the compatibility of these files with the Contractor hardware or software. In the event that a conflict arises between the signed and sealed construction documents prepared by the Government and the furnished Source drawing files, the signed and sealed construction documents govern. The Contractor is responsible for determining if any conflict exists. Use of these Source Drawing files does not relieve the Contractor of duty to fully comply with the contract documents, including and without limitation, the need to check, confirm and coordinate the work of all contractors for the project. If the Contractor uses, duplicates or modifies these electronic source drawing files for use in producing construction data related to this contract, remove all previous indicia of ownership (seals, logos, signatures, initials and dates).

1.4 RECORD DRAWINGS

The Government will provide pdf and or program files at the preconstruction conference that contains one set of "as-designed" electronic CAD files in the specified software and format revised to reflect all amendments and the final contract PDF drawings. The CAD files

are provided to enable preparation of as-built or as-constructed drawings. If discrepancies exist between the CAD files and the contract PDF drawings, correct the CAD files to show the contract PDF drawings.

1.4.1 Variation with Contract Drawings

The electronic files provided are not part of the contract documents. If there is any discrepancy between the electronic files and the contract drawings, the contract drawings govern. The Government has no responsibility to modify any GFM due to changes in the design that occur after award.

Evaluate the content and quality of the GFM upon receipt. If major discrepancies or omissions occur in the GFM, notify the Contracting Officer and indicate the nature of such variations.

1.4.2 Data Loss, Corruption, and Error

Transfer of GFM files may result in corrupted files resulting in data loss and errors. Use of GFM files at own risk. Verify data integrity upon receipt and request a replacement if necessary. Make any adjustment in file structure, format, or software version as needed to make GFM compatible with computer systems and/or software to meet the requirements of the contract.

1.4.3 Modeling Completeness and Quality

The Government makes no guarantee that the GFM provide the level of completeness or quality as required by the contract. Further, the Government makes no guarantee that identified variations will be corrected upon notification.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Warranty Management Plan

Warranty Tags

Spare Parts Data

SD-08 Manufacturer's Instructions

Posted Instructions

SD-10 Operation and Maintenance Data

Operation and Maintenance Manuals; G, RO

SD-11 Closeout Submittals

As-Built Drawings; G, RO

Record Drawings; G, RO

Record Model; G, RO

As-Built Record of Equipment and Materials

Final Approved Shop Drawings; G, RO

Construction Contract Specifications; G, RO

Certification of EPA Designated Items; G, RO

Certification Of USDA Designated Items; G, RO

Interim DD FORM 1354; G, RO

Checklist for DD FORM 1354; G, RO

1.6 SPARE PARTS DATA

Submit two copies of the Spare Parts Data list, or electronically in PDT format, via email.

a. Indicate manufacturer's name, part number, and stock level required for test and balance, pre-commissioning, maintenance and repair activities. List those items that may be standard to the normal maintenance of the system.

1.7 QUALITY CONTROL

Additions and corrections to the contract drawings must be equal in quality and detail to that of the originals. Line colors, line weights, lettering, layering conventions, and symbols must be the same as the original line colors, line weights, lettering, layering conventions, and symbols.

1.8 WARRANTY MANAGEMENT

1.8.1 Warranty Management Plan

Develop a warranty management plan which contains information relevant to FAR 52.246-21 Warranty of Construction. At least 30 days before the planned pre-warranty conference, submit electronically and three hard copies of the warranty management plan. Include within the warranty management plan all required actions and documents to assure that the Government receives all warranties to which it is entitled. The plan narrative must contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesmen, or of engineering background, not necessarily familiar with this contract. The term "status" as indicated below must include due date and whether item has been submitted or was accomplished. Submit warranty information, made available during the construction phase, to the Contracting Officer for approval prior to each monthly pay estimate. Assemble approved

information in a binder and turn over to the Government upon acceptance of the work. The construction warranty period must begin on the date of project acceptance and continue for the full product warranty period. Conduct a joint 4 month and 9 month warranty inspection, measured from time of acceptance; with the Contractor, Contracting Officer and the Customer Representative. The warranty management plan must include, but is not limited to, the following:

a. Roles and responsibilities of personnel associated with the warranty process, including points of contact and telephone numbers within the organizations of the Contractors, subcontractors, manufacturers or suppliers involved.

b. For each warranty, the name, address, telephone number, and e-mail of each of the guarantor's representatives nearest to the project location.

c. A list and status of delivery of Certificates of Warranty for extended warranty items, including roofs, HVAC balancing, pumps, motors, transformers, and for commissioned systems, such as fire protection and alarm systems, sprinkler systems, and lightning protection systems.

d. As-Built Record of Equipment and Materials list for each warranted equipment, item, feature of construction or system indicating:

(1) Name of item.
(2) Model and serial numbers.
(3) Location where installed.
(4) Name and phone numbers of manufacturers or suppliers.
(5) Names, addresses and telephone numbers of sources of spare parts.
(6) Warranties and terms of warranty. Include one-year overall warranty of construction, including the starting date of warranty of construction. Items which have warranties longer than one year must be indicated with separate warranty expiration dates.
(7) Cross-reference to warranty certificates as applicable.
(8) Starting point and duration of warranty period.
(9) Summary of maintenance procedures required to continue the warranty in force.
(10) Cross-reference to specific pertinent Operation and Maintenance manuals.
(11) Organization, names and phone numbers of persons to call for warranty service.
(12) Typical response time and repair time expected for various warranted equipment.

e. The plans for attendance at the 4 and 9 month post-construction warranty inspections conducted by the Government.

f. Procedure and status of tagging of equipment covered by warranties longer than one year.

g. Copies of instructions to be posted near selected pieces of equipment where operation is critical for warranty or safety reasons.

1.8.2 Performance Bond

The Performance Bond must remain effective throughout the construction and warranty period .

a. In the event the Contractor fails to commence and diligently pursue any construction warranty work required, the Contracting Officer will have the work performed by others, and after completion of the work, will charge the remaining construction warranty funds of expenses incurred by the Government while performing the work, including, but not limited to administrative expenses.

b. In the event sufficient funds are not available to cover the construction warranty work performed by the Government at the Contractor's expense, the Contracting Officer will have the right to recoup expenses from the bonding company.

c. Following oral or written notification of required construction warranty repair work, respond in a timely manner. Written verification will follow oral instructions. Failure to respond will be cause for the Contracting Officer to proceed against the Contractor.

1.8.3 Pre-Warranty Conference

Prior to contract completion, and at a time designated by the Contracting Officer, meet with the Contracting Officer to develop a mutual understanding with respect to the requirements of this section. At this meeting, establish and review communication procedures for Contractor notification of construction warranty defects, priorities with respect to the type of defect, reasonable time required for Contractor response, and other details deemed necessary by the Contracting Officer for the execution of the construction warranty In connection with these requirements and at the time of the Contractor's quality control completion inspection, furnish the name, telephone number and address of a licensed and bonded company which is authorized to initiate and pursue construction warranty work action on behalf of the Contractor. This point of contact must be located within the local service area of the warranted construction, be continuously available, and be responsive to Government inquiry on warranty work action and status. This requirement does not relieve the Contractor of any of its responsibilities in connection with other portions of this provision.

1.8.4 Contractor's Response to Construction Warranty Service Requirements

Following oral or written notification by the Contracting Officer, respond to construction warranty service requirements in accordance with the "Construction Warranty Service Priority List" and the three categories of priorities listed below. Submit a report on any warranty item that has been repaired during the warranty period. Include within the report the cause of the problem, date reported, corrective action taken, and when the repair was completed. If the Contractor does not perform the construction warranty within the timeframe specified, the Government will perform the work and back charge the construction warranty payment item established.

a. First Priority Code 1. Perform onsite inspection to evaluate situation, and determine course of action within 4 hours, initiate work within 6 hours and work continuously to completion or relief.

b. Second Priority Code 2. Perform onsite inspection to evaluate situation, and determine course of action within 8 hours, initiate work within 24 hours and work continuously to completion or relief.

c. Third Priority Code 3. All other work to be initiated within 3 work days and work continuously to completion or relief.

d. The "Construction Warranty Service Priority List" is as follows:

Code 1-Life Safety Systems
(1) Fire suppression systems.
(2) Fire alarm system(s) in place in the building.

Code 3-All other work not listed above.

1.8.5 Warranty Tags

At the time of installation, tag each warranted item with a durable, oil and water resistant tag approved by the Contracting Officer. Attach each tag with a copper wire and spray with a silicone waterproof coating. Also, submit two record copies of the warranty tags showing the layout and design. The date of acceptance and the QC signature must remain blank until the project is accepted for beneficial occupancy. Show the following information on the tag.

Type of product/material	
Model number	
Serial number	
Contract number	
Warranty period from/to	
Inspector's signature	
Construction Contractor	
Address	
Telephone number	
Warranty contact	
Address	
Telephone number	
Warranty response time priority code	
WARNING - PROJECT PERSONNEL TO PERFORM ONLY OPERATIONAL MAINTENANCE DURING THE WARRANTY PERIOD.	

PART 2 PRODUCTS

2.1 RECORD DRAWINGS

Prepare the CAD drawing files in Revit 2022 and AutoCAD Release 2022 format compatible with a Windows 10 operating system.

2.1.1 Additional Drawings

If additional drawings are required, prepare them using the specified electronic file format applying the same graphic standards specified for original drawings. The title block and drawing border to be used for any new final record drawings must be identical to that used on the contract drawings.

2.1.1.1 Sheet Numbers and File Names

If a sheet needs to be added between two sequential sheets, append a Supplemental Drawing Designator in accordance with ERDC/ITL TR-24-3 Adding a drawing sheet, and ERDC/ITL TR-23-1 Adding or deleting drawing sheets and index sheet procedures.

2.2 ADVANCED MODELING PACKAGE

For each Advanced Modeling Package submittal for the Final Record Model Package, submit in accordance with ERDC/ITL TR-24-3 and also provide the following items:

a. Advanced Modeling PxP: Provide an electronic copy of the most current approved version of the project Advanced Modeling PxP.

b. Electronic Files: Provide an electronic list (.txt file or similar), of all submitted electronic files including a description, directory, and file name for each file submitted. Identify which files have been produced from the Model and Facility Data. For all sheet files, include a list of the sheet titles and sheet numbers.

c. Advanced Modeling Submittal Checklist: Complete the USACE BIM/CIM Advanced Modeling Submittal Checklist and include with each submittal. Download the Checklist from the USACE CAD/BIM Technology Center website.

d. Advanced Modeling Files: Provide all native Advanced Modeling files associated with the production of the contract drawings and associated as-modeled drawings. Update and maintain in compliance with the Advanced Modeling formatting, content requirement, and standards in , in order to yield a complete and coordinated document package.

e. Quality Control (QC) Reports: Provide electronic PDFs of all QC reports and checklist utilized to ensure full compliance with the contract requirements and standards.

f. CAD Exports of BIM-Generated Sheets and Drawings: Provide supplemental 2D CAD exports from the project BIM model as needed to demonstrate compliance with contract requirements.2.3 CERTIFICATION OF EPA DESIGNATED ITEMS

Submit the Certification of EPA Designated Items as required by FAR 52.223-9 Estimate of Percentage of Recovered Material Content for EPA

Designated Items and FAR 52-223-17 Affirmative Procurement of EPA designated items in Service and Construction Contracts. Include on the certification form the following information: project name, project number, Contractor name, license number, Contractor address, and certification. The certification will read as follows and be signed and dated by the Contractor. "I hereby certify the information provided herein is accurate and that the requisition/procurement of all materials listed on this form comply with current EPA standards for recycled/recovered materials content. The following exemptions may apply to the non-procurement of recycled/recovered content materials:

a. The product does not meet appropriate performance standards;

b. The product is not available within a reasonable time frame;

c. The product is not available competitively (from two or more sources);

d. The product is only available at an unreasonable price (compared with a comparable non-recycled content product)."

2.4 CERTIFICATION OF USDA DESIGNATED ITEMS

Submit the Certification of USDA Designated Items as required by FAR 52-223-1 Bio-based Product Certifications and FAR 52.223-2 Affirmative Procurement of Biobased Products Under Service and Construction Contracts. Include on the certification form the following information: project name, project number, Contractor name, license number, Contractor address, and certification. The certification will read as follows and be signed and dated by the Contractor. "I hereby certify the information provided herein is accurate and that the requisition/procurement of all materials listed on this form comply with current USDA standards for biobased materials content. The following exemptions may apply to the non-procurement of biobased content materials:

a. The product does not meet appropriate performance standards;

b. The product is not available within a reasonable time frame;

c. The product is not available competitively (from two or more sources);

d. The product is only available at an unreasonable price (compared with a comparable bio-based content product)."

2.5 PDF AS-BUILT FILES

Provide electronic PDF "plots" of all contract drawings sheets associated with the as-built drawing submittal. Compile and organize the PDF set to match the contract drawings.

2.6 REDLINES AND MARKUPS

Provide PDFs of the current working redlines and/or markups complying with the as-builts drawing and markup requirements contained in this specification.

2.7 AS-BUILT RE-SUBMISSION REQUIREMENTS

If elements of an as-built submittal or advanced modeling package are rejected, provide the following for each re-submission, in addition to any information required in Section 01 33 00 SUBMITTAL PROCEDURES:

a. Re-submit all components required under paragraph As-Builts or Advanced Modeling Package, including a new Advanced Modeling Submittal Checklist and updated content in response to Government comments.

b. Provide a copy of all Government review comments.

c. Provide a disposition/response to each Government review comment for a back-check of the re-submission deliverable.

PART 3 EXECUTION

3.1 AS-BUILT DRAWINGS

Provide and maintain two black line print copies of the PDF contract drawings for As-Built Drawings. Maintain the as-builts throughout construction as red-lined hard copies on site and or red-lined PDF files. Submit As-Built Drawings 30 days prior to Beneficial Occupancy Date (BOD).

3.1.1 Markup Guidelines

Make comments and markup the drawings complete without reference to letters, memos, or materials that are not part of the As-Built drawing. Show what was changed, how it was changed, where item(s) were relocated and change related details. These working as-built markup prints must be neat, legible and accurate as follows:

a. Use base colors of red, green, and blue. Color code for changes as follows:

(1) Special (Blue) - Items requiring special information, coordination, or special detailing or detailing notes.

(2) Deletions (Red) - Over-strike deleted graphic items (lines), lettering in notes and leaders.

(3) Additions (Green) - Added items, lettering in notes and leaders.

b. Provide a legend if colors other than the "base" colors of red, green, and blue are used.

c. Add and denote any additional equipment or material facilities, service lines, incorporated under As-Built Revisions if not already shown in legend.

d. Use frequent written explanations on markup drawings to describe changes. Do not totally rely on graphic means to convey the revision.

e. Use legible lettering and precise and clear digital values when marking prints. Clarify ambiguities concerning the nature and application of change involved.

f. Wherever a revision is made, also make changes to related section views, details, legend, profiles, plans and elevation views,

schedules, notes and call out designations, and mark accordingly to avoid conflicting data on all other sheets.

g. For deletions, cross out all features, data and captions that relate to that revision.

h. For changes on small-scale drawings and in restricted areas, provide large-scale inserts, with leaders to the applicable location.

i. Indicate one of the following when attaching a print or sketch to a markup print:

1) Add an entire drawing to contract drawings

2) Change the contract drawing to show changes on the drawing.

3) Provided for reference only to further detail the initial design.

j. Incorporate all shop and fabrication drawings into the markup drawings.

3.1.2 As-Built Drawings Content

Revise As-Built Drawings in accordance with ERDC/ITL TR-23-1. Keep these working as-built markup drawings current on a weekly basis and at least one set available on the jobsite at all times. Changes from the contract drawings which are made during construction or additional information which might be uncovered in the course of construction must be accurately and neatly recorded as they occur by means of details and notes. Submit the working as-built markup drawings for approval prior to submission of each monthly pay estimate. For failure to maintain the working and final record drawings as specified herein, the Contracting Officer will withhold 10 percent of the monthly progress payment until approval of updated drawings. Show on the as-built drawings, but not limited to, the following information:

a. The actual location, kinds and sizes of all sub-surface utility lines. In order that the location of these lines and appurtenances may be determined in the event the surface openings or indicators become covered over or obscured, show by offset dimensions to two permanently fixed surface features the end of each run including each change in direction on the record drawings. Locate valves, splice boxes and similar appurtenances by dimensioning along the utility run from a reference point. Also record the average depth below the surface of each run.

b. The location and dimensions of any changes within the building structure.

c. Layout and schematic drawings of electrical circuits and piping.

d. Correct grade, elevations, cross section, or alignment of roads, earthwork, structures or utilities if any changes were made from contract plans.

e. Changes in details of design or additional information obtained from working drawings specified to be prepared or furnished by the Contractor; including but not limited to shop drawings, fabrication, erection, installation plans and placing details, pipe sizes, insulation material, dimensions of equipment, and foundations.

f. The topography, invert elevations and grades of drainage installed or affected as part of the project construction.

g. Changes or Revisions which result from the final inspection.

h. Where contract drawings or specifications present options, show only the option selected for construction on the working as-built markup drawings.

i. If borrow material for this project is from sources on Government property, or if Government property is used as a spoil area, furnish a contour map of the final borrow pit/spoil area elevations.

j. Systems designed or enhanced by the Contractor, such as HVAC controls, fire alarm, fire sprinkler, and irrigation systems.

k. Changes in location of equipment and architectural features.

l. Modifications.

m. Actual location of anchors, construction and control joints, etc., in concrete.

n. Unusual or uncharted obstructions that are encountered in the contract work area during construction.

o. Location, extent, thickness, and size of stone protection particularly where it will be normally submerged by water.

3.2 RECORD DRAWING FILES

If additional drawings are required, prepare them using the specified electronic file format applying the same graphic standards specified for original drawings. The title block and drawing border to be used for any new final record drawings must be identical to that used on the contract drawings. Accomplish additions and corrections to the contract drawings using CAD files. Provide all program files and hardware necessary to prepare final PDF record drawings. The Contracting Officer will review final PDF record drawings for accuracy and return them to the Contractor for required corrections, changes, additions, and deletions.

3.2.1 Rename the CAD Drawing files

Rename the CAD Drawing files using the contract number as the Project Code field,(e.g., W91238-15-C-10A-102.DWG) as instructed in the Pre-Construction conference. Use only those renamed files for the Marked-up changes. Make all changes on the layer/level as the original item.

a. For AutoCAD files (DWG), enter all as-built delta changes and notations on the AS-BUILT layer.

b. When final revisions have been completed, show the wording "RECORD DRAWING AS-BUILTS" followed by the name of the Contractor in letters at least 3/16 inch high on the cover sheet drawing. Date RECORD DRAWING AS-BUILTS" drawing revisions in the revision block.

c. Within 20 days after Government approval of all of the working record

drawings for a phase of work, prepare the final CAD record drawings for that phase of work and submit PDF drawing files and two sets of prints for review and approval. The Government will promptly return one set of prints annotated with any necessary corrections. Within 10 days revise the CAD files accordingly at no additional cost and submit one set of final prints for the completed phase of work to the Government. Within 20 days of substantial completion of all phases of work, submit the final record drawing package for the entire project. Submit one set of electronic CAD files, and one set of the approved working record PDF and or programfiles with two sets of prints. The CAD files must be complete in all details and identical in form and function to the CAD drawing files supplied by the Government. Prepare AutoCAD files for transmittal using e-Transmit. Make any transactions or adjustments necessary to accomplish this. The Government reserves the right to reject any drawing files it deems incompatible with the customer's CAD system. Paper prints, drawing files and storage media submitted will become the property of the Government upon final approval. Failure to submit final record PDF drawing files, CAD files and marked prints as specified will be cause for withholding any payment due under this contract. Approval and acceptance of final record drawings must be accomplished before final payment is made.

3.3 RECORD DRAWINGS

Prepare final record drawings after the completion of each definable feature of work as listed in the Contractor Quality Control Plan (such as Foundations, Utilities, or Structural Steel as appropriate for the project). Transfer the changes from the approved working as-built markup drawings to the original electronic CAD drawing files. Modify the as-built CAD drawing files to correctly show the features of the project as-built by bringing the working CAD drawing set into agreement with approved working as-built markup drawings, and adding such additional drawings as may be necessary. Refer to ERDC/ITL TR-23-1. Jointly review the working as-built markup drawings with printouts from working as-built CAD drawing PDF files for accuracy and completeness. Monthly review of working as-built CAD drawing PDF file printouts must cover all sheets revised since the previous review. These PDF drawing files are part of the permanent records of this project. Any drawings damaged or lost must be satisfactorily replaced at no expense to the Government.

Drawing revisions (include within change order price the cost to change working and final record drawings to reflect revisions) and compliance with the following procedures.

a. Follow directions in the revision for posting descriptive changes.

b. The revision delta size must be 5/16 inch unless the area where the delta is to be placed is crowded. Use a smaller size delta for crowded areas.

c. Place a revision delta at the location of each deletion.

d. For new details or sections which are added to a drawing, place a revision delta by the detail or section title.

e. For minor changes, place a revision delta by the area changed on the drawing (each location).

f. For major changes to a drawing, place a revision delta by the

title of the affected plan, section, or detail at each location.

g. For changes to schedules or drawings, place a revision delta either by the schedule heading or by the change in the schedule.

3.3.1 Final Record Drawing Package

Submit the final record PDF and CAD drawings package for the entire project within 20 days of substantial completion of all phases of work. Submit one set of ANSI D size PDF and CAD files, two sets of ANSI D size prints and one set of the approved working record drawings. The package must be complete in all details and identical in form and function to the contract drawing files supplied by the Government.

3.4 FINAL APPROVED SHOP DRAWINGS

Submit final approved project shop drawings 30 days after transfer of the completed facility.

3.5 CONSTRUCTION CONTRACT SPECIFICATIONS

Submit final PDF file record construction contract specifications, including revisions thereto, 30 days after transfer of the completed facility. Failure to submit final record PDF specification files, PDF files as specified will be cause for withholding payment due under this contract. Approval and acceptance of final record construction contract specifications must be accomplished before final payment is made.

3.6 AS-BUILT RECORD OF EQUIPMENT AND MATERIALS

Furnish one copy or electronically in PDT Format, via email the preliminary record of equipment and materials used on the project 15 days prior to final inspection. This preliminary submittal will be reviewed and returned 2 days after final inspection with Government comments. Submit sets of final record of equipment and materials 10 days after final inspection. Key the designations to the related area depicted on the contract drawings. List the following data:

RECORD OF DESIGNATED EQUIPMENT AND MATERIALS DATA				
Description	Specification Section	Manufacturer and Catalog, Model, and Serial Number	Composition and Size	Where Used

3.7 OPERATION AND MAINTENANCE MANUALS

Provide project operation and maintenance manuals as specified in Section 01 78 23 OPERATION AND MAINTENANCE DATA. Provide four electronic copies of the Operation and Maintenance Manual files and one hard copy of the Operation and Maintenance Manuals. Submit to the Contracting Officer for approval within 30 calendar days of the Project Completion date. Update and resubmit files for final approval at BOD.

3.8 CLEANUP

Leave premises "broom clean." Clean interior and exterior glass surfaces exposed to view; remove temporary labels, stains and foreign substances; polish transparent and glossy surfaces; vacuum carpeted and soft surfaces. Clean equipment and fixtures to a sanitary condition. Replace filters of operating equipment. Clean debris from roofs, gutters, downspouts and drainage systems. Sweep paved areas and rake clean landscaped areas. Remove waste and surplus materials, rubbish and construction facilities from the site..

3.9 REAL PROPERTY RECORD

Refer to UFC 1-300-08 for instruction on completing the DD FORM 1354. Contact the Contracting Officer for any project specific information necessary to complete the DD FORM 1354.

3.9.1 Interim DD FORM 1354

Near the completion of Project, but a minimum of 60 days prior to final acceptance of the work, complete, update draft DD FORM 1354 attached to this section, and submit an accounting of all installed property with Interim DD FORM 1354. Include any additional assets, improvements, and alterations from the Draft DD FORM 1354.

3.9.2 Completed DD FORM 1354

Attach the Real Property receiving Component's completed for each applicable building to the completed DD 1354. For convenience, a blank fillable PDF DD FORM 1354 may be obtained at the following link: www.esd.whs.mil/Portals/54/Documents/DD/forms/dd/dd1354.pdf

Submit the completed Checklist for DD FORM 1354 of Installed Equipment items. Attach this list to the updated DD FORM 1354.

-- End of Section --

SECTION 01 78 23

OPERATION AND MAINTENANCE DATA
05/23, CHG 2: 11/25

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (ASHRAE)

ASHRAE GUIDELINE 1.4	(2019) Preparing Systems Manuals for Facilities

ASTM INTERNATIONAL (ASTM)

ASTM E1971	(2024) Standard Guide for Stewardship for the Cleaning of Commercial and Institutional Buildings
ASTM E2166	(2016; R 2023) Standard Practice for Organizing and Managing Building Data

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-10 Operation and Maintenance Data

Facility Data Workbook; G, RO

Operation And Maintenance Manual, Progress Submittal; G, RO

Operation And Maintenance Manual, Prefinal Submittal; G, RO

Operation And Maintenance Manual, Final Submittal; G, RO

SD-11 Closeout Submittals

Record Drawings And Utility Systems; G, RO

1.3 MEETINGS

To assure that Operation and Maintenance Manual and Facility Data Workbook requirements are being met through the duration of the project, organize the following meetings and discuss the subsequent topics:

1.3.1 Pre-Construction Meeting

At a minimum, discuss the following:

a. The requirement for Operation and Maintenance Manuals and Facility Data deliverables under this contract including coordination meetings

b. Processes and method of gathering Facility Data information during construction

c. Primary roles and responsibilities associated with the development and delivery of the Operation and Maintenance Manuals and Facility Data deliverables, and

d. Identify and agree upon a date and attendance list for the meetings described below:

1.3.2 Operation and Maintenance Manual and Facility Data Workbook Coordination Meeting

Facilitate a meeting after the Pre-Construction Meeting prior to the submission of the Operation and Maintenance Manual Progress Submittal. Meeting attendance must include the Contractor's Operation and Maintenance Manual and Facility Data Workbook Preparer, Designer of Record (DOR), Quality Control Manager, the Government's Design Manager (DM), Contracting Officer's Representative, and Government's facility data reviewer. Include any Mechanical, Electrical, and Fire Protection Sub-Contractors.

The purpose of this meeting is to reach a mutual understanding of the scope of work concerning the contract requirements for Operation and Maintenance Manual and coordinate the efforts necessary by both the Government and Contractor to ensure an accurate collection, preparation and timely Government review of Operation and Maintenance Manual.

1.3.3 Submittal Coordination Meeting

Facilitate a meeting following submission and Government review of each design or progress submittal of the Operation and Maintenance Manual and Facility Data Workbook.

a. Include personnel from the Coordination meeting and any additional personnel identified.

b. The purpose of this meeting is to demonstrate ongoing compliance with the requirements identified in this specification. Discuss Government review comments and unresolved items preventing completion and Government approval of the Operation and Maintenance Manuals and Facility Data Workbook (FDW).

c. The applicable deliverables, along with Government remarks associated with review of these submittals serve as the primary guide and agenda for this meeting.

1.4 FACILITY DATA WORKBOOK

Develop an editable, electronic spreadsheet based on the equipment in the Operation and Maintenance Manuals that contains the information required to start a preventive maintenance program. As a minimum, provide Facility

Data Workbook as a list of system equipment, location installed, warranty expiration date, manufacturer, model, and serial number.

1.5 OPERATION AND MAINTENANCE MANUAL MEDIA

Assemble Operation and Maintenance Manual into an electronically bookmarked file using the most current version of Adobe Acrobat or similar software capable of producing PDF file format. Provide compact disks (CD) or data digital versatile disk (DVD) as appropriate, so that each one contains operation, maintenance and record files, project record documents, and training videos. Include a complete bookmarked operation and maintenance directory.

1.5.1 CD or DVD Label and Disk Holder or Case

Provide the following information on the disk label and disk holder or case:

a. Building Number

b. Project Title

c. Activity and Location

d. Construction Contract Number

e. Prepared For: (Contracting Agency)

f. Prepared By: (Name, title, phone number and email address)

g. Include the disk content on the disk label

h. Date

i. Virus scanning program used

1.5.2 O&M Manual Tabbed Hard Copy

Provide a hard copy of the O&M manual upon completion of the project. Provide tabs for each section and subsection for ease of navigation by the user.

1.6 O&M MANUAL CONTENT

Organize the bookmarked Operation and Maintenance Manual into the following Parts in accordance with ASHRAE GUIDELINE 1.4, and as modified and detailed below. Word template for O&M Manual is available at: www.wbdg.org/dod/ufgs/ufgs-01-78-23.

1.6.1 Part 1: Executive Summary

Provide a summary of the information found in the O&M manual including the purpose of the manual and a description of the manual's organization.

1.6.2 Part 2: Facility Design and Construction

1.6.2.1 General Facility and Systems Description

Provide an overview of the intent for design and use of the facility.

Provide a PDF of the Record Drawings prepared in accordance with 01 78 00 CLOSEOUT SUBMITTALS and bookmarked using the sheet title and sheet number. Include uncluttered 11 by 17 inches floor plans with room numbers, type or function of space, and overall facility dimensions on the floor plans. Do not include items such as construction instructions, references, or frame numbers.

Detail the overall dimensions of the facility, number of floors, foundation type, expected number of occupants, and facility Category Code list and generally describe all the facility systems and any special building features (for example, HVAC Controls, Sprinkler Systems, Cranes, Elevators, and Generators). Include photographs marked up and labeled to show key operating components and the overall facility appearance.

1.6.2.2 Basis of Design

Provide a copy of the contract Basis of Design.

1.6.2.3 Contract Documents, RFP, Amendments, and Modifications

Provide the contract construction documents complete, to include specifications, drawings, Request for Proposal, amendments, and modifications.

1.6.3 Part 3: Facilities, Systems, and Assemblies Information

1.6.3.1 Organization

Bookmark information in this section using the current version of ASTM E2166 Uniformat II, UFGS numbers, and document type as outlined in the example below. Bookmark/tab each item to the third level for easy navigation of the manual.

Example as shown in Table below:

PARTS AND SUBPART NUMBERING
3.1 B20 EXTERIOR CLOSURE (System)
3.1.1 B2030 EXTERIOR DOORS (Subsystem)
3.1.1.1 B2030110 GLAZED DOORS (Component)
3.1.1.1.1 Applicable specifications List in UFGS Format
3.1.1.1.2 Manufacturer's Operations and Maintenance Data
3.1.1.1.3 Approved Submittal
3.1.1.1.4 Coordination/Shop Drawings
3.1.1.1.5 Sequence of Operation for Operating Equipment
3.1.1.1.6 Testing Equipment Information and Performance Data
3.1.1.1.7 Routine Maintenance Requirements
3.1.1.1.8 Repair Procedures
3.1.1.1.9 Emergency Procedures & Locations of Applicable Controls
3.1.1.1.10 Warranties
3.1.1.1.11 Record Drawings and Utility Systems

PARTS AND SUBPART NUMBERING
3.1.1.1.12 Contractor / Supplies Listing and Contact Information

1.6.3.2 Related Specifications

Reference each specification related to the subsystem in this section, and locate the actual specification section in Part 2 of the O&M Manual. List specifications in table format as shown in the below example.

UFGS Number	Specification Title	Page Spec Begins in Part 2

1.6.3.3 Manufacturer's Operations and Maintenance Data

Provide a copy of all manufacturer specifications and cutsheets. Provide text-searchable, high-quality document files from the manufacturer's online or electronic documentation. Color documents are preferred. Provide documents specific to the product(s) installed under this Contract. Provide identification and coverage for the parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Provide Uniformat II Level 3 identification for D20, D30, D40 installed equipment. When possible, do not submit document files containing multiple product catalogs from the same manufacturer, or product data from multiple manufacturers in the same files. Provide documents directly from the manufacturer whenever possible. Do not provide scanned copies of hardcopy documents. Provide identification and coverage for the parts of each component, assembly, subassembly, and accessory of the end items subject to replacement. Include special hardware requirements, such as requirement to use high-strength bolts and nuts. Identify parts by make, model, serial number, and source of supply to allow reordering without further identification. Provide clear and legible illustrations, drawings, and exploded views to enable easy identification of the items. When illustrations omit the part numbers and description, both the illustrations and separate listing must show the index, reference, or key number that will cross-reference the illustrated part to the listed part. Group the parts shown in the listings by components, assemblies, and subassemblies in accordance with the manufacturer's standard practice. Parts data may cover more than one model or series of equipment, components, assemblies, subassemblies, attachments, or accessories, such as typically shown in a master part catalog.

1.6.3.4 Approved Submittals and Certificates

Provide a copy of all submittals documented with the required approval as applicable for each UFGS specification listed in the table outlined in

applicable specifications. Include copies of SD-07 Certificates submittals documented with the required approval, SD-08 Manufacturer's Instructions submittals documented with the required approval, and SD-10 Operation and Maintenance Data submittals documents with the required approval.

1.6.3.5 Approved Coordination/Shop Drawings

Drawings, diagrams and schedules specifically prepared to illustrate some portion of the work. Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the Contractor for integrating the product or system into the project. Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be coordinated.

1.6.4 Sequence of Operation for Operating Equipment

Provide record one-line diagrams for each equipment location. Provide specific instructions, procedures, and illustrations for the following phases of operation for the installed model and features of each system:

1.6.4.1 Safety Precautions and Hazards

List personnel hazards and equipment or product safety precautions for operating conditions. List all residual hazards identified in the Activity Hazard Analysis provided under Section 01 35 26 GOVERNMENTAL SAFETY REQUIREMENTS. Provide recommended safeguards for each identified hazard. Specify if any certifications or licenses are required to operate the equipment.

1.6.4.2 Operator Prestart

Provide procedures required to install, set up, and prepare each system for use.

1.6.4.3 Startup, Shutdown, and Post-Shutdown Procedures

Provide narrative description for Startup, Shutdown and Post-shutdown operating procedures including the control sequence for each procedure.

1.6.4.4 Normal Operations

Provide Control Diagrams with data to explain operation and control of systems and specific equipment. Provide narrative description of Normal Operating Procedures.

1.6.4.5 Emergency Operations

Provide Emergency Procedures for equipment malfunctions to permit a short period of continued operation or to shut down the equipment to prevent further damage to systems and equipment. Provide Emergency Shutdown Instructions for fire, explosion, spills, or other foreseeable contingencies. Provide guidance and procedures for emergency operation of utility systems including required valve positions, valve locations and zones or portions of systems controlled.

1.6.4.6 Operator Service Requirements

Provide instructions for services to be performed by the operator such as

lubrication, adjustment, inspection, and recording gauge readings.

1.6.4.7 Environmental Conditions

Provide a list of Environmental Conditions (temperature, humidity, and other relevant data) that are best suited for the operation of each product, component or system. Describe conditions under which the item equipment should not be allowed to run.

1.6.4.8 Operating Log

Provide forms, sample logs, and instructions for maintaining necessary operating records.

1.6.4.9 Additional Requirements for Equipment Control Systems

Provide Data Package 5 and the following for all control systems:

a. Provide a narrative description on how to perform and apply functions, features, modes, and other operations, including unoccupied operation, seasonal changeover, manual operation, and alarms. Include detailed technical manual for programming and customizing control loops and algorithms.

b. Submit complete controls equipment schedules, full as-built sequence of operations, wiring and logic diagrams, Input/Output Tables, equipment schedules, copies of checkout tests and calibrations performed by the Contractor (not Cx tests), and all associates information.

c. Full print out of all schedules and set points after testing and acceptance of the system.

d. Full as-built print out of software program.

e. Marking of system sensors and thermostats on the as-built floor plan and mechanical drawings with their control system designations.

1.6.4.10 Testing Equipment Information and Performance Data

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components. Provide final set points.

Include completed prefunctional checklists, functional performance test forms, and monitoring reports. Include recommended schedule for retesting and blank test forms. Provide final set points.

1.6.5 Routine Maintenance Requirements

1.6.5.1 Preventive Maintenance Plan, Schedule, and Procedures

Provide manufacturer's schedule for routine preventive maintenance, inspections, condition monitoring (predictive tests) and adjustments required to ensure proper and economical operation and to minimize repairs. Provide instructions stating when the systems should be retested. Provide manufacturer's projection of preventive maintenance work-hours on a daily, weekly, monthly, and annual basis including requirements by type of activity. For periodic calibrations, provide

manufacturer's specified frequency and procedures for each separate operation.

a. Define the anticipated time required to perform each test (work-hours), test apparatus, number of personnel identified by responsibility, and a testing validation procedure permitting the record operation capability requirements within the schedule. Provide a remarks column for the testing validation procedure referencing operating limits of time, pressure, temperature, volume, voltage, current, acceleration, velocity, alignment, calibration, adjustments, cleaning, or special system notes. Delineate procedures for preventive maintenance, inspection, adjustment, lubrication and cleaning necessary to minimize repairs.

b. Repair requirements must inform operators how to check out, troubleshoot, repair, and replace components of the system. Include electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting of the system after acceptance.

1.6.5.2 Lubrication Data

Include the following preventive maintenance lubrication data, in addition to instructions for lubrication required under paragraph OPERATOR SERVICE REQUIREMENTS:

a. A table showing recommended lubricants for specific temperature ranges and applications.

b. Charts with a schematic diagram of the equipment showing lubrication points, recommended types and grades of lubricants, and capacities. Provide procedural instructions for Oil Sampling for all equipment.

c. A Lubrication Schedule showing service interval frequency.

1.6.6 Repair Procedures

Provide instructions and a list of tools required to repair or restore the product or equipment to proper condition or operating standards. Provide manufacturer's recommended procedures and instructions for correcting problems and making repairs for the installed model and features of each system. Include potential environmental and indoor air quality impacts of recommended maintenance procedures and materials. Specify if any certifications or licenses are required to repair the equipment.

1.6.6.1 Troubleshooting Guides and Diagnostic Techniques

Provide step-by-step procedures to promptly isolate the cause of typical malfunctions. Describe clearly why the checkout is performed and what conditions are to be sought. Identify tests or inspections and test equipment required to determine whether parts and equipment may be reused or require replacement.

1.6.6.2 Wiring Diagrams and Control Diagrams

Provide point-to-point drawings of wiring and control circuits including factory-field interfaces. Provide a complete and accurate depiction of the actual job specific wiring and control work. On diagrams, number electrical and electronic wiring and pneumatic control tubing and the

terminals for each type, identically to actual installation configuration and numbering.

1.6.6.3 Removal and Replacement Instructions

Provide step-by-step procedures and a list of required specialty tools and supplies for removal, replacement, disassembly, and assembly of components, assemblies, subassemblies, accessories, and attachments. Provide tolerances, dimensions, settings and adjustments required. Use a combination of text and illustrations.

1.6.6.4 Repair Work-Hours

Provide manufacturer's projection of repair work-hours including requirements by type of craft. Identify, and tabulate separately, repair that requires the equipment manufacturer to complete or to participate.

1.6.6.5 Warranty Information

List and explain the various warranties and clearly identify the servicing and technical precautions prescribed by the manufacturers or contract documents in order to keep warranties in force. Identify if replacement of a subassembly, attachment or accessory requires the entire assembly to be replaced. Include warranty information for primary components of the system. Provide copies of warranties required by Section 01 78 00 CLOSEOUT SUBMITTALS.

1.6.6.6 Extended Warranty Information

List all warranties for products, equipment, components, and sub-components whose duration exceeds one year. For each warranty listed, indicate the applicable specification section, duration, start date, end date, and the point of contact for warranty fulfillment. Also, list or reference the specific operation and maintenance procedures that must be performed to keep the warranty valid. Provide copies of warranties required by Section 01 78 00 CLOSEOUT SUBMITTALS.

1.6.6.7 Record Drawings and Utility Systems

The record drawings are the final compilation of actual conditions reflected in the as-built drawings. Provide record drawings as outlined in 01 78 00 CLOSEOUT SUBMITTALS.

Using Record Source Drawings, show and document details of the actual installation of the utility systems, annotate and highlight the Operation and Maintenance information. Provide the following drawings at a large enough scale to differentiate designated isolation units from surrounding valves and switches.

1.6.6.8 Personnel Training Requirements

Provide information available from the manufacturers that is needed for use in training designated personnel to properly operate and maintain the equipment and systems.

1.6.6.9 Contractor / Supplier Listing and Contact Information

Provide a list that includes the name, address, telephone number, email and website of the General Contractor and each Subcontractor who installed

the product or equipment, or system. For each item, also provide the name address and telephone number of the manufacturer's representative and service organization that can provide replacements most convenient to the project site. Provide the name, address, and telephone number of the product, equipment, and system manufacturers.

1.6.7 Part 4: Facility Operations

1.6.7.1 Completed Facility Operating Plan

Provide a plan that documents that procedures for the operation of systems and assemblies in the facility. The systems that should be included in the Operating Plan include, but are not limited to:

a. Electrical systems and equipment

b. Mechanical systems and equipment

c. Fire Protection systems and equipment

d. Control Systems and equipment

e. Architectural and Structural systems, fixtures, structures, and equipment

f. Vertical transportation such as elevators and escalators

1.6.7.2 Testing Equipment and Special Tool Information

Include information on test equipment required to perform specified tests and on special tools needed for the operation, maintenance, and repair of components. Provide final set points.

1.6.7.3 Testing and Performance Data

Include completed prefunctional checklists, functional performance test forms, and monitoring reports. Include recommended schedule for retesting and blank test forms. Provide final set points.

1.6.7.4 Approved Field Test Reports and Manufacturer's Field Reports

Compile and provide approved Field Test Reports (SD-06) and Manufacturer's Field Reports (SD-09) submittals.

1.6.7.5 Maintenance Plans, Procedures, Checklists, Records, and Spare Parts Inventory

1.6.7.5.1 Maintenance Schedules

Include recommended maintenance schedules for systems and equipment.

1.6.7.5.2 Ongoing Commissioning Operational and Maintenance Record Keeping

Include ongoing commissioning and optimization procedures and documentation to monitor and improve the performance of facility systems.

1.6.7.5.3 Janitorial and Cleaning Plans and Procedures

Include a copy of facility cleaning and janitorial plan with procedures

and intended chemicals and equipment.

Provide environmentally friendly cleaning recommendations in accordance with ASTM E1971.

1.6.7.6 Utility Record Drawings

1.6.7.6.1 Utility Schematic Diagrams

Provide a one-line schematic diagram for each utility system such as power, water, wastewater, and gas/fuel. Schematic diagram must show from the point where the utility line is connected to the mainline up to the 5 foot connection point to the facility. Indicate location or area designation for route of transmission or distribution lines; locations of duct banks, manholes/handholes or poles; isolation units such as valves and switches; and utility facilities such as pump stations, lift stations, and substations.

1.6.7.6.2 Enlarged Connection and Cutoff Plans

Provide enlarged plans and provide information between the 5 foot utilities connection point and where utilities connect to facility distribution. Include enough information to enable someone unfamiliar to locate the connection and cutoff points. Indicate designations such as room number, panel number, circuit breaker, or valve number of each utility and equipment connection and cutoff point, and what that connection and cutoff point controls.

1.6.7.6.2.1 Description of Utility Metering and Monitoring Systems

Provide in narrative format a description of the utility metering and monitoring systems. Include locations, function, and related systems.

1.6.7.6.2.2 Procedures for Tracking Utility Use and Reporting

Procedures for usage reporting and tracking in support of establishing and monitoring utility budgets and costs, and in developing annual energy reports.

1.6.7.6.2.3 One-Line Diagrams and Meter Location of System

Provide one-line diagrams and design drawings that highlight meter locations on the site.

1.6.7.6.3 Spare Parts and Supply Lists

Provide lists of spare parts and supplies required for repair to ensure continued service or operation without unreasonable delays. Special consideration is required for facilities at remote locations. List spare parts and supplies that have a long lead-time to obtain.

1.6.8 Part 5: Training

Provide a copy of training plans used for each type of equipment along with training materials used, arranged in specification sequence. Provide a copy of training records, sign-in sheets, and agendas. Include training and documentation on the updating and continued use of the O&M Manual.

1.6.9 Part 7: Regulatory Requirements

Provide information describing regulatory and policies compliance requirements or provide a reference to where it is stored.

1.6.10 Part 8: Permits

Provide information requiring frequently asked questions and associated answers or provide a reference to where it is stored.

1.6.11 Part 9: Operations and Maintenance Manual Approval

Provide a signed document stating that the project O&M Manual has been reviewed and confirming agreement with the approach it presents. Include contact information for the signer for coordination of any future changes.

1.7 SCHEDULE OF OPERATION AND MAINTENANCE DATA PACKAGES

Provide the O&M data packages specified in individual technical sections. O&M Data Packages are one of the components of the O&M Manual. The information required in each type of data package follows:

1.7.1 Package Quality

Documents must be fully legible. Operation and Maintenance data must be consistent with the manufacturer's standard brochures, schematics, printed instructions, general operating procedures, and safety precautions.

1.7.2 Data Package 1

a. Safety precautions and hazards

b. Cleaning recommendations

c. Maintenance and repair procedures

d. Warranty information

e. Extended warranty information

f. Contractor information

g. Spare parts and supply list

1.7.3 Data Package 2

a. Safety precautions and hazards

b. Normal operations

c. Environmental conditions

d. Lubrication data

e. Preventive maintenance plan, schedule, and procedures

f. Cleaning recommendations

g. Maintenance and repair procedures

h. Removal and replacement instructions

i. Spare parts and supply list

j. Parts identification

k. Warranty information

l. Extended warranty information

m. Contractor information

1.7.4 Data Package 3

a. Safety precautions and hazards

b. Operator prestart

c. Startup, shutdown, and post-shutdown procedures

d. Normal operations

e. Emergency operations

f. Environmental conditions

g. Operating log

h. Lubrication data

i. Preventive maintenance plan, schedule, and procedures

j. Cleaning recommendations

k. Troubleshooting guides and diagnostic techniques

l. Wiring diagrams and control diagrams

m. Maintenance and repair procedures

n. Removal and replacement instructions

o. Spare parts and supply list

p. Product submittal data

q. O&M submittal data

r. Parts identification

s. Warranty information

t. Extended warranty information

u. Testing equipment and special tool information

v. Testing and performance data

w. Contractor information

x. Field test reports

1.7.5 Data Package 4

a. Safety precautions and hazards

b. Operator prestart

c. Startup, shutdown, and post-shutdown procedures

d. Normal operations

e. Emergency operations

f. Operator service requirements

g. Environmental conditions

h. Operating log

i. Lubrication data

j. Preventive maintenance plan, schedule, and procedures

k. Cleaning recommendations

l. Troubleshooting guides and diagnostic techniques

m. Wiring diagrams and control diagrams

n. Repair procedures

o. Removal and replacement instructions

p. Spare parts and supply list

q. Repair work-hours

r. Product submittal data

s. O&M submittal data

t. Parts identification

u. Warranty information

v. Extended warranty information

w. Personnel training requirements

x. Testing equipment and special tool information

y. Testing and performance data

z. Contractor information

aa. Field test reports

1.7.6 Data Package 5

a. Safety precautions and hazards

b. Operator prestart

c. Start-up, shutdown, and post-shutdown procedures

d. Normal operations

e. Environmental conditions

f. Preventive maintenance plan, schedule, and procedures

g. Troubleshooting guides and diagnostic techniques

h. Wiring and control diagrams

i. Maintenance and repair procedures

j. Removal and replacement instructions

k. Spare parts and supply list

l. Product submittal data

m. Manufacturer's instructions

n. O&M submittal data

o. Parts identification

p. Testing equipment and special tool information

q. Warranty information

r. Extended warranty information

s. Testing and performance data

t. Contractor information

u. Field test reports

1.7.7 Changes to Submittals

Provide manufacturer-originated changes or revisions to submitted data if a component of an item is so affected subsequent to acceptance of the O&M Data. Submit changes, additions, or revisions required by the Contracting Officer for final acceptance of submitted data within 30 calendar days of the notification of this change requirement.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 SUBMITTAL SCHEDULING

3.1.1 Operation and Maintenance Manual, Progress Submittal

Submit the Progress submittal when construction is approximately 50 percent complete, to the Contracting Officer for approval. Provide Operation and Maintenance Manual Files (Bookmarked PDF). Include the elements and portions of system construction completed up to this point. The purpose of this submittal is to verify progress is in accordance with contract requirements as discussed during the Operation and Maintenance Manual Coordination Meeting.

3.1.2 Operation and Maintenance Manual, Prefinal Submittal

Submit the 100 percent submittal of the Operation and Maintenance Prefinal Submittal to the Contracting Officer for approval a minimum of 60 calendar days prior to the Project completion date. This submittal must provide a complete, working document that can be used to operate and maintain the facility. Any portion of the submittal that is incomplete or inaccurate requires the entire submittal to be returned for correction. Any discrepancies discovered during the Government's review of Operation and Maintenance Progress submittal must be corrected prior to the Prefinal submission. The Prefinal Submittal must include Operation and Maintenance Manual Files (Bookmarked PDF).

3.1.3 Operation and Maintenance Manual, Final Submittal

Submit completed Operation and Maintenance Manual Files (Bookmarked PDF) and one hard copy of the Operation and Maintenance Manuals. The Final submittal is due at Project completion date. Any discrepancies discovered during the Government's review of the Prefinal submittal, including the Field Verification, must be corrected prior to the Final submission.

-- End of Section --

SECTION 02 41 00

DEMOLITION
05/10

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2014) Safety and Health Requirements Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 61	National Emission Standards for Hazardous Air Pollutants

1.2 PROJECT DESCRIPTION

1.2.1 Demolition/Deconstruction Plan

Prepare a Demolition Plan and submit proposed salvage, demolition, removal, and storage procedures for approval before work is started. Include in the plan procedures for careful removal and disposition of materials specified to be salvaged, coordination with other work in progress, a disconnection schedule of utility services, and airfield lighting, a detailed description of methods and equipment to be used for each operation and of the sequence of operations. Coordinate with Waste Management Plan. Provide procedures for safe conduct of the work in accordance with EM 385-1-1. Plan shall be approved by Contracting Officer prior to work beginning.

1.2.2 General Requirements

Do not begin demolition until authorization is received from the Contracting Officer. Remove rubbish and debris from the project site; do not allow accumulations on airfield pavements. The work includes demolition, , salvage of identified items and materials, and removal of resulting rubbish and debris. Remove rubbish and debris from Government property daily, unless otherwise directed. Store materials that cannot be removed daily in areas specified by the Contracting Officer. In the interest of occupational safety and health, perform the work in accordance with EM 385-1-1, Section 23, Demolition, and other applicable Sections.

1.3 ITEMS TO REMAIN IN PLACE

Take necessary precautions to avoid damage to existing items to remain in place, to be reused, or to remain the property of the Government. Repair or replace damaged items as approved by the Contracting Officer. Coordinate the work of this section with all other work indicated. Construct and maintain shoring, bracing, and supports as required. Ensure

that structural elements are not overloaded. Increase structural supports or add new supports as may be required as a result of any cutting, removal, deconstruction, or demolition work performed under this contract. Do not overload structural elements or pavements to remain. Provide new supports and reinforcement for existing construction weakened by demolition, deconstruction, or removal work. Repairs, reinforcement, or structural replacement require approval by the Contracting Officer prior to performing such work.

1.3.1 Existing Construction Limits and Protection

Do not disturb existing construction beyond the extent indicated or necessary for installation of new construction. Provide temporary shoring and bracing for support of building components to prevent settlement or other movement. Provide protective measures to control accumulation and migration of dust and dirt in all work areas. Remove snow, dust, dirt, and debris from work areas daily.

1.3.2 Weather Protection

For portions of the building to remain, protect building interior and materials and equipment from the weather at all times. Where removal of existing roofing is necessary to accomplish work, have materials and workmen ready to provide adequate and temporary covering of exposed areas.

1.3.3 Utility Service

Maintain existing utilities indicated to stay in service and protect against damage during demolition and deconstruction operations. Prior to start of work, utilities serving each area of alteration or removal will be shut off by the Government and disconnected and sealed by the Contractor.

1.3.4 Facilities

Protect electrical and mechanical services and utilities. Where removal of existing utilities and pavement is specified or indicated, provide approved barricades, temporary covering of exposed areas, and temporary services or connections for electrical and mechanical utilities. Floors, roofs, walls, columns, pilasters, and other structural components that are designed and constructed to stand without lateral support or shoring, and are determined to be in stable condition, must remain standing without additional bracing, shoring, or lateral support until demolished, unless directed otherwise by the Contracting Officer. Ensure that no elements determined to be unstable are left unsupported and place and secure bracing, shoring, or lateral supports as may be required as a result of any cutting, removal, or demolition work performed under this contract.

1.3.5 Airfield Lighting

Prior to any removal work, and in the presence of the Contracting Officer, the Contractor shall perform a survey of existing taxiway and apron lights, instruments, and signs to determine and log the location of any non-functional or damaged units prior to removal or alteration. Any damage or loss of function shown to have occurred during construction must be repaired by the contractor at no expense to the Government.

1.4 BURNING

The use of burning at the project site for the disposal of refuse and debris will not be permitted.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Existing Conditions; G, RO

SD-07 Certificates

Demolition Plan; G, RO

Notification; G, RO

1.6 QUALITY ASSURANCE

Submit timely notification of demolition projects to Federal, State, regional, and local authorities in accordance with 40 CFR 61, Subpart M. Notify the Regional Office of the United States Environmental Protection Agency (USEPA), State's environmental protection agency, local air pollution control district/agency and the Contracting Officer in writing 10 working days prior to the commencement of work in accordance with 40 CFR 61, Subpart M. Comply with federal, state, and local hauling and disposal regulations. Comply with the Environmental Protection Agency requirements specified. Use of explosives will not be permitted.

1.6.1 Dust and Debris Control

Prevent the spread of dust and debris on airfield pavements and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution. Sweep pavements as often as necessary to control the spread of debris that may result in foreign object damage potential to aircraft.

1.7 PROTECTION

1.7.1 Traffic Control Signs

a. Where aircraft safety is endangered in the area of removal work, use traffic barricades with flashing lights. Anchor barricades in a manner to prevent displacement by wind, jet or prop blast. Notify the Contracting Officer prior to beginning such work.

1.7.2 Protection of Personnel

Before, during and after the demolition work continuously evaluate the condition of the structure being demolished and take immediate action to

protect all personnel working in and around the project site. No area, section, or component of floors, roofs, walls, columns, pilasters, or other structural element will be allowed to be left standing without sufficient bracing, shoring, or lateral support to prevent collapse or failure while workmen remove debris or perform other work in the immediate area.

1.8 FOREIGN OBJECT DAMAGE (FOD)

Aircraft and aircraft engines are subject to FOD from debris and waste material lying on airfield pavements. Remove all such materials that may appear on operational aircraft pavements due to the Contractor's operations. If necessary, the Contracting Officer may require the Contractor to install a temporary barricade at the Contractor's expense to control the spread of FOD potential debris. The barricade shall include a fence covered with a fabric designed to stop the spread of debris. Anchor the fence and fabric to prevent displacement by winds or jet/prop blasts. Remove barricade when no longer required.

1.9 RELOCATIONS

Perform the removal and reinstallation of relocated items as indicated with workmen skilled in the trades involved. Repair or replace items to be relocated which are damaged by the Contractor with new undamaged items as approved by the Contracting Officer.

1.10 EXISTING CONDITIONS

Before beginning any demolition or deconstruction work, survey the site and examine the drawings and specifications to determine the extent of the work. Record existing conditions in the presence of the Contracting Officer showing the condition of structures and other facilities adjacent to areas of alteration or removal. Photographs sized 4 inch will be acceptable as a record of existing conditions. Include in the record the elevation of the top of foundation walls, finish floor elevations, possible conflicting electrical conduits, plumbing lines, alarms systems, the location and extent of existing cracks and other damage and description of surface conditions that exist prior to before starting work. It is the Contractor's responsibility to verify and document all required outages which will be required during the course of work, and to note these outages on the record document. Submit survey results.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXISTING FACILITIES TO BE REMOVED

Inspect and evaluate existing structures onsite for reuse. Existing construction scheduled to be removed for reuse shall be disassembled. Dismantled and removed materials are to be separated, set aside, and prepared as specified, and stored or delivered to a collection point for reuse, remanufacture, recycling, or other disposal, as specified. Materials shall be designated for reuse onsite whenever possible.

3.1.1 Utilities and Related Equipment

3.1.1.1 General Requirements

Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by the Contracting Officer. Do not interrupt existing utilities serving facilities occupied and used by the Government except when approved in writing and then only after temporary utility services have been approved and provided. Do not begin demolition or deconstruction work until all utility disconnections have been made. Shut off and cap utilities for future use, as indicated.

3.1.1.2 Disconnecting Existing Utilities

Remove existing utilities , as indicated and terminate in a manner conforming to the nationally recognized code covering the specific utility and approved by the Contracting Officer. When utility lines are encountered but are not indicated on the drawings, notify the Contracting Officer prior to further work in that area. Remove meters and related equipment and deliver to a location on the installation in accordance with instructions of the Contracting Officer.

3.1.2 Paving and Slabs

Remove concrete and asphaltic concrete paving and slabs as indicated. Provide neat sawcuts at limits of asphalt pavement removal as indicated. Specific airfield pavement removal requirements and methods are provided in specification section 32 13 14.13 CONCRETE PAVEMENT FOR AIRFIELDS AND OTHER HEAVY-DUTY PAVEMENTS.

3.1.3 Airfield Lighting

Remove existing airfield lighting as indicated. Remove edge lights, associated transformers, and any other airfield lighting equipment as indicated and dispose of off station .

Prior to any removal work, and in the presence of the Contracting Officer, the Contractor shall perform a survey of existing taxiway and apron lights, instruments, and signs to determine and log the location of any non-functional or damaged units prior to removal or alteration. Any damage or loss of function shown to have occurred during construction must be repaired by the contractor at no expense to the Government.

3.2 CONCURRENT EARTH-MOVING OPERATIONS

Do not begin excavation, filling, and other earth-moving operations that are sequential to demolition work in areas occupied by structures to be demolished until all demolition and deconstruction in the area has been completed and debris removed. Fill holes and other hazardous openings.

3.3 DISPOSITION OF MATERIAL

3.3.1 Title to Materials

Except for salvaged items specified in related Sections, and for materials or equipment scheduled for salvage, all materials and equipment removed and not reused or salvaged, shall become the property of the Contractor and shall be removed from Government property. Title to materials resulting from demolition and deconstruction, and materials and equipment

to be removed, is vested in the Contractor upon approval by the Contracting Officer of the Contractor's demolition, deconstruction, and removal procedures, and authorization by the Contracting Officer to begin demolition and deconstruction. The Government will not be responsible for the condition or loss of, or damage to, such property after contract award. Showing for sale or selling materials and equipment on site is prohibited.

3.3.2 Unsalvageable and Non-Recyclable Material

Dispose of unsalvageable and non-recyclable combustible material off Government-controlled land by the Contractor at his own expense.

3.4 CLEANUP

Remove debris and rubbish from excavations. Remove and transport the debris in a manner that prevents spillage on streets or adjacent areas. Apply local regulations regarding hauling and disposal.

3.5 DISPOSAL OF REMOVED MATERIALS

3.5.1 Regulation of Removed Materials

Dispose of debris, rubbish, scrap, and other nonsalvageable materials resulting from removal operations with all applicable federal, state and local regulations as contractually specified in the Waste Management Plan. Storage of removed materials on the project site is prohibited.

3.5.2 Burning on Government Property

Burning of materials removed from demolished astructures will not be permitted on Government property.

-- End of Section --

SECTION 02 81 00

TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS
02/10

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INTERNATIONAL AIR TRANSPORT ASSOCIATION (IATA)

IATA DGR	(2018) Dangerous Goods Regulations

U.S. DEPARTMENT OF TRANSPORTATION (DOT)

DOT 4500.9R	Defense Transportation Regulation, Part 2, Cargo Movement, Chapter 204, Hazardous Material

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Standards Applicable to Generators of Hazardous Waste
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 266	Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities
40 CFR 268	Land Disposal Restrictions
40 CFR 270	EPA Administered Permit Programs: The Hazardous Waste Permit Program
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan
40 CFR 302	Designation, Reportable Quantities, and Notification

40 CFR 61	National Emission Standards for Hazardous Air Pollutants
49 CFR 107	Hazardous Materials Program Procedures
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements
49 CFR 173	Shippers - General Requirements for Shipments and Packagings
49 CFR 178	Specifications for Packagings

1.2 DEFINITIONS

1.2.1 Hazardous Material

A substance or material which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated pursuant to the Hazardous Materials Transportation Act, 49 U.S.C. Appendix Section 1801 et seq. The term includes materials designated as hazardous materials under the provisions of 49 CFR 172, Sections .101 and .102 and materials which meet the defining criteria for hazard classes and divisions in 49 CFR 173. EPA designated hazardous wastes are also hazardous materials.

1.2.2 Hazardous Waste

A waste which meets criteria established in RCRA or specified by the EPA in 40 CFR 261 or which has been designated as hazardous by a RCRA authorized state program.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for Contractor Quality Control approval. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Onsite Hazardous Waste Management; G

Notices of Non-Compliance and Notices of Violation; G

Packaging Notifications; G

SD-06 Test Reports

Recordkeeping; G

Spill Response

Exception Report; G

SD-07 Certificates

Certification; G

Security Plan; G

Transportation and Disposal Coordinator; G

Training; G

EPA Offsite Policy

Certificates of Disposal; G

Shipping Documents and Packagings Certification; G

Waste Minimization; G

1.4 QUALITY ASSURANCE

1.4.1 Transportation and Disposal Coordinator

Designate, by position and title, one person to act as the Transportation and Disposal Coordinator (TDC) for this contract. The TDC shall serve as the single point of contact for all environmental regulatory matters and shall have overall responsibility for total environmental compliance at the site including, but not limited to, accurate identification and classification of hazardous waste and hazardous materials; determination of proper shipping names; identification of marking, labeling, packaging and placarding requirements; completion of waste profiles, hazardous waste manifests, asbestos waste shipment records, PCB manifests, bill of ladings, exception and discrepancy reports; and all other environmental documentation. The TDC shall have, at a minimum, one year of specialized experience in the management and transportation of hazardous waste and have been Department of Transportation certified under 49 CFR 172, Subpart H.

1.4.2 Training

The Contractor's hazardous materials employees shall be trained, tested, and certified to safely and effectively carry out their assigned duties in accordance with Section 01 35 29.13 HEALTH, SAFETY, AND EMERGENCY RESPONSE PROCEDURES FOR CONTAMINATED SITES . The Contractor's employees transporting hazardous materials or preparing hazardous materials for transportation, including samples, shall be trained, tested, and certified in accordance with 49 CFR 172, Subpart H, including security awareness and any applicable security plans. Where shipment of hazardous materials by air may be occurring, such as for sample shipments, the Contractor's hazardous material employees shall also be trained on IATA DGR. Contractor employees making determinations that shipments do not constitute DOT regulated hazardous materials shall also be trained, tested, and certified in accordance with 49 CFR 172, Subpart H.

1.4.3 Certification

The Contractor and/or subContractors transporting hazardous materials shall possess a current certificate of registration issued by the Research and Special Programs Administration (RSPA), U.S. Department of

Transportation, when required by 49 CFR 107, Subpart G. Submit copies of the certificates or written statements certifying exemption from these requirements.

1.4.4 Laws and Regulations Requirements

Work shall meet or exceed the minimum requirements established by Federal, state, and local laws and regulations which are applicable. These requirements are amended frequently and compliance with amendments is required as they become effective. In the event that compliance exceeds the scope of work or conflicts with specific requirements of the contract, notify the Contracting Officer immediately.

PART 2 PRODUCTS

2.1 MATERIALS

Provide all the materials required for the packaging, labeling, marking, placarding and transportation of hazardous and regulated wastes and hazardous materials in conformance with Department of Transportation standards. Details in this specification shall not be construed as establishing the limits of the Contractor's responsibility.

2.1.1 Packagings

Provide bulk containers for packaging hazardous and regulated materials/wastes consistent with the authorizations referenced in the Hazardous Materials Table in 49 CFR 172, Section.101, Column 8. Bulk and non-bulk packaging shall meet the corresponding specifications in 49 CFR 173 referenced in the Hazardous Materials Table, 49 CFR 172, Section .101. Each packaging shall conform to the general packaging requirements of Subpart B of 49 CFR 173, to the requirements of 49 CFR 178 at the specified packing group performance level, to the requirements of special provisions of column 7 of the Hazardous Materials Table in 49 CFR 172, Section .101, and shall be compatible with the material to be packaged as required by 40 CFR 262. Also provide other packaging related materials such as materials used to cushion or fill voids in overpacked containers, etc. Sorbent materials shall not be capable of reacting dangerously with, being decomposed by, or being ignited by the hazardous materials being packaged. Additionally, sorbents used to treat free liquids to be disposed of in landfills shall be non-biodegradable as specified in 40 CFR 264, Section .314. In addition, packaging notifications will be provided to the Government in accordance with 49 CFR 172, Section .178.2(c) regarding type and dimensions of closures, including gaskets, needed to satisfy performance test requirements.

2.1.2 Markings

Provide markings for each hazardous material/waste package, freight container, and transport vehicle consistent with the requirements of 49 CFR 172, Subpart D and 40 CFR 61, Section.149(d) (for asbestos). Markings shall be capable of withstanding, without deterioration or substantial color change, a 180 day exposure to conditions reasonably expected to be encountered during container storage and transportation.

2.1.3 Labeling

Provide primary and subsidiary labels for hazardous materials/wastes consistent with the requirements in the Hazardous Materials Table in

49 CFR 172, Section .101, Column 6. Labels shall meet design specifications required by 49 CFR 172, Subpart E including size, shape, color, printing, and symbol requirements. Labels shall be durable and weather resistant and capable of withstanding, without deterioration or substantial color change, a 180 day exposure to conditions reasonably expected to be encountered during container storage and transportation.

2.1.4 Placards

For each offsite shipment of hazardous material/waste, provide primary and subsidiary placards consistent with the requirements of 49 CFR 172, Subpart F. Placards shall be provided for each side and each end of bulk packaging, freight containers, transport vehicles, and rail cars requiring such placarding. Placards may be plastic, metal, or other material capable of withstanding, without deterioration, a 30 day exposure to open weather conditions and shall meet design requirements specified in 49 CFR 172, Subpart F.

2.1.5 Spill Response Materials

Provide spill response materials including, but not limited to, containers, adsorbent, shovels, and personal protective equipment. Spill response materials shall be available at all times in which hazardous materials/wastes are being handled or transported. Spill response materials shall be compatible with the type of material being handled.

2.2 EQUIPMENT AND TOOLS

Provide miscellaneous equipment and tools necessary to handle hazardous materials and hazardous wastes in a safe and environmentally sound manner.

PART 3 EXECUTION

3.1 ONSITE HAZARDOUS WASTE MANAGEMENT

These paragraphs apply to Government owned waste only. Contractors are prohibited by 10 U.S.C. 2692 from storing Contractor owned waste onsite for any length of time. The Contractor is responsible for ensuring compliance with all Federal, state, and local hazardous waste laws and regulations and shall verify those requirements when preparing reports, waste shipment records, hazardous waste manifests, or other documents. Identify hazardous wastes using criteria set forth in 40 CFR 261 or all applicable state and local laws, regulations, and ordinances. When accumulating hazardous waste onsite, comply with generator requirements in 40 CFR 262 and any applicable state or local law or regulations. Onsite accumulation times shall be restricted to applicable time frames referenced in 40 CFR 262, Section.34 and any applicable state or local law or regulation. Accumulation start dates shall commence when waste is first generated (i.e. containerized or otherwise collected for discard). Only use containers in good condition and compatible with the waste to be stored. Ensure containers are closed except when adding or removing waste, and immediately mark all hazardous waste containers with the words "hazardous waste" and other information required by 40 CFR 262, Section.32 and any applicable state or local law or regulation as soon as the waste is containerized. An additional marking shall be placed on containers of "unknowns" designating the date sampled, and the suspected hazard. Inspect containers for signs of deterioration and for responding to any spills or leaks. Inspect all hazardous waste areas weekly and provide written documentation of the inspection. Include date and time of

inspection, name of individual conducting the inspection, problems noted, and corrective actions taken on the inspection logs.

3.1.1 Hazardous Waste Classification

Identify, in consultation with the Contracting Officer waste generator , all waste codes applicable to each hazardous waste stream based on requirements in 40 CFR 261 or any applicable state or local law or regulation. Also identify all applicable treatment standards in 40 CFR 268 and state land disposal restrictions and make a determination as to whether or not the waste meets or exceeds the standards. Waste profiles, analyses, classification and treatment standards information shall be submitted to Contracting Officer for review and approval.

3.1.2 Management Plan

Prepare a plan detailing the manner in which hazardous wastes will be managed and describing the types and volumes of hazardous wastes anticipated to be managed as well as the management practices to be utilized. The plan shall identify the method to be used to ensure accurate piece counts and/or weights of shipments; shall identify waste minimization methods; shall propose facilities to be utilized for treatment, storage, and/or disposal; shall identify areas onsite where hazardous wastes are to be handled; and shall identify whether transfer facilities are to be utilized; and if so, how the wastes will be tracked to ultimate disposal. Submit the plan prior to start of work. Written documentation of weekly hazardous waste inspections shall be submitted on a monthly basis.

3.2 OFFSITE HAZARDOUS WASTE MANAGEMENT

Use RCRA Subtitle C permitted facilities which meet the requirements of 40 CFR 264 or facilities operating under interim status which meet the requirements of 40 CFR 265. Offsite treatment, storage, and/or disposal facilities with significant RCRA violations or compliance problems (such as facilities known to be releasing hazardous constituents into ground water, surface water, soil, or air) shall not be used. Submit Notices of Non-Compliance and Notices of Violation by a Federal, state, or local regulatory agency issued to the Contractor in relation to any work performed under this contract. Immediately provide copies of such notices to the Contracting Officer. Also furnish all relevant documents regarding the incident and any information requested by the Contracting Officer, and coordinate its response to the notice with the Contracting Officer or the designated representative prior to submission to the notifying authority. Also furnish a copy to the Contracting Officer of all documents submitted to the regulatory authority, including the final reply to the notice, and all other materials, until the matter is resolved.

3.2.1 Treatment, Storage, and/or Disposal Facility and Transporter

Provide the Contracting Officer with EPA ID numbers, names, locations, and telephone numbers of TSD facilities and transporters. This information shall be contained in the Hazardous Waste Management Plan and shall be approved by the Contracting Officer prior to waste disposal.

3.2.2 Status of the Facility

Facilities receiving hazardous waste shall be permitted in accordance with

40 CFR 270 or operating under interim status in accordance with 40 CFR 265 requirements, or permitted by a state authorized by the Environmental Protection Agency to administer the RCRA permit program. Additionally, prior to using a TSD Facility, contact the EPA Regional Offsite Coordinator specified in 40 CFR 300, Section .440, to determine the facility's status, and document all information necessary to satisfy the requirements of the EPA Offsite policy and submit this information to the Contracting Officer.

3.2.3 Shipping Documents and Packagings Certification

Prior to shipment of any hazardous material offsite and a minimum of 2 days prior to anticipated pickup, provide for review written certification to the Contracting Officer that hazardous materials have been properly packaged, labeled, and marked in accordance with Department of Transportation and EPA requirements. Furnish designated disposal facility packaging assurances by the not later than 35 days after acceptance of the shipment. The Contractor's TDC shall also provide written certification regarding waste minimization efforts documenting that efforts have been taken to reduce the volume and toxicity of waste to the degree economically practicable and that the method of treatment, storage, or disposal selected minimizes threats to human health and the environment.

3.2.4 Transportation

Prior to conducting hazardous materials activities, the Contractor responsible for pre-transportation activities shall either certify to the Government that a Security Plan is in place which meets the requirements of 49 CFR 172, Subpart I or in the event that the types or amounts of hazardous materials are excluded from the security planning requirements, a written statement to that effect detailing the basis for the exception. Use manifests for transporting hazardous wastes as required by 40 CFR 263 or any applicable state or local law or regulation. Transportation shall comply with all requirements in the Department of Transportation referenced regulations in the 49 CFR series. Prepare hazardous waste manifests for each shipment of hazardous waste shipped offsite. Manifests shall be completed using instructions in 40 CFR 262, Subpart B and any applicable state or local law or regulation. Submit manifests and waste profiles to Contracting Officer for review and approval. Prepare land disposal restriction notifications as required by 40 CFR 268 or any applicable state or local law or regulation for each shipment of hazardous waste. Submit notifications with the manifest to the Contracting Officer for review and approval. In accordance with DOT 4500.9R, inspect motor vehicles used to transport hazardous materials in accordance the 49 CFR and DOT safety regulations and complete DDForm 626, Motor Vehicle Inspection .

3.2.5 Treatment and Disposal of Hazardous Wastes

The hazardous waste shall be transported to an approved hazardous waste treatment, storage, or disposal facility within 90 days of the accumulation start date on each container . Ship hazardous wastes only to facilities which are properly permitted to accept the hazardous waste or operating under interim status. Ensure wastes are treated to meet land disposal treatment standards in 40 CFR 268 prior to land disposal. Propose TSD facilities via submission of the Hazardous Waste Management Plan, subject to the approval of the Contracting Officer. Submit Certificates of Disposal documenting the ultimate disposal, destruction or placement of asbestos within 180 days of initial shipment. Receipt of

these certificates will be required for final payment.

3.3 OBTAINING EPA ID NUMBERS

Complete EPA Form 8700-12, Notification of Hazardous Waste Activity, and submit to the Contracting Officer for review and approval. Allow a minimum of 30 days for processing the application and assigning the EPA ID number. Shipment shall be made not earlier than one week after receipt of the EPA ID number.

3.4 WASTE MINIMIZATION

Minimize the generation of hazardous waste to the maximum extent practicable and take all necessary precautions to avoid mixing clean and contaminated wastes. Identify and evaluate recycling and reclamation options as alternatives to land disposal. Requirements of 40 CFR 266 shall apply to: hazardous wastes recycled in a manner constituting disposal; hazardous waste burned for energy recovery; lead-acid battery recycling; and hazardous wastes with economically recoverable precious metals. Submit written certification that waste minimization efforts have been undertaken to reduce the volume and toxicity of waste to the degree economically practicable and that the method of treatment, storage, or disposal selected minimizes threats to human health and the environment.

3.5 RECORDKEEPING

Maintain adequate records to support information provided to the Contracting Officer regarding exception reports, annual reports, and biennial reports; maintain asbestos waste shipment records for a minimum of 3 years from the date of shipment or any longer period required by any applicable law or regulation or any other provision of this contract; and maintain bill of ladings for a minimum of 375 days from the date of shipment or any longer period required by any applicable law or regulation or any other provision of this contract. Submit information necessary to file state annual or EPA biennial reports for all hazardous waste transported, treated, stored, or disposed of under this contract. Do not forward these data directly to the regulatory agency but to the Contracting Officer at the specified time. The submittal shall contain all the information necessary for filing of the formal reports in the form and format required by the governing Federal or state regulatory agency. A cover letter shall accompany the data to include the contract number, Contractor name, and project location. In the events that a manifest copy documenting receipt of hazardous waste at the treatment storage and disposal facility is not received within 35 days of shipment initiation, or that a manifest copy documenting receipt of PCB waste at the designated facility is not received within 35 days of shipment initiation, prepare and submit an exception report to the Contracting Officer within 37 days of shipment initiation.

3.6 SPILL RESPONSE

In the event of a spill or release of a hazardous substance (as designated in 40 CFR 302), or pollutant or contaminant, or oil (as governed by the Oil Pollution Act (OPA), 33 U.S.C. 2701 et seq.), notify the Contracting Officer immediately. Any direction from the Contracting Officer concerning a spill or release shall not be considered a change under the contract. If the spill exceeds a reporting threshold, follow the pre-established procedures for immediate reporting to the Contracting Officer. Comply with all applicable requirements of Federal, state, or

local laws or regulations regarding any spill incident.

3.7 EMERGENCY CONTACTS

The Contractor is responsible for complying with the emergency contact provisions in 49 CFR 172, Section .604. Whenever the Contractor ships hazardous materials, provide a 24 hr emergency response contact and phone number of a person knowledgeable about the hazardous materials being shipped and who has comprehensive emergency response and incident mitigation information for that material, or has immediate access to a person who possesses such knowledge and information. The phone shall be monitored on a 24 hour basis at all times when the hazardous materials are in transportation, including during storage incidental to transportation. Ensure that information regarding this emergency contact and phone number are placed on all hazardous material shipping documents. Designate an emergency coordinator and post the following information at areas in which hazardous wastes are managed:

a. The name of the emergency coordinator.

b. Phone number through which the emergency coordinator can be contacted on a 24 hour basis.

c. The telephone number of the local fire department.

d. The location of fire extinguishers and spill control materials.

Attachment A SAMPLE OFF-SITE POLICY CERTIFICATION MEMO	
Project/Contract #:	
Waste Stream:	
Primary TSD Facility, EPA ID # and Location:	
Alter. TSD Facility, EPA ID # and Location:	
EPA Region	Contact
I	(617) 918-1752
II	(212) 637-4130
III	(214) 814-5267
IV	(404) 562-8591
V	(312) 353-8207
VI	(214) 665-2282
VII	(913) 551-7154
VIII	(303) 312-6419
IX	(415) 972-3304
X	(206) 553-2859
EPA representative contacted:	
EPA representative phone number:	
Date contacted:	
Comment:	
The above EPA representative was contacted on _____. As of that date the above sites were considered acceptable in accordance with the Off-Site Policy in 40 CFR 300.440.	
Date:	Signature:
Phone number:	

-- End of Section --

SECTION 02 61 13

EXCAVATION AND HANDLING OF CONTAMINATED MATERIAL
02/10, CHG 1: 02/21

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT

1.1.1 Measurement

Base measurement for excavation and onsite transportation on the actual number of cubic yards of contaminated material in-place prior to excavation. Base determination of the volume of contaminated material excavated on cross-sectional volume determination reflecting the differential between the original elevations of the top of the contaminated material and the final elevations after removal of the contaminated material. Base measurement for backfilling of excavated areas on in-place cubic yards of compacted fill. Base measurement for construction of stockpile areas on the number of square yards of stockpile liner constructed.

1.1.2 Payment

1.1.2.1 Excavation and Transportation

Compensation for excavation and onsite transportation of contaminated material will be paid as a unit cost. Include any other items incidental to excavation and handling not defined as having a specific unit cost.

1.1.2.2 Backfilling

Compensation for backfill soil, transportation of backfill, backfill soil conditioning, backfilling, compaction, and geotechnical testing will be paid as a single unit cost.

1.1.2.3 Stockpiling

Compensation for construction of stockpile areas will be paid for as a unit cost. Include all aspects of grading, preparation, handling, placement, maintenance, removal, treatment, and disposal of stockpile cover materials and liner materials and all other items incidental to construction of stockpiles in the unit cost.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D5434	(2012) Field Logging of Subsurface Explorations of Soil and Rock

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2024) Safety -- Safety and Health

Requirements Manual

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1926	Safety and Health Regulations for Construction
40 CFR 302	Designation, Reportable Quantities, and Notification

1.3 DESCRIPTION OF WORK

The work consists of excavation and temporary storage of contaminated soil and groundwater. Characterization data on the nature and extent of the contaminated material is shown in Appendices. Subsurface conditions are shown on the drawings and in Appendix A attached to the specification. Submit a Work Plan as specified below. Notify the Contracting Officer within 24 hours, and before excavation, if contaminated material is discovered that has not been previously identified or if other discrepancies between data provided and actual field conditions are discovered. Backfill material is not available onsite. Ground water is approximately 1 to 4 feet below pre-excavation ground surface. Conduct required sampling and chemical analysis in accordance with 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

1.3.1 Scheduling

Notify the Contracting Officer 30 calendar days prior to the start of excavation of contaminated material. The Contractor is responsible for contacting regulatory agencies in accordance with the applicable reporting requirements.

1.3.2 Work Plan

Submit a Work Plan within 30 calendar days after notice to proceed. Do not perform work at the site, except site inspections and surveys, until the Work Plan is approved. Allow 30 calendar days in the schedule for the Government's review. No adjustment for time or money will be made if resubmittals of the Work Plan are required due to deficiencies in the plan. At a minimum, include the following in the the Work Plan:

a. Schedule of activities.

b. Method of excavation and equipment to be used.

c. Shoring or side-wall slopes proposed.

d. Dewatering plan.

e. Storage methods and locations for liquid and solid contaminated material.

f. Borrow sources and haul routes.

g. Decontamination procedures.

h. Spill contingency plan.

1.3.3 Other Submittal Requirements

Submit separate cross-sections of each area before and after excavation and after backfilling, test results, and 5 copies of the Closure Report within 14 calendar days of work completion at the site.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Work Plan; G

SD-02 Shop Drawings

SURVEYS; G

SD-06 Test Reports

Closure Report; G

1.5 REGULATORY REQUIREMENTS

1.5.1 Permits and Licenses

Obtain required federal, state, and local permits for excavation and storage of contaminated material. Obtain permits at no additional cost to the Government.

1.5.2 Air Emissions

Monitor and control air emissions in accordance with Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

PART 2 PRODUCTS

2.1 SPILL RESPONSE MATERIALS

Provide appropriate spill response materials including, but not limited to the following: containers, adsorbents, shovels, and personal protective equipment. Make spill response materials available at all times when contaminated materials/wastes are being handled or transported. Provide spill response materials that are compatible with the type of materials and contaminants being handled.

2.2 BACKFILL

Excavated material may be re-used at the site, provided it meets the requirements of specification section 31 00 00 EARTHWORK. Obtain addition backfill material from offsite sources approved by the Contracting Officer, tested and classified in accordance with Section 31 00 00 EARTHWORK.

PART 3 EXECUTION

3.1 SURVEYS

Perform surveys immediately prior to and after excavation of contaminated material to determine the volume of contaminated material removed. Also, perform surveys immediately after backfill of each excavation. Provide cross-sections on 25 foot intervals and at break points for all excavated areas. Survey and show locations of confirmation samples on the drawings.

3.2 EXISTING STRUCTURES AND UTILITIES

Do not perform excavation until site utilities have been field located. Take the necessary precautions to ensure no damage occurs to existing structures and utilities. Repair damage to existing structures and utilities resulting from the Contractor's operations at no additional cost to the Government. Do not disturb utilities encountered that were not previously shown or otherwise located without approval from the Contracting Officer.

3.3 CONTAMINATED MATERIAL REMOVAL

3.3.1 Excavation

Excavate areas of contamination to the depth and extent shown on the drawings and not more than 0.2 ft beyond the depth and extent shown on the drawings unless directed by the Contracting Officer. Perform excavation in a manner that will limit spills and the potential for contaminated material to be mixed with uncontaminated material. Maintain an excavation log describing visible signs of contamination encountered for each area of excavation. Prepare excavation logs in accordance with ASTM D5434. During excavation, a photoionization detector (PID) shall be used to screen for worker safety. Permissible Exposure Limits (PELs) for the contaminants of concern shall be established by the Contractor and included in the Contractor's Accident Prevention Plan (APP) and Work Plan.

3.3.2 Shoring

If workers must enter the excavation, evaluate, shore, slope or brace it as required by EM 385-1-1 and 29 CFR 1926 section 650.

3.3.3 Dewatering

Divert surface water to prevent entry into the excavation. Limit dewatering to that necessary to assure adequate access, a safe excavation, prevent the spread of contamination, and to ensure that compaction requirements can be met. Per Installation requirements, all groundwater encountered must be stored and tested for PFAS analytes using EPA Method 1633 before discharge and meet discharge requirements per DoD cleanup requirements and the requirements provided in Appendix A attached to this specification. After treatment, discharge the treated groundwater at the Fort Dix Waste Water Treatment Plant (WWTP). Limit the amount of discharge sent to the Fort Dix WWTP to no more than 10,000 gallons per day. See the drawings for the treated groundwater disposal location at the Fort Dix WWTP.

3.4 CONFIRMATION SAMPLING AND ANALYSIS

The Contracting Officer will be present to inspect the removal of

contaminated material from each site. After all material suspected of being contaminated has been removed, examine the excavation for evidence of contamination. Excavate additional material as directed by the Contracting Officer. After all suspected contaminated material is removed, collect confirmation samples and analyze for contaminants of concern.

For sample collection, follow Table 1 of Department of Air Force Best Management Practices for Addressing Contaminated Soils on Military Construction and Facilities Sustainment, Restoration, and Modernization Projects Memorandum dated March 4, 2025 or as directed by the Contracting Officer. Mark locations of samples in the field and document on the as-built drawings.

3.5 CONTAMINATED MATERIAL STORAGE

Place material in temporary storage immediately after excavation and after treatment while awaiting test results. The following paragraphs describe acceptable methods of material storage. For further guidance on contaminated material storage, refer to Department of the Air Force Best Management Practices (BMP)for Addressing Contaminated Soils on Military Construction and Facilities Sustainment, Restoration, and Modernization Projects Playbook. Provide storage units that are in good condition and constructed of materials that are compatible with the material or liquid to be stored. If multiple storage units are required, clearly label each unit with an identification number and keep a written log to track the source of contaminated material in each temporary storage unit.

3.5.1 Stockpiles

Construct stockpiles to isolate stored contaminated material from the environment. Stockpile size greater than 250 cubic yards is prohibited. Construct stockpiles to include:

a. Geomembrane cover free of holes or other damage to prevent precipitation from entering the stockpile. Provide non-reinforced geomembrane covers that have a minimum thickness of 10 mils. Provide scrim reinforced geomembrane covers that have a minimum weight of 40 lbs/1000 square feet. Extend the cover material over the berms and anchor or ballast to prevent it from being removed or damaged by wind.

b. Berms surrounding the stockpile, a minimum of 12 inches in height. Berm vehicle access points.

c. Slope the liner system to allow collection of leachate. Storage and removal of liquid which collects in the stockpile, in accordance with paragraph Liquid Storage.

3.5.2 Roll-Off Units

Use water-tight roll-off units used to temporarily store contaminated material. Place a cover over the units to prevent precipitation from contacting the stored material. Remove liquid which collects inside the units and store in accordance with paragraph Liquid Storage.

3.5.3 Liquid Storage

Liquid collected from excavations and stockpiles can either be stored in a temporary storage/frac tank or transferred directly to a temporary mobile

treatment system capable of treating PFAS, and petroleum and chlorinated hydrocarbon-contaminated water to the discharge requirements or the most recent applicable Federal, State, or local regulations regarding the discharge of petroleum and chlorinated hydrocarbons. Liquid storage containers shall be water-tight and shall be located as indicated in the Drawings. Liquid will be stored on-site no longer than 90 days after treatment is complete.

3.6 SAMPLING

3.6.1 Sampling of Stored Material

Collect samples of stored material at a frequency of once per 500 cubic yards. Test samples for the following:

Chemical Parameter	
VOCs using EPA method 8260 PFAS using EPA method 1633 Total Petroleum Hydrocarbons using a State-approved method	

Analyses for contaminated material to be taken to an offsite treatment facility must conform to local, state, and federal criteria as well as to the requirements of the treatment facility. Furnish documentation of all analyses performed to the Contracting Officer. Additional sampling and analyses to the extent required by the approved offsite treatment, storage or disposal (TSD) facility is the responsibility of the Contractor and must be performed at no additional cost to the Government.

3.6.2 Sampling Liquid

Sample liquid collected from excavations and storage areas at a frequency of once for every full holding vessel of liquid collected. Test samples for the following:

Chemical Parameter	
VOCs using EPA method 8260 PFAS using EPA method 1633 Total Petroleum Hydrocarbons using a State-approved method	

Treat liquid with contaminant levels that exceed action levels onsite. Dewater and use Granular activated carbon (GAC) to remove PFAS and other contaminants. After filtration is completed, hold treated water in frac tanks and test treated water until testing results show all contaminants are treated to USEPA MCLs for VOCs, Total Petroleum Hydrocarbons and the DOD-approved screening levels for PFAS. Once testing demonstrates treatment is successful, discharge water at the Fort Dix WWTP. Discharge Volume must not exceed 10,000 gallons per day.

3.7 SPILLS

In the event of a spill or release of a hazardous substance (as designated in 40 CFR 302), pollutant, contaminant, or oil (as governed by the Oil Pollution Act (OPA), 33 U.S.C. 2701 et seq.), notify the Contracting Officer immediately. If the spill exceeds the reporting threshold, follow the pre-established procedures as described in the Base Wide Contingency Plan for immediate reporting and containment. Take immediate containment actions to minimize the effect of any spill or leak. Perform cleanup in accordance with applicable federal, state, and local regulations. As directed by the Contracting Officer, perform additional sampling and testing to verify spills have been cleaned up. Perform spill cleanup and testing at no additional cost to the Government.

3.8 BACKFILLING

3.8.1 Confirmation Test Results

Backfill excavations immediately after all contaminated materials have been removed and confirmation test results have been approved. Place and compact backfill to the lines and grades shown on the drawings.

3.8.2 Compaction

Place approved backfill in accordance with Section 31 00 00 EARTHWORK.

3.9 DISPOSAL REQUIREMENTS

Perform offsite disposal of contaminated material in accordance with Section 02 81 00 TRANSPORTATION AND DISPOSAL OF HAZARDOUS MATERIALS.

3.10 CLOSURE REPORT

Submit 5 copies of a Closure Report within 14 calendar days of completing work at the site. Label the report with the contract number, project name, location, date, name of general Contractor, and the Corps of Engineers District contracting for the work. As a minimum, include the following information:

a. A cover letter signed by a Professional Engineer registered in the State of New Jerey who is a responsible company official certifying that all services involved have been performed in accordance with the terms and conditions of the contract documents and regulatory requirements.

b. A narrative report including, but not limited to, the following:

(1) site conditions, ground water elevation, and cleanup criteria;

(2) excavation logs;

(3) field screening readings;

(4) quantity of materials removed from each area of contamination;

(5) quantity of water/product removed during dewatering;

(6) sampling locations and sampling methods;

(7) sample collection data such as time of collection and method of preservation;

(8) sample chain-of-custody forms; and

(9) source of backfill.

c. Copies of all chemical and physical test results.

d. Copies of all manifests and land disposal restriction notifications.

e. Copies of all certifications of final disposal signed by the responsible disposal facility official.

f. Waste profile sheets.

g. Scale drawings showing limits of each excavation, limits of contamination, known underground utilities within 50 feet of excavation, sample locations, and sample identification numbers. Show on-site stockpile, storage, treatment, loading, and disposal areas on the drawings.

h. Progress Photographs. Use color photographs to document progress of the work. Take a minimum of four views of the site showing the location of the area of contamination, entrance/exit road, and any other notable site conditions before work begins. After work has been started, photographically record daily activities at each work location. Provide photographs that include:

(1) Soil removal and sampling.

(2) Dewatering operations.

(3) Unanticipated events such as spills and the discovery of additional contaminated material.

(4) Contaminated material/water storage, handling, treatment, and transport.

(5) Site or task-specific employee respiratory and personal protection.

(6) Fill placement and grading.

(7) Post-construction photographs. After completion of work at each site, take a minimum of four views of each excavation site.

Include a digital version of all photos shown in the report with the Closure Report. Attach an information box to each print. Arrange the typewritten box as follows:

Project Name:	Direction of View:
Location:	Date/Time:
Photograph No.:	Description of View:

-- End of Section --

ASSISTANT SECRETARY OF DEFENSE
3400 DEFENSE PENTAGON
WASHINGTON, DC 20301-3400

ENERGY, INSTALLATIONS,
AND ENVIRONMENT

CLEARED
For Open Publication

Jan 21, 2025

Department of Defense
OFFICE OF PREPUBLICATION AND SECURITY REVIEW

MEMORANDUM FOR ASSISTANT SECRETARY OF THE ARMY (INSTALLATIONS, ENERGY, AND ENVIRONMENT)
ASSISTANT SECRETARY OF THE NAVY (ENERGY, INSTALLATIONS, AND ENVIRONMENT)
ASSISTANT SECRETARY OF THE AIR FORCE (ENERGY, INSTALLATIONS, AND ENVIRONMENT)
DIRECTOR, NATIONAL GUARD BUREAU (JOINT STAFF, J3/4/7)
DIRECTOR, DEFENSE LOGISTICS AGENCY (INSTALLATION MANAGEMENT)

SUBJECT: Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program

The Department of Defense (DoD) conducts cleanup under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the Defense Environmental Restoration Program (DERP). Our goal is protection of human health and the environment in a risk-based, fiscally-sound manner. This memorandum provides clarifying technical guidance on the investigation of per- and polyfluoroalkyl substances (PFAS) based on updated U.S. Environmental Protection Agency (EPA) information. This guidance is applicable to investigating these chemicals at Environmental Restoration Account-funded, Base Realignment and Closure Account-funded, and federal Air and Army Guard Operation and Maintenance account-funded sites.

EPA establishes Regional Screening Levels (RSLs) for many chemicals addressed under CERCLA. RSLs reflect chemical-specific concentrations for individual contaminants in air, drinking water, and soils that, if exceeded, may warrant further investigation. RSLs for PFAS continue to change as new toxicity values are used to refine existing RSLs or develop new RSLs for additional PFAS. When EPA updates the RSLs for PFAS, the Department evaluates and incorporates the updated RSLs, as appropriate, into DoD investigations. As part of this evaluation, the Department considers several factors, such as detectability, the availability of peer-reviewed science[1], and the availability of EPA-approved analytical methods. When one of these criteria is not met and DoD is unable to use an RSL, DoD provides an adjusted screening level with a justification for why the screening level was chosen. This approach ensures DoD is including as many PFAS as possible in its investigations, while also maintaining consistency and the highest level of data quality across the Department.

EPA RSLs that are derived from toxicity values that meet the criteria for data quality may still have analytical limitations. Certain PFAS have EPA-approved analytical methods but have RSL values below the method detection limit (MDL). When a PFAS has a RSL below the pooled MDL identified in EPA Method 1633, DoD will use the maximum contaminant level

[1] DoD Instruction on Emerging Chemicals (ECs) of Environmental Concern (DoDI 4715.18, 2024), Appendix 3A

(MCL), if established, as the DoD screening level for tap water and groundwater used as drinking water. Where there is no established MCL, DoD will use the pooled MDL identified in EPA Method 1633.

EPA Method 1633 has not been validated for certain PFAS analytes included in EPA's RSL tables. DoD Components will only use a laboratory accredited to EPA Method 1633 by the DoD Environmental Laboratory Accreditation Program (ELAP) for all PFAS analyzed in each matrix. In cases where a DoD Component's site-specific conceptual site model (CSM) identifies an analyte that is not listed as being validated by an EPA-approved analytical method, laboratories can add additional PFAS to the analyte list as necessary[2].

Attachment 1 identifies PFAS screening levels, including EPA RSLs and DoD-adjusted screening levels, that DoD Components will incorporate into DoD investigations. Attachment 2 is provided for reference and includes the EPA RSLs on which attachment 1 values are based and identifies any RSLs not incorporated into DoD investigations for reasons listed above.

DoD Components will incorporate the screening levels listed in attachment 1 into preliminary assessment/site inspections (PA/SI) to determine if further investigation in the remedial investigation (RI) phase is warranted, or if no further action is required. PA/SIs that were previously completed using older RSL values with determinations of "no further action" will be re-assessed based on the updated screening levels in attachment 1. When in the RI phase, DoD Components will follow the established CERCLA risk assessment process[3], which includes using EPA peer-reviewed values.

PFAS will be addressed in the same manner as other chemicals under DERP. Evaluations of site conditions should consider historical and current activities and chemical use and identify chemicals that were likely to have been released as a result of DoD activities[4]. Consistent with CERCLA - and as with all chemicals - DoD Components should use the CSM to determine the appropriateness of addressing chemicals for which DoD is not likely the source.

This memorandum is effective immediately and supersedes and cancels the Assistant Secretary of Defense for Energy, Installations, and Environment memorandum, "Investigating Per- and Polyfluoroalkyl Substances within the Department of Defense Cleanup Program," August 24, 2023, and the subsequent website update accounting for EPA's November 2023 updated RSLs. DoD will reflect these changes to PFAS-related RSLs and DoD-adjusted screening levels on its PFAS website at: https://www.acq.osd.mil/eie/eer/ecc/pfas/tf/policies.html.

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[2] The laboratory must validate performance, and establish quality control criteria for any additional PFAS, as required by DoD ELAP. This information must be documented in the laboratory's procedure.

[3] The risk assessments process will be done in collaboration with regulators and in accordance with Risk Assessment Guidance for Superfund Volume I, Part A (EPA/540/1-89/002, December 1989).

[4] Chemicals have been detected at DoD installations that are not a result of DoD activities. HFPO-DA, as an example, has primarily been used in the manufacture of fluoropolymers, so it is not likely to have been released at the vast majority of DoD properties.

The point of contact for this matter is Ms. Cristina Harvey at 703-571-9067 or marcia.c.harvey2.civ@mail.mil.

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Brendan M. Owens

Attachments:
As stated

Attachment 1: DoD Screening Levels[1] for PFAS for Use in DoD Preliminary Assessments/Site Inspections (November 2024)

Chemical	Chemical Abbreviation	CASRN	DoD Screening Levels [2,3]	
			Tap Water[4] (ng/L or ppt)	Residential Soil (µg/kg or ppb)
hexafluoropropylene oxide dimer acid	HFPO-DA (GenX)	13252-13-6	1.5	23
perfluorobutanoic acid	PFBA	375-22-4	1,800	7,800
perfluorobutanesulfonic acid	PFBS	375-73-5	600	1,900
perfluorohexanoic acid	PFHxA	307-24-4	990	3,200
perfluorohexanesulfonic acid	PFHxS	355-46-4	10(7)	130
perfluorononanoic acid	PFNA	375-95-1	5.9	19
perfluorooctanoic acid	PFOA	335-67-1	4.0(5)	0.070(6)
perfluorooctanesulfonic acid	PFOS	1763-23-1	4.0(5)	0.63
bis(trifluoromethylsulfonyl)amine	TFSI	82113-65-3	590	2,300
perfluoropropanoic acid	PFPrA	422-64-0	980	3,900
perfluorodecanoic acid	PFDA	335-76-2	0.52(6)	0.06(6)

CASRN: Chemical Abstracts Service Registry Number

1. The DoD PFAS screening levels are based on EPA's RSL tables dated November 2024 except where the EPA RSLs were below the MDLs of EPA-approved analytical methods.
2. The PFAS screening levels in attachment 1 are provided with a level of precision to two significant figures, consistent with the EPA's RSL Tables.
3. The DoD PFAS screening levels assume multiple PFAS are present and therefore use a hazard quotient (HQ) = 0.1
4. Screening levels are for tap water and groundwater that is used for drinking water.
5. Certain PFAS RSLs have EPA-approved analytical methods, but with values that are below the method detection limit (MDL). For PFAS with RSLs below the MDL and with an established maximum contaminant level (MCL), DoD uses the MCL as the screening level.
6. Certain PFAS RSLs have EPA-approved analytical methods, but with values that are below the method detection limit. For PFAS with RSLs below the method detection limit (MDL) that do not have an MCL, DoD uses the method's pooled MDL to establish consistent and measurable values.
7. Certain PFAS RSLs have EPA-approved analytical methods and with RSLs higher than the established MCL. For PFAS with RSLs above the MCL, DoD uses the MCL as the screening level.

Attachment 2: EPA Regional Screening Levels for PFAS in Tap/Groundwater and Soil (November 2024)[1]

Chemical	Chemical Abbreviation	CASRN	November 2024	
			TR=1E-06, HQ=0.1 (2)	
			Tap Water[3]	Residential Soil
			(ng/L or ppt)	(μg /kg or ppb)
hexafluoropropylene oxide dimer acid	HFPO-DA (GenX)	13252-13-6	1.5	23
perfluorobutanoic acid	PFBA	375-22-4	1,800	7,800
perfluorobutanesulfonic acid	PFBS	375-73-5	600	1,900
perfluorohexanoic acid	PFHxA	307-24-4	990	3,200
perfluorohexanesulfonic acid	PFHxS	355-46-4	39(6)	130
perfluorononanoic acid	PFNA	375-95-1	5.9	19
perfluorooctanoic acid	PFOA	335-67-1	0.0027(4)	0.019(4)
perfluorooctanesulfonic acid	PFOS	1763-23-1	0.20(4)	0.63
bis(trifluoromethylsulfonyl)amine	TFSI	82113-65-3	590	2300
perfluoropropanoic acid	PFPrA	422-64-0	980	3,900
perfluorodecanoic acid	PFDA	335-76-2	0.004(4)	0.013(4)
perfluoroundecanoic acid(5)	*PFUDA*	*2058-94-8*	*600*	*1,900*
perfluorododecanoic acid(5)	*PFDoDA*	*307-55-1*	*100*	*320*
perfluorotetradecanoic acid(5)	*PFTetDA*	*376-06-7*	*2,000*	*6,300*
perfluorooctadecanoic(5)	*PFODA*	*16517-11-6*	*80,000*	*250,000*

THQ=Target Hazard Quotient
TR=Target Risk
CASRN: Chemical Abstracts Service Registry Number

1. Non-carcinogenic reference doses (RfDs) and carcinogenic oral slope factors (OSFs) will be selected in accordance with Appendix 3A, DoD Instruction 4715.18 (DoDI 4715.58, 4 September 2019).
2. When multiple PFAS are encountered at a site, RSLs set at a hazard quotient of 0.1 are used for screening purposes.
3. RSLs are for tap water and groundwater that is used for drinking water.
4. These PFAS RSLs have EPA-approved analytical methods, but with values that are below the method detection limit (MDL). These values were not incorporated.
5. These PFAS RSLs were based on toxicity values that were not peer-reviewed and therefore do not meet the minimum data quality standards provided in DoD Instruction on Emerging Chemicals (ECs) of Environmental Concern (DoDI 4715.18, 2024), Appendix 3A. These values are not incorporated in either DoD PA/SI or RI assessments.

6. This PFAS RSL has EPA-approved analytical methods and with an RSL value higher than the established MCL. This value was not incorporated.

8.0 CONCLUSIONS AND RECOMMENDATIONS

The U.S. Air Force (USAF) has completed environmental investigations at five study areas on Joint Base McGuire-Dix-Lakehurst (JB MDL) Operable Unit 8 (OU-8), also known as the Triangle Area Operable Unit, to identify areas of environmental concern resulting from historical fire training, suspected fire training, and industrial operations and to assess potential human health and ecological impacts. Site characterizations were developed from phased remedial investigations (RIs) and historical site information to document the extent of environmental concerns that are the result of previous military activity. The Phase II RI at OU-8 was conducted at former fire training areas (FTAs) FT-08 and FT-11, at suspected former FTAs AT-28 and AT-29, and at the former Non-Destructive Inspection (NDI) shop area (OT-14). The OU-8 RI project objectives established in the OU-8 Remedial Investigation Work Plan (RIWP) (SAIC 2011) and shown below are documented in this report, as described in the subsequent sections:

- Determine the nature and extent and risks associated with the detected concentrations of chemicals of potential concern (COPCs) in soil, groundwater, surface water, and surface sediment.
- Delineate the horizontal and vertical extent of groundwater and soil contamination.
- Confirm the presence or absence of definable groundwater contaminant plume(s) using permanent monitoring wells.
- Define local-scale groundwater flow direction and flow rate and evaluate aquifer homogeneity/heterogeneity through hydrogeologic testing of permanent monitoring wells.
- Investigate the potential for a confining layer underlying the surface aquifer.
- Evaluate the background distribution of metals, pesticides, and polycyclic aromatic hydrocarbon (PAH) concentrations in soil, surface water, sediment, and groundwater.
- Conduct a human health risk assessment (HHRA) and screening-level ecological risk assessment (SLERA).

The use of fuels, waste solvents, oils, and other combustible components in the former FTA and suspected FTA sites, the residues of these activities, and waste discharges to surface drainage from the NDI shop are the primary concerns for the environmental investigations at OU-8.

8.1 SUMMARY OF REMEDIAL INVESTIGATION RESULTS

The Phase I/II characterization studies at OU-8 consisted of the installation and sampling of 286 Triad-based temporary monitoring wells, 51 permanent monitoring wells, 47 CPT locations, 54 soil borings, 151 groundwater elevation measurements, and 17 aquifer (slug) tests. Screening-level Triad-based groundwater investigations were conducted at OU-8 between March and May 2008 and in September 2011 to delineate and bound lateral and vertical groundwater concentrations. The analytical results from the Triad groundwater sampling were used with inferred groundwater flow directions to optimize the location and screen depths of permanent groundwater monitoring wells in each site area. Permanent monitoring well sampling was conducted between January and April 2013. Chemical data quality was evaluated by comparison of constituent concentrations in environmental samples to quality

assurance/quality control (QA/QC) blank samples from the field and laboratory. Inorganic chemical constituents, pesticides, and PAH concentrations were compared against site-specific background concentrations (BEM 2013) to identify site-related constituents for nature and extent assessments. Site-related inorganic and organic constituent concentrations were compared to conservative Project Action Limits (PALs) established at the JB MDL – McGuire area OU-06, OU-07, and OU-08 (SAIC 2011). Conservative PAL concentrations that were applied to the data consisted of New Jersey Residential Direct Contact Soil Remediation Standards (NJ RDCSRS) (NJDEP 2012), New Jersey Practical Quantitation Limits (PQLs), and U.S. Environmental Protection Agency (USEPA) regional screening levels (RSLs) (USEPA 2013), as appropriate, to delineate areas of environmental contamination.

Environmental contamination at OU-8 varies by site area and is characterized predominantly by distributions of residual chlorinated solvent, fuel-related hydrocarbons, and metals compounds in groundwater and PAH, phthalate, dioxin/furan, pesticide, and metals concentrations in soil surface water and sediment occurring at concentrations that variably exceed conservative action levels. The primary release mechanism for environmental contamination is vertical migration of residual contaminants from site soils to groundwater. The depth of contamination for some compounds is attributed to dissolved-phase transport under prevailing vertical hydraulic gradients and chemical dispersion. Non-aqueous phase liquids (NAPLs) were not encountered at the OU-8 study areas.

Potentially affected geologic formations underlying OU-8 consist of interlayered sand, silt, and clay of the Cohansey Formation, the Kirkwood Formation, the Manasquan Formation, and the Vincentown Formation. Interpreted CPT profiles at OU-8 indicate a thickening trend of soil with sandy characteristics occurring eastward from Site FT-08 to Sites FT-11/AT-29 and extending to a depth of approximately 30 to 35 feet below ground surface (ft bgs). The Cohansey and Kirkwood Formations are underlain by silty and clayey sand to sandy silt and clay lithologies of the Manasquan and Vincentown Formations, which are distinguished by a dark-green gray, green-black, or gray coloration and the presence of glauconite and marine shell fragments. Intervals of cemented sand and gravel have also been encountered in the Manasquan/Vincentown Formations. Monitoring well borings at Site FT-08 indicate that the depth to the top of the Manasquan/Vincentown Formation ranges from 30 to 39.5 ft bgs in the northern portion of OU-8. The top of the Manasquan/Vincentown Formations declines to approximately 87.5 ft bgs near the southeastern boundary of OU-8 (URS 2002).

The hydraulic characteristics of the formations underlying OU-8 contribute to the fate and transport of chemical constituents in the environment through chemical and physical processes. Shallow groundwater at OU-8 occurs in the predominantly silty and clayey sand deposits of the Cohansey Sand and Kirkwood Formation. Groundwater elevations in the wells underlying OU-8 ranged between 0 and 8.9 ft bgs between January and May 2013. The overall direction of groundwater flow at OU-8 is to the east toward the JB MDL facility boundary; however, shallow groundwater flow is locally redirected by surface water drainages. Artesian conditions were observed in the 500-series well cluster at Site FT-08 and in well FT08-MW804. Upward-directed vertical hydraulic gradients were observed at Site AT-28 adjacent to a northwestward-flowing drainage; at Site AT-29 within the Jacks Run drainage south of the JB MDL property boundary; and in five well clusters at Site FT-08, with the most consistent upward gradients observed in the 500-series and 700-series well clusters near the surface drainage south of FT-08. Upward gradients were inconsistent away from the surface drainages. The overall geometric average hydraulic conductivity was measured at approximately 0.37 feet per day, with the maximum hydraulic conductivity observed in wells FT08-MW102 (3.87 to 6.02 feet per day) and AT29-MW402 (3.4 feet per day).

8.1.1 Former Fire Training Area No. 1 (Site FT-08)

Site FT-08 is a former FTA located in the northern portion of the Runway Triangle Area approximately 500 feet northwest of the hazardous cargo loading and parking area and 200 feet southwest of an active taxiway. The FTA was used from the late 1940s to 1958 to burn waste oils, aviation gasoline, jet fuel, hydraulic fluid, spent solvent, and alcohols during fire department training exercises. There were no precautions taken at that time to prevent seepage of the waste chemicals into the soil and groundwater from either the chemical holding area or the burn location.

Groundwater – Groundwater at Site FT-08 is impacted by volatile organic compounds (VOCs), primarily trichloroethylene (TCE) and benzene, and metals. Phase I Triad-based groundwater sampling delineated the horizontal and vertical extent of TCE and benzene in the groundwater. The distribution of TCE extends in the direction of the groundwater hydraulic gradient to the South Run tributary alignment, where trace TCE concentrations have been detected in the surface water. Benzene was not detected in the surface water. The maximum TCE concentration in groundwater was detected at a depth of 25 to 29 ft bgs, and the maximum benzene concentration was detected at a depth of 18 to 22 ft bgs. Phase II supplemental groundwater sampling detected isolated concentrations of TCE and benzene in groundwater between 10 and 30 ft bgs. Groundwater sampling of 31 multi-level permanent monitoring wells located based on the Triad distributions of TCE and benzene detected more localized concentrations of chlorinated solvents (TCE, cis-1,2-dichloroethene [cis-1,2-DCE], 1,2-dichloroethane [1,2-DCA]); aromatic hydrocarbons (benzene); and isolated concentrations of 2-hexanone, 1,1-DCE, and methylene chloride. Concentrations of TCE, cis-1,2-DCE, and 1,1-DCE exceeded the Class I groundwater PQLs in the 300-series well cluster and in well FT08-MW603, with maximum concentrations occurring at a depth of 20 to 30 ft bgs. Benzene concentrations exceeded the PQL in well FT08-MW304 and in the 600-series well cluster, with the maximum concentrations occurring at depths between 20 and 40 ft bgs. VOCs were non-detect or below PALs in the deeper wells; combined with Triad sampling, these results demonstrate that the vertical extent of contamination is defined. Dissolved and total metals constituents exceeded background concentrations and PQLs in shallow (<30 feet) and deep (≥30 ft bgs) groundwater at FT-08.

Surface and Subsurface Soil – Dioxin/furan compounds, semi-volatile organic compounds (SVOCs) (including nine PAH compounds), and pesticides are the predominant chemicals detected in the soil at Site FT-08. The highest concentrations of dioxin/furan compounds occur in the identified FTA; however, routine brush burning conducted near Site FT-08 or undocumented historical earth-moving activities at the site may contribute to the apparent random distribution of PAH and dioxin/furan detections in the surface soil.

Lateral delineation of dioxins in the surface soil has not been demarcated north of sample FT08-SS234, west of samples FT08-SS10 and FT08-SS238, and south of sample FT08-SS241. Ongoing brush-burning activity near FT-08 may limit the ability to fully delimit the lateral extent of dioxins in the surface soil. The highest concentrations of pesticides are located adjacent to the hazardous cargo parking area fence away from the former FTA and are unrelated to the FTA. The highest concentrations of SVOCs above screening criteria were observed in the southwest portion of the investigation area. The extent of SVOCs has been delineated laterally in the surface soil. The vertical extent of PAHs in subsurface soil has not been delineated fully to residential or non-residential soil standards. PAHs exceeded background concentrations in the southwest portion of FT-08 away from the suspected chemical storage area/burn area.

Inorganic chemicals are observed in a widespread, consistent distribution across FT-08. The metals detected in surface soil did not exceed residential soil remediation standard (SRS) or essential nutrient criteria. Concentrations of arsenic and thallium in subsurface soil exceeded background concentrations and residential criteria but did not exceed non-residential soil standards. The horizontal and vertical extent of inorganic chemicals in soil is delineated at FT-08.

Surface Water – Surface water in the stream drainage downslope from Site FT-08 is not presently affected by proximity to the former site area. Although organic constituent concentrations detected in the surface water at FT-08 in the most recent sampling were below the PALs, trace concentrations of TCE in the surface water in 2008 indicate a potential hydraulic pathway for solvent migration. Inorganic constituents in the surface water were below the established background (BEM 2013) concentrations or surface water PALs.

Sediment – Organic constituent concentrations detected in sediment from the South Run tributary at FT-08 consisted of isolated VOCs, PAH compounds, pesticides, dioxin/furan compounds, and metals. PAH and pesticide compounds detected in the sediment were below the JB MDL background for sediment (BEM 2013). Concentrations of PAH compounds exceeding the PALs were detected upstream of the FT-08 site area. Pesticide concentrations for 4,4'-dichlorodiphenyldichloroethane (4,4'-DDD), 4,4'-dichlorodiphenyldichloroethylene (4,4'-DDE), 4,4'-dichlorodiphenyltrichloroethane (4,4'-DDT), and dieldrin exceeded the PALs in the stream channel. Source areas for PAH and pesticide compounds in the surface drainage are abundant in OU-8 and the presence of PAH compounds at low concentrations in the sediment is not directly attributable to Site FT-08. Dioxin/furan compounds were detected in the central portion of the main stream channel topographically downslope from FT-08. Although dioxin compounds have been detected in the soil at FT-08, the presence of dioxin/furan compounds in the surface drainage may also be associated with the controlled burning of the open fields at OU-8. Inorganic constituents in the sediments associated with FT-08 were generally below background concentrations.

Fate and Transport at Site FT-08 – Potential chemical release mechanisms at FT-08 result from the use of metals-bearing waste fuels and solvents during historical fire training exercises over a shallow, permeable aquifer; diffusion and leaching from soil, resulting in migration to deeper soils and groundwater; surface run-off and transport to surface water and sediment; discharge of contaminated groundwater to surface water and sediment; and airborne particulate emission. Precipitation that does not leave the site as surface run-off or evapotranspiration infiltrates into the subsurface. The rate of infiltration is controlled by the frequency and volume of precipitation, surface cover, surface topography, and the saturated hydraulic conductivity of the surface soil. Water infiltrating through contaminated surface and subsurface soil or fill will take soluble chemicals into solution with transport to the underlying soil and groundwater. Factors that affect the leaching rate include the chemical concentration, chemical solubility, equilibrium soil/water distribution coefficient (K_d), pH, and volume of infiltration. The physical transport of inorganic and organic chemical constituents from the soil at FT-08 could be affected by the erosive effects of soil run-off with overland transport to surface water and sediment. A conceptual site model for Site FT-08 is provided in Section 5.0.

8.1.1.1 Human Health Risk Assessment for Site FT-08

An HHRA was conducted to estimate the risk to potential current and future Base Maintenance Workers, future Routine Site Workers, future Construction Workers, and hypothetical future Adult and Child Residents. Although it is unlikely that the shallow groundwater will be used as a drinking water source in the foreseeable future, the potential risks associated with shallow groundwater use were quantified for the Routine Worker and Resident.

Risk-based screening of surface and total soil data resulted in the identification of seven metals (aluminum, arsenic, beryllium, chromium, cobalt, iron, and thallium); dioxin/furans (as 2,3,7,8-tetrachlorodibenzodioxin [2,3,7,8-TCDD] equivalent [TEQ]); four pesticides (chlordane, dieldrin, alpha-chlordane, and gamma-chlordane); and seven SVOCs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene) as COPCs for quantitative risk evaluation.

Risk-based screening of groundwater data resulted in the identification of 16 metals (aluminum, arsenic, beryllium, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, thallium, vanadium, and zinc); one pesticide (endrin aldehyde); and four VOCs (1,2-dichlorooethane, benzene, TCE, and cis-1,2-DCE) as COPCs for quantitative risk evaluation.

Risk-based screening of surface water data from the FT-08 and AT-28 ditches resulted in the identification of 12 metals (aluminum, arsenic, beryllium, cadmium, chromium, cobalt, iron, lead, manganese, mercury, thallium, and vanadium) and two pesticides (4,4'-DDT and dieldrin) as COPCs for quantitative risk evaluation.

Risk-based screening of sediment data from the FT-08 and AT-28 ditches resulted in the identification of four metals (arsenic, beryllium, chromium, and iron); dioxin/furans (as 2,3,7,8-TCDD TEQ); and six SVOCs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene) as COPCs for quantitative risk evaluation. Results of the quantitative risk assessment for each of the four receptors are summarized below.

Current and Future Base Maintenance Worker – The total estimated cancer risk (3E-05) for the Base Maintenance Worker exposed to surface soil, surface water, and sediment is within the USEPA's acceptable risk range of 10-6 to 10-4 and the total noncancer Hazard Index (HI) (0.3) is less than 1.

Current and Future Routine Worker – The total estimated cancer risk (4E-04) for the Routine Worker exposed to surface soil, groundwater, surface water, and sediment is at the high end of USEPA's acceptable risk range of 10-6 to 10-4 and the total noncancer HI (21) is greater than 1. The estimated cancer risk is associated primarily with potable use of groundwater (2.7E-04) containing arsenic, benzene, and TCE. The estimated cancer risks for the Routine Worker exposed to surface soil (8.5E-05), surface water (6.2E-07), and sediment (2.2E-07) are within or below USEPA's acceptable risk range. The estimated noncancer HI is also associated primarily with potable use of groundwater (21) containing arsenic, iron, thallium, and TCE. The estimated HIs for the Routine Worker exposed to surface soil (0.2), surface water (0.1), and sediment (0.002) are all less than 1.

Future Construction Worker – The total estimated cancer risk for the Construction Worker (1E-05) exposed to total soil and groundwater is within USEPA's acceptable risk range of 10-6 to 10-4; however, the total noncancer HI (53) is greater than 1. The estimated noncancer HI is associated primarily with exposure to groundwater (53) containing TCE. The estimated HI for the Construction Worker exposed to total soil (0.1) is less than 1.

Future Resident – The total estimated cancer risk (2E-03) for a Resident exposed to surface soil, groundwater (potable use), surface water (recreational use), and sediment exceeds USEPA's acceptable risk range of 10-6 to 10-4 and the total noncancer HI (137) is greater than 1. The estimated cancer risks associated with potable use of groundwater (1.0E-03) containing arsenic, benzene, 1,2-DCA, and TCE and with exposure to surface soil (1.1E-03) containing carcinogenic PAH compounds (cPAHs), dieldrin, arsenic, and dioxins both exceed the acceptable risk range. The estimated cancer risks for the Resident exposed to surface water (2.8E-06) and sediment (5.8E-06) are within USEPA's acceptable risk range. The estimated noncancer HI is associated primarily with potable use of groundwater (132) containing aluminum, arsenic, cadmium, cobalt, iron, thallium, vanadium, and TCE. The estimated HI for the Resident Child exposed to surface soil (2.9) also exceeds 1 due primarily to the individual Hazard Quotient (HQ) for dieldrin of 1.3. The estimated HI for the Resident Child exposed to surface water is 1.2; however, all individual HQs are less than 1. The estimated HI for exposure to sediment (0.06) is less than 1.

8.1.1.2 Screening-Level Ecological Risk Assessment for Site FT-08

The potential for ecological risk at FT-08 was determined through a SLERA. The SLERA for the OU-8 Sites consisted of a characterization of the site ecological setting, development of an ecological conceptual site model (Eco-CSM), a description of the fate and transport of constituents detected in various environmental media, a description of the ecological receptors, a description of the complete exposure pathways, calculation of screening-level HQs for both community-level and food chain receptors, the identification of preliminary and final chemicals of potential ecological concern (COPECs), and a description of the uncertainties within the process.

A number of chemicals were identified as preliminary COPECs because of one or more of the following reasons: (1) the maximum detected concentrations (MDCs) exceeded ecological screening values (ESVs); (2) the constituents had no ESVs; (3) the constituents could potentially bioaccumulate; and (4) while not a bioaccumulative constituent, uptake factors were provided in the USEPA Ecological Soil Screening Levels (eco-SSL) guidance (for soil only).

Risk-based screening of surface soil data resulted in the identification of 59 preliminary COPECs (17 dioxin/furan congeners, 16 metals, 8 pesticides, 17 SVOCs, and 1 VOC) for quantitative evaluation.

Risk-based screening of surface water data from the FT-08 and AT-28 ditches resulted in the identification of 17 preliminary COPECs (14 total and/or dissolved metals, 2 pesticides, and 1 SVOC) for quantitative evaluation.

Risk-based screening of sediment data from the FT-08 and AT-28 ditches resulted in the identification of 45 preliminary COPECs (16 dioxin/furan congeners, 14 metals, 4 pesticides, and 11 SVOCs) for quantitative evaluation.

Risk characterization for the preliminary COPECs was accomplished at the community level and at the food web level. At the ecological community level, potential ecological hazards were identified by comparing detected constituent concentrations in each environmental medium to appropriate ESVs. To estimate whether preliminary COPECs detected in environmental media at FT-08 have the potential to pose ecological hazards to upper trophic level feeding guilds through food web interactions, HQs were calculated by comparing the total daily doses (TDDs) of COPECs for each feeding guild to the appropriate toxicity reference values (TRVs).

The terrestrial feeding guilds evaluated and the representative receptor species used for each guild included herbivorous mammal (white-footed mouse), herbivorous bird (chipping sparrow), invertivorous mammal (short-tailed shrew), invertivorous bird (American woodcock), carnivorous mammal (red fox), and carnivorous bird (red-tailed hawk). The aquatic/riparian feeding guilds evaluated and the representative species used for each guild included herbivorous mammal (muskrat), herbivorous bird (mallard duck), invertivorous mammal (raccoon), invertivorous bird (green-backed heron), carnivorous/piscivorous mammal (mink), and carnivorous/piscivorous bird (belted kingfisher).

Subsequent to the initial identification of the preliminary COPECs, several lines of evidence were utilized to refine the list of preliminary COPECs. These additional lines of evidence included (1) comparison to background concentrations, (2) comparison to alternative screening values, (3) frequency of detection, (4) magnitude of the calculated HQ value for community-level and food web receptors, and (5) assessment of mean detected constituent concentrations. These additional lines of evidence were used collectively in a weight-of-evidence evaluation to refine the list of COPECs. No final COPECs were identified at FT-08. As a result, no further action is required for surface soil, surface water, and sediment from an ecological perspective.

8.1.2 Suspected Fire Training Area No. 4 (Site AT-28)

Site AT-28 (Suspected FTA No. 4) is located approximately 200 feet southeast of the hazardous cargo loading and parking area and 1,500 feet southeast of Site FT-08. Patches of stressed vegetation were identified during a preliminary assessment and an accumulation of charred metal ashes, possibly from former fire training activities, was located adjacent to the footprint of a former building. A drainage swale to the west of AT-28 drains to an underground culvert northwest of the site area. A man-made ditch is located east of the former site area.

Groundwater – Groundwater underlying Site AT-28 is affected by fuel-related compounds, pesticides, and semi-volatile compounds. Seventy-six Triad-based multi-level groundwater samples collected from 31 clustered direct push technology (DPT) locations during Phase I sampling delineated the lateral and vertical extent of chemical constituents in the AT-28 groundwater. Volatile and semi-volatile, fuel-related chemical compounds in the groundwater underlying AT-28 were detected at concentrations that were generally below the PALs. Pesticide concentrations exceeded the PALs for 4,4'-DDD, 4,4'-DDE, and dieldrin but are potentially unrelated to former fire training activity. Metals concentrations were reduced to non-detected or less than the PALs in groundwater samples filtered to remove particulates, with the exception of iron, manganese, and thallium.

Phase II groundwater sampling from permanent monitoring wells detected fuel-related aromatic hydrocarbon (benzene, toluene, ethylbenzene, and xylenes [BTEX]) and component compounds; isolated semi-volatile concentrations of PAH compounds, pentachlorophenol, diphenyl, and trace pesticide (4,4'-DDD, beta-benzenehexachloride [beta-BHC]) concentrations. Organic constituents that exceeded Class I groundwater concentrations and/or USEPA RSLs were detected exclusively in well AT28-MW301 and consisted of fuel-related compounds ethylbenzene, toluene, total xylenes, m- and/or p-xylene, o-xylene, 1,2,4-trimethylbenzene (1,2,4-TMB), 1,3,5-trimethylbenzene (1,3,5-TMB), and isopropylbenzene. Concentrations of SVOC compounds that exceeded the Class I PALs were detected in well AT28-MW301 and consisted of 2-methylnapthalene, naphthalene, pentachlorophenol, and phenanthrene. The pesticides beta-BHC and 4,4'-DDD exceeded background and the groundwater PALs. Unfiltered metals consisting of vanadium and iron exceeded background concentrations and Class I PALs in well AT28-MW301.

Surface Soil – Forty-seven chemicals were detected at concentrations exceeding PAL and/or residential criteria in surface soil at Site AT-28. Dioxin/furan compounds (25 in total), 7 SVOCs, and 7 VOCs were the most widely detected chemicals. Concentrations of VOCs did not exceed residential criteria. SVOCs are largely observed to the west of the original RI study area for AT-28 between FT-08 and AT-28. PAH concentrations exceeded background concentrations and residential criteria in surface soil. All PAHs, except benzo(a)pyrene, are below PALs at AT-28. The lateral extent of VOCs and SVOCs in the surface soil is bounded by the drainage ditch on the western side of the site. The lateral extent of dioxins is considered defined. Additional refinement of the lateral extent of the presence of dioxins/furans in surface soil north of AT28-SS223 and AT28-SS216 have not been collected within the constructed carport area due to earth reworking activities associated with construction. Dioxins are bounded to the north of the carport area in the northernmost area of AT-28. The distribution of pesticides is widespread and may be unrelated to historical fire training activity at Site AT-28. Arsenic exceeded residential criteria at 28 of 30 sample locations. Concentrations of arsenic in surface soil did not exceed PAL criteria and only exceeded facility background concentrations at one location. Concentrations of lead exceeded PAL and residential criteria at one sample location, AT28-SS10. The lateral and vertical extent of inorganic chemicals in the surface soil at AT-28 is delineated.

Subsurface Soil – Concentrations of 46 compounds detected exceeded PAL and/or residential criteria in the subsurface soil. Forty-one of the chemicals were identified because PAL and/or residential criteria are not established for the chemicals. Dioxin/furan compounds and VOCs were the most widely detected chemicals from the nature and extent evaluation. Ethylbenzene was the only VOC to exceed available residential evaluation criteria. SVOCs did not exceed available residential or non-residential evaluation criteria. The distribution of VOCs and SVOCs is within the area bounded by the ditch to the west-southwest and has been defined in vertical extent. The distribution of pesticides is isolated to the southern portion of the area with the vertical and horizontal extent defined. Concentrations of detected pesticides exceeded background concentrations and residential criteria. Concentrations of pesticides did not exceed PAL evaluation criteria. The vertical presence of dioxins in soil may need further refinement at station AT28-218. The vertical extent of dioxins/furans in subsurface soil has been defined at all other locations.

Surface Water – Organic constituents detected in the surface water at Site AT-28 consisted predominantly of BTEX compounds with fuel-related benzene derivatives, chlorinated solvents (TCE, cis-1,2-DCE, methyl ethyl ketone [MEK]), and isolated SVOC and pesticide concentrations. VOCs exceeding the action levels were detected predominantly in the drainage to the west of Site AT-28 and consisted of fuel-related BTEX compounds ethylbenzene, m- and/or p-xylene, o-xylene, total xylenes, naphthalene, and 1,2,4-TMB. The exceedances of ethylbenzene, xylenes, and naphthalene may represent the impact of contaminated groundwater discharge into the drainage trenches. The shared drainage extends from FTA 13, located southwest of AT-28, and flows north-northwest past AT-28 to a culvert northwest of the site. Inorganic constituents exceeding the action levels were detected in the drainage trench to the east of Site AT-28.

Sediment – VOCs, pesticides, dioxin/furan, and metals compounds were detected in the sediment at Site AT-28. Detected VOC concentrations were below the action levels for sediment. Pesticide compounds were generally below background concentrations established for JB MDL sediment (BEM 2013). Background pesticide concentrations for 4,4'-DDD, 4,4'-DDE, and dieldrin exceeded the PALs in the east drainage and in the western stream channel. Dioxin and dibenzofuran compounds were detected in the western stream channel downslope from the site area and in the east drainage. Inorganic constituents in the sediments associated with Site AT-28 that exceeded background and PAL concentrations consisted of cadmium and mercury. The exceedance of 4,4'-DDD may represent the impact of contaminated groundwater discharge through sediment to the drainage trenches.

Fate and Transport at Site AT-28 – Potential chemical release mechanisms at AT-28 result from the use of metals-bearing waste fuels and solvents during historical fire training exercises over a shallow, permeable aquifer; diffusion and leaching from soil, resulting in migration to deeper soils or groundwater; surface run-off and transport to surface water and sediment; discharge of contaminated groundwater to surface water and sediment; and airborne particulate emission. Precipitation that does not leave the site as surface run-off or evapotranspiration infiltrates into the subsurface. The rate of infiltration is controlled by the frequency and volume of precipitation, surface cover, surface topography, and the saturated hydraulic conductivity of the surface soil. Water infiltrating through contaminated surface and subsurface soil or fill will take soluble chemicals into solution with transport to the underlying soil and groundwater. Factors that affect the leaching rate include the chemical concentration, chemical solubility, K_d, pH, and volume of infiltration. The physical transport of inorganic and organic chemical constituents from the soil at AT-28 could result from the erosive effects of soil run-off with transport to surface water and sediment. Groundwater contamination at the site is presently localized to a single well location at Site AT-28. A conceptual site model for Site AT-28 is provided in Section 5.0.

8.1.2.1 Human Health Risk Assessment for Site AT-28

An HHRA was conducted to estimate the risk to potential current and future Base Maintenance Workers, future Routine Site Workers, future Construction Workers, and hypothetical future Adult and Child Residents. Although it is unlikely that the shallow groundwater will be used as a drinking water source in the foreseeable future, the potential risks associated with shallow groundwater use were quantified for the Routine Worker and Resident.

Risk-based screening of surface and total soil data resulted in the identification of seven metals (aluminum, arsenic, beryllium, chromium, iron, lead, and thallium); dioxin/furans (as 2,3,7,8-TCDD TEQ); six pesticides (4,4'-DDD, 4,4'-DDE, chlordane, dieldrin, alpha-chlordane, and gamma-chlordane); seven SVOCs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene); and three VOCs (1,2,4-TMB, benzene, and ethylbenzene) as COPCs for quantitative risk evaluation.

Risk-based screening of groundwater data resulted in the identification of nine metals (aluminum, arsenic, beryllium, cadmium, chromium, cobalt, iron, manganese, and vanadium); two pesticides (4,4'-DDD and beta-BHC); four SVOCs (2-methylnaphthalene, diphenyl, naphthalene, and pentachlorophenol); and seven VOCs (1,2,4-TMB, 1,3,5-TMB, ethylbenzene, toluene, total xylene, m- and/or p-xylene, and o-xylene) as COPCs for quantitative risk evaluation.

Risk-based screening of surface water data from the FT-08 and AT-28 ditches resulted in the identification of 12 metals (aluminum, arsenic, beryllium, cadmium, chromium, cobalt, iron, lead, manganese, mercury, thallium, and vanadium) and two pesticides (4,4'-DDT and dieldrin) as COPCs for quantitative risk evaluation.

Risk-based screening of sediment data from the FT-08 and AT-28 ditches resulted in the identification of four metals (arsenic, beryllium, chromium, and iron); dioxin/furans (as 2,3,7,8-TCDD TEQ); and six SVOCs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and indeno(1,2,3-cd)pyrene) as COPCs for quantitative risk evaluation. Results of the quantitative risk assessment for each of the four receptors are summarized below.

Current and Future Base Maintenance Worker – The total estimated cancer risk (5E-06) for the Base Maintenance Worker exposed to surface soil, surface water, and sediment is within USEPA's acceptable risk range of 10-6 to 10-4 and the total noncancer HI (0.3) is less than 1.

Future Routine Worker – The total estimated cancer risk for the Routine Worker (6E-05) exposed to surface soil, groundwater, surface water, and sediment is within USEPA's acceptable risk range of 10-6 to 10-4; however, the total noncancer HI (2) is greater than 1. The estimated noncancer HI is associated primarily with exposure to groundwater (2), with all individual HQs and all target-organ-specific HIs less than 1.

Future Construction Worker – The total estimated cancer risk for the Construction Worker (2E-06) exposed to total soil and groundwater is within USEPA's acceptable risk range of 10-6 to 10-4; however, the total noncancer HI (4) is greater than 1. The estimated noncancer HI is associated primarily with exposure to groundwater (4) containing 1,3,5-TMB with an individual HQ of 2.0 and xylenes. Xylenes were detected in one groundwater sample and were reported as total xylenes, m- and/or p-xylene, and o-xylene. The individual HQs for each of these isomers ranged from 0.31 to 0.69 and inclusion of all three would result in over-counting the impact of this chemical. Therefore, 1,3,5-TMB is considered the only hazard driver for this receptor.

Future Resident – The total estimated cancer risk (2E-04) for a hypothetical Resident exposed to surface soil, groundwater (potable use), surface water (recreational use), and sediment is at the top of USEPA's acceptable risk range of 10-6 to 10-4 and the total noncancer HI (23) is greater than 1. The estimated cancer risk is associated primarily with potable use of groundwater (2E-04) containing arsenic, ethylbenzene, pentachlorophenol, 4,4'-DDD, and beta-BHC. The estimated cancer risks for the Resident exposed to surface soil (5E-05), surface water (3E-06), and sediment (6E-06) are within USEPA's acceptable risk range. The estimated noncancer HI is also associated primarily with potable use of groundwater (18) containing 1,2,4-TMB, xylenes, manganese, and iron. All four of these COPCs have individual HQs greater than 1. The estimated HI for the hypothetical Resident Child exposed to surface soil (3) also exceeds 1 due primarily to dioxins (as 2,3,7,8-TCDD TEQ) with an individual HQ of 2.3. The estimated HI for the Resident Child exposed to surface water is 1 and all individual HQs are less than 1. The estimated HI for exposure to sediment (0.06) is less than 1.

8.1.2.2 Screening-Level Ecological Risk Assessment for Site AT-28

The potential for ecological risks at AT-28 was determined through a SLERA. The SLERA for the OU-8 Sites consisted of a characterization of the site ecological setting, development of an Eco-CSM, a description of the fate and transport of constituents detected in various environmental media, a description of the ecological receptors, a description of the complete exposure pathways, calculation of screening-level HQs for both community-level and food chain receptors, the identification of preliminary and final COPECs, and a description of the uncertainties within the process.

A number of chemicals were identified as preliminary COPECs because of one or more of the following reasons: (1) the MDCs exceeded ESVs; (2) the constituents had no ESVs; (3) the constituents could potentially bioaccumulate; and (4) while not a bioaccumulative constituent, uptake factors were provided in the USEPA eco-SSL guidance (for soil only).

Risk-based screening of surface soil data resulted in the identification of 66 preliminary COPECs (17 dioxin/furan congeners, 16 metals, 9 pesticides, 18 SVOCs, and 6 VOCs) for quantitative evaluation.

Risk-based screening of surface water data from the FT-08 and AT-28 ditches resulted in the identification of 17 preliminary COPECs (14 total and/or dissolved metals, 2 pesticides, and 1 SVOC) for quantitative evaluation.

Risk-based screening of sediment data from the FT-08 and AT-28 ditches resulted in the identification of 45 preliminary COPECs (16 dioxin/furan congeners, 14 metals, 4 pesticides, and 11 SVOCs) for quantitative evaluation.

Risk characterization for the preliminary COPECs was accomplished at the community level and at the food web level. At the ecological community level, potential ecological hazards were identified by comparing detected constituent concentrations in each environmental medium to appropriate ESVs. To estimate whether preliminary COPECs detected in environmental media at AT-28 have the potential to pose ecological hazards to upper trophic level feeding guilds through food web interactions, HQs were calculated by comparing the TDDs of COPECs for each feeding guild to the appropriate TRVs.

The terrestrial feeding guilds evaluated and the representative receptor species used for each guild included herbivorous mammal (white-footed mouse), herbivorous bird (chipping sparrow), invertivorous mammal (short-tailed shrew), invertivorous bird (American woodcock), carnivorous mammal (red fox), and carnivorous bird (red-tailed hawk). The aquatic/riparian feeding guilds evaluated and the representative species used for each guild included herbivorous mammal (muskrat), herbivorous bird (mallard duck), invertivorous mammal (raccoon), invertivorous bird (green-backed heron), carnivorous/piscivorous mammal (mink), and carnivorous/piscivorous bird (belted kingfisher).

Subsequent to the initial identification of the preliminary COPECs, several lines of evidence were utilized to refine the list of preliminary COPECs. These additional lines of evidence included (1) comparison to background concentrations, (2) comparison to alternative screening values, (3) frequency of detection, (4) magnitude of the calculated HQ value for community-level and food web receptors, and (5) assessment of mean detected constituent concentrations. These additional lines of evidence were used collectively in a weight-of-evidence evaluation to refine the list of COPECs. No final COPECs were identified at AT-28. As a result, no further action is required for surface soil, surface water, and sediment from an ecological perspective.

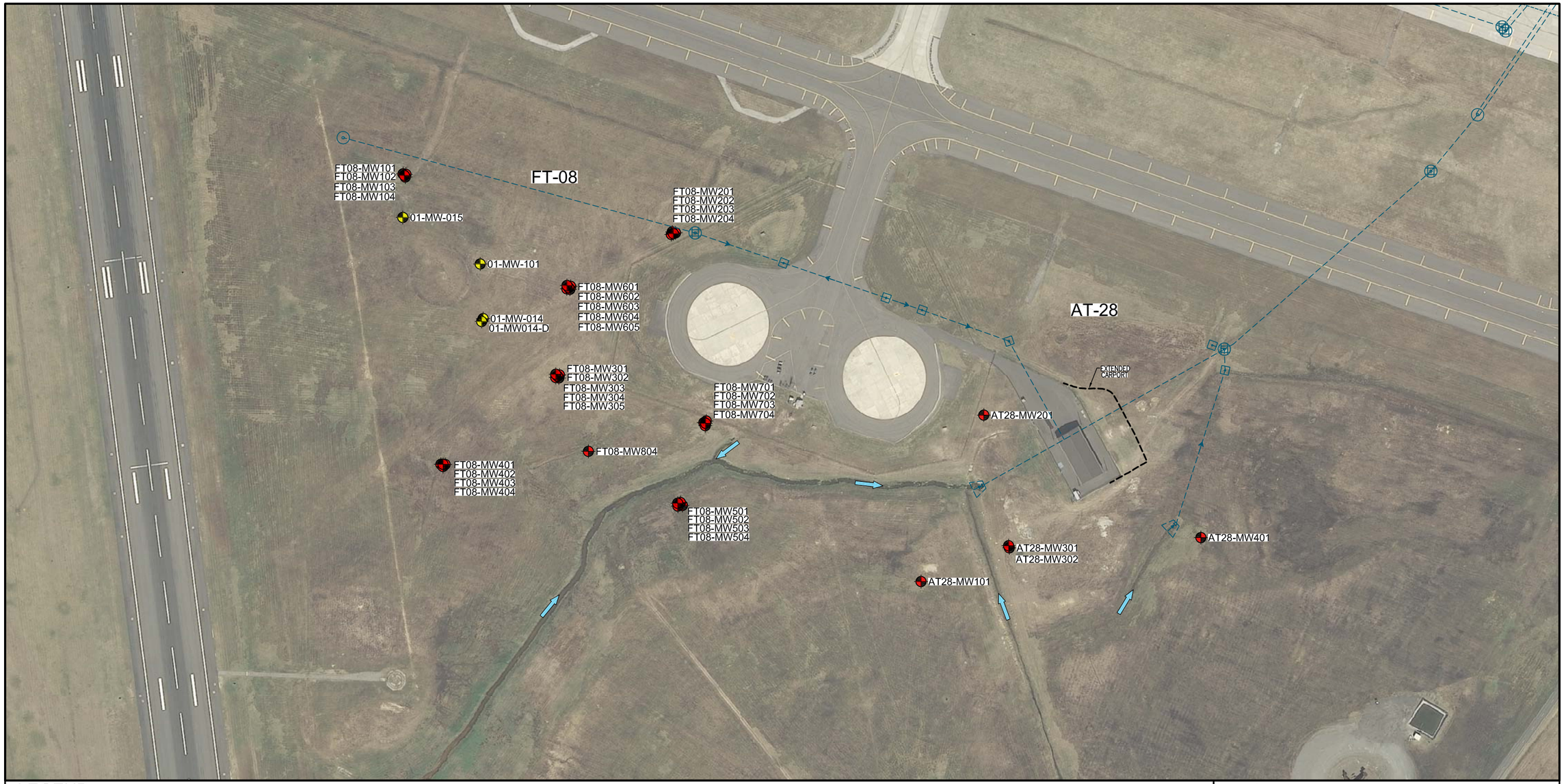
8.1.3 Non-Destructive Inspection Shop Drain Field (Site OT-14)

Site OT-14 is the former NDI shop (former Building 1623) located at the eastern end of the Runway Triangle Area. Shop activities involved inspecting aircraft parts for structural defects using x-rays and dye penetrants. Wastes consisting of penetrants, emulsifiers, and developers were discharged for six years (1966 to 1972) to an adjacent drain field through a pipe located on the north side of the shop. Approximately 55 gallons of each waste were released to the drain field every 18 to 20 months to percolate into the subsurface soil. A second drain was identified west of the shop. After 1972, two 5,000-gallon septic tanks were installed northwest of the NDI shop and were used to collect sanitary waste. As of 1996, a contractor pumped out these septic tanks on a monthly basis for disposal at the facility's wastewater treatment plant. These septic tanks were finally emptied and filled-in-place in 2009 when former Building 1623 was razed. A former 3,000-gallon No. 2 fuel oil underground storage tank (UST) (UST 8) was removed in October 1995 and was replaced with an aboveground storage tank at that time, which was later removed when former Building 1623 was razed in 2009. The UST Closure Report indicates that UST 8 was found in good condition (no visible holes), properly removed, and the excavation was backfilled with crushed stone (Arecon 1995). No groundwater was encountered at this site. Soil samples were collected and the analytical results indicated no contamination of concern related to past operations of UST 8.

OT-14 is surrounded by grassed areas to the north, west, and south, which are mowed regularly. A paved area is adjacent to the footprint of the shop building to the east. The New Jersey Department of Environmental Protection's (NJDEP's) 2002 Land Use/Land Cover geographic information system defines this area as herbaceous emergent wetlands. At OT-14, a drainage ditch runs within 100 feet along the western and northwestern sides. Two outfalls exist in the OT-14 drain field area. One outfall is located at the northern end of the shop and the second is on the western side.

Groundwater – Detected constituents in the groundwater at Site OT-14 consisted of fuel-related volatile compounds, phthalates and isolated PAH compounds, pesticides, and metals. Chemical concentrations exceeding the PALs consisted of isolated concentrations of bis-2(ethylhexyl) phthalate, dieldrin, and unfiltered metals (aluminum, arsenic, beryllium, chromium, iron, lead, manganese, and vanadium). Analysis of groundwater samples filtered for particulates detected iron and manganese at concentrations exceeding the PALs. Organic constituents were not detected in the groundwater at Site OT-14 during Phase II monitoring well sampling, with the exception of an isolated dieldrin concentration that exceeded background and the PAL. Unfiltered metals constituents consisting of lead and selenium exceeded background concentrations but were below the Class I PALs for shallow groundwater at OT-14. Filtered concentrations of aluminum, cobalt, manganese, sodium, and zinc in the shallow groundwater exceeded Class I PAL concentrations but were below background levels at Site OT-14.

Surface Soil – Five chemicals were detected in surface soil at concentrations exceeding PAL and/or residential criteria. The distribution of VOCs and SVOCs is isolated to a single detection of each chemical that did not exceed available background levels, PALs, or residential criteria. The frequency of detection of pesticides was widespread across the area. The presence of dieldrin in concentrations



LEGEND:

- PERMANENT MONITORING WELL INSTALLED BY SAIC
- PERMANENT MONITORING WELL INSTALLED BY OTHERS
- STORM SEWER LINE
- MANHOLE
- CATCH BASIN
- ROUND GRATE
- STORM INLET
- SURFACE STREAM FLOW

IMAGE SOURCE:

NEW JERSEY OFFICE OF GIS, TRENTON, NJ AERIAL PHOTOGRAPHY, MARCH, 2012 IMAGE

0 125 250 500

SCALE: 1" = 250'

JOINT BASE McGUIRE - DIX - LAKEHURST

ENVIRONMENTAL RESTORATION PROGRAM

OU-8 PERMANENT MONITORING WELL LOCATION
AT-28 AND FT-08

DRAWN BY:	REV. NO./DATE:	CAD FILE: C:\12050\DWGS
P. HOLM	1/ 7/11/16	R17-OU8_FIG-4-1

Figure 4-1.

OU-8 Sites FT-08 and AT-28 Permanent Monitoring Well Locations

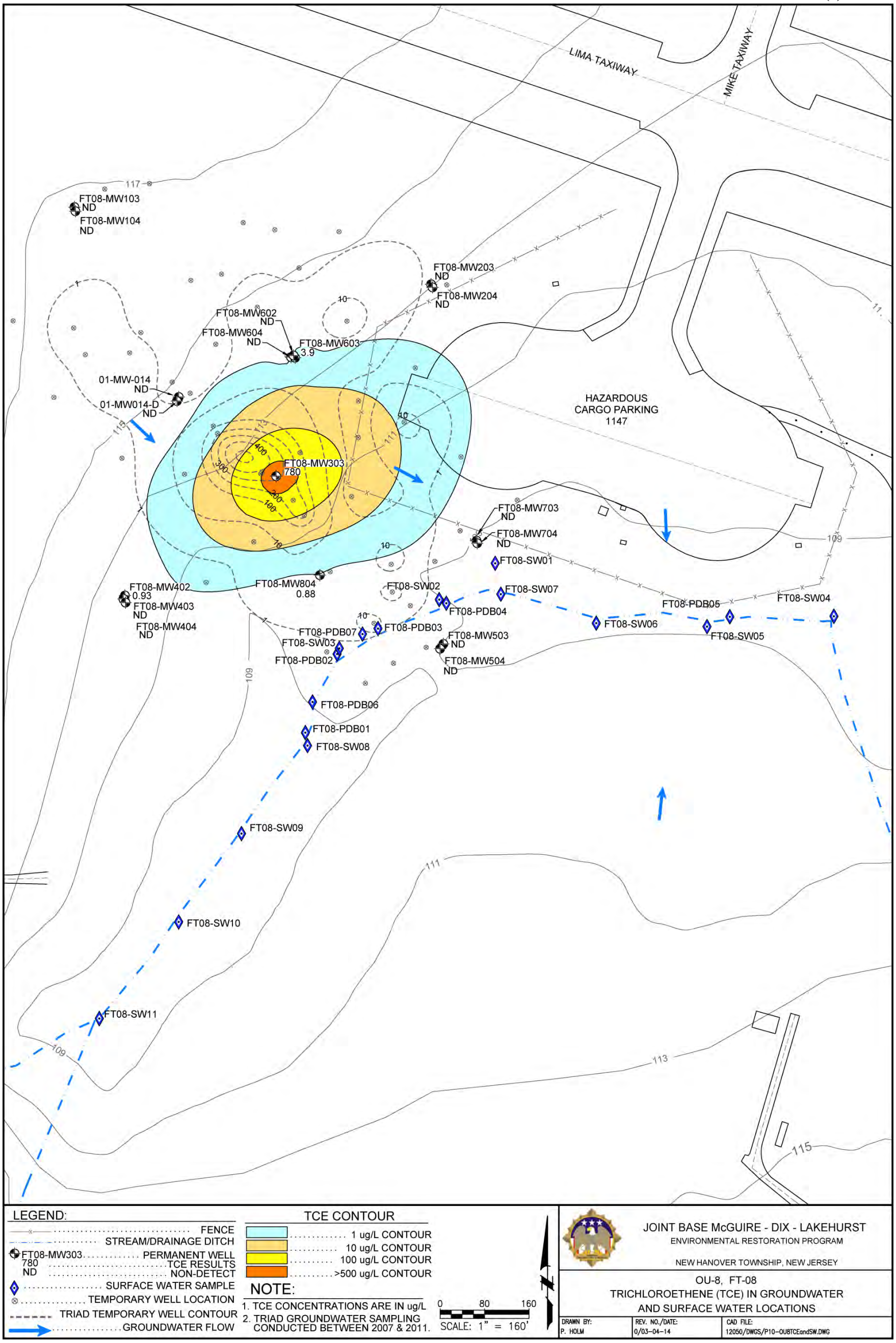


Figure 4-19.
OU-8 Site FT-08 TCE in Groundwater and Surface Water Locations

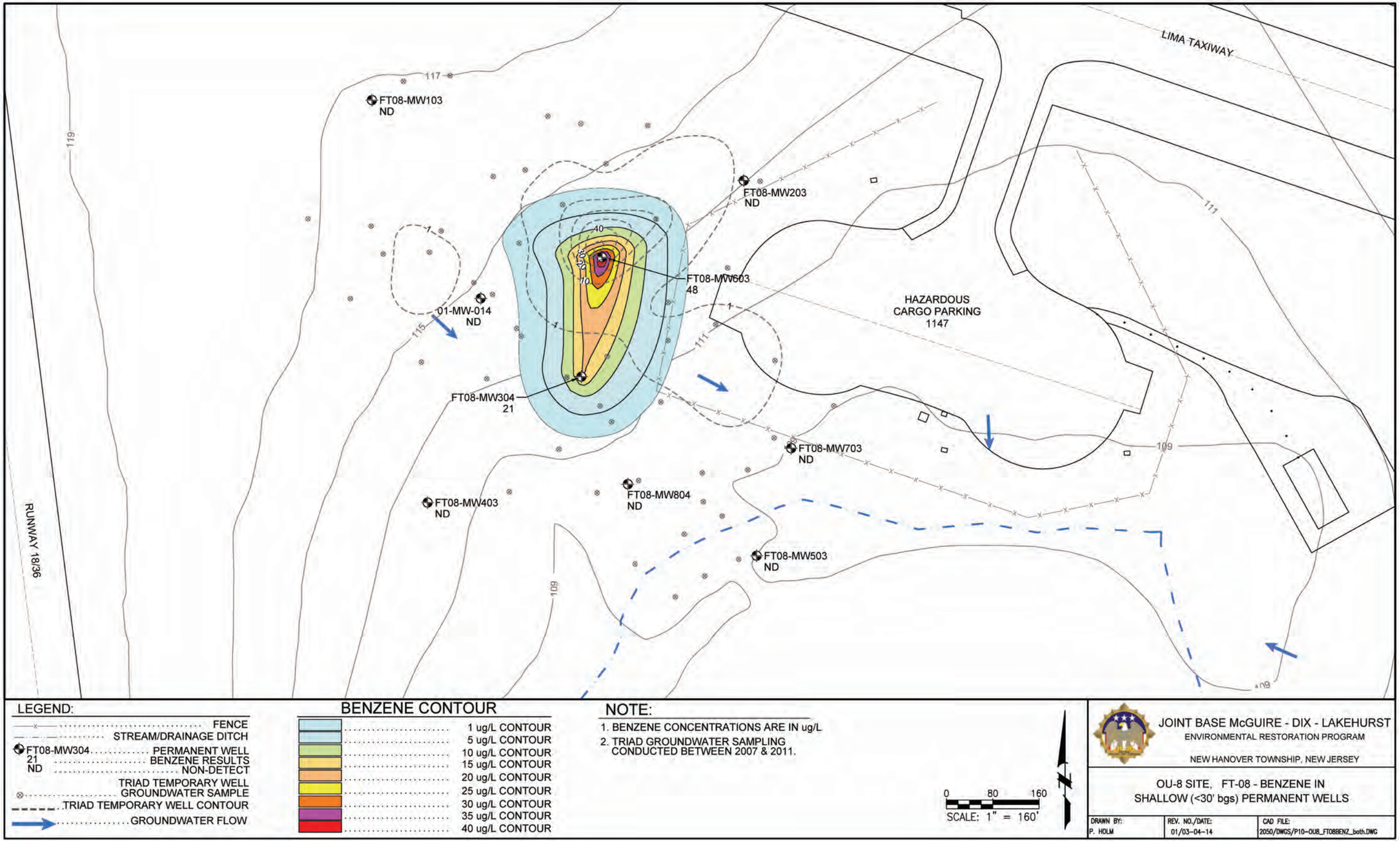
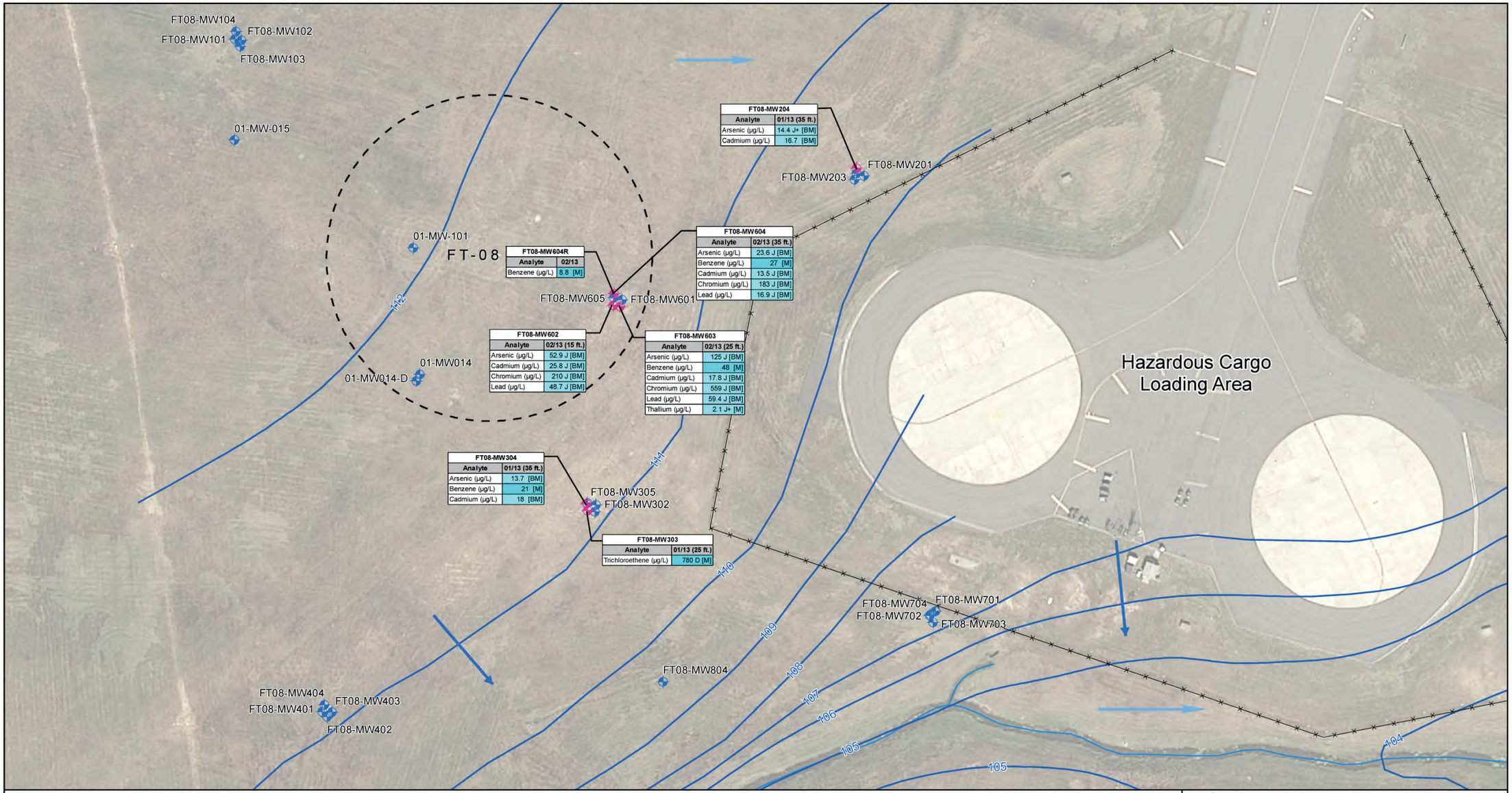


Figure 4-20.
OU-8 Site FT-08 Benzene Results in Shallow (<30 ft bgs) Permanent Wells



LEGEND:

- PERMANENT WELL WITH MCL EXCEEDANCES AND ABOVE BACKGROUND
- PERMANENT WELL
- SURFACE WATER
- GROUNDWATER CONTOUR (1 FT)
- ORIGINAL RI SITE BOUNDARY
- GROUNDWATER FLOW DIRECTION
- SURFACE WATER FLOW DIRECTION
- FENCE
- [M] EXCEEDANCE OF MCL CRITERIA
- [BM] EXCEEDANCE OF BACKGROUND AND MCL

0 25 50 100 150 200 Feet

SCALE: 1 " = 100 '

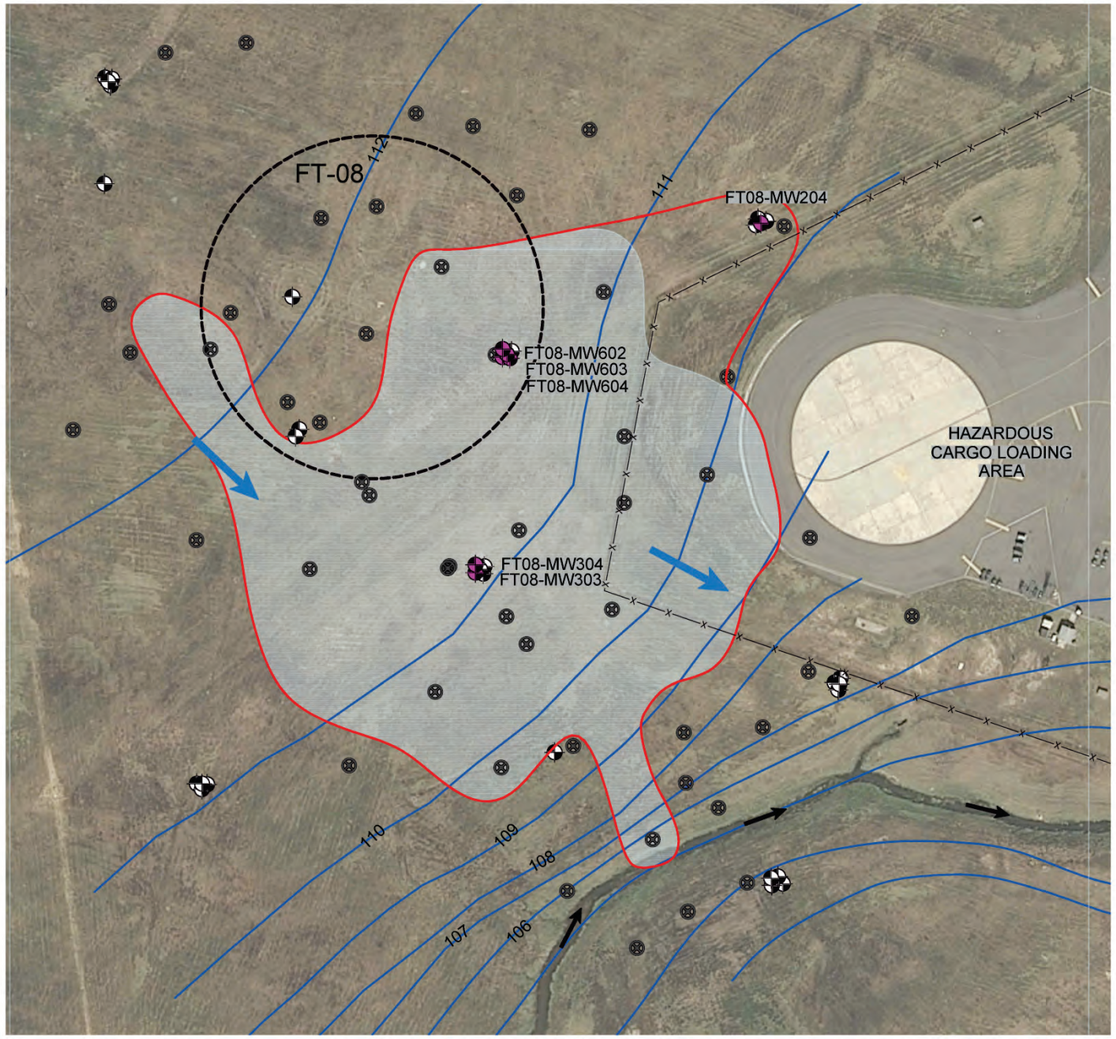
IMAGE SOURCE:
NEW JERSEY OFFICE OF GIS, TRENTON, NJ AERIAL PHOTOGRAPHY, MARCH, 2012

JOINT BASE McGUIRE - DIX - LAKEHURST
ENVIRONMENTAL RESTORATION PROGRAM
NEW HANOVER TOWNSHIP, NEW JERSEY

GROUNDWATER CONSTITUENTS EXCEEDING MCLs AT OU-8 SITE FT-08

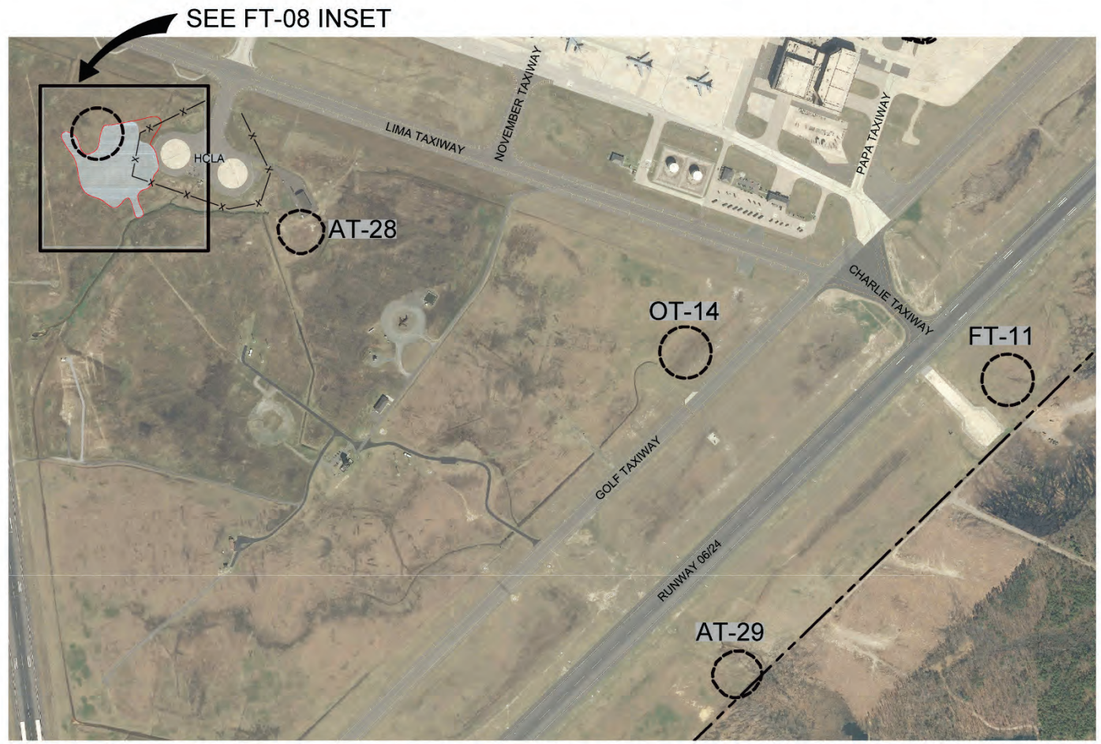
CREATED BY:	REV. NO.-DATE:	MXD FILE:
A. BROWN	0 - 3/10/2014	Figure 8-1 Groundwater MCLs_BK.mxd

Figure 8-1.
Groundwater Constituents Exceeding MCLs at OU-8 Site FT-08



FT-08 AREA INSET

0 50 100 150 300
SCALE: 1" = 150'



FT-08, AT-28, AT-29, FT-11 AND OT-14 KEY MAP

NOTE:
ORIGINAL SITE BOUNDARIES FOR SITES AT-28, AT-29, FT-11, & OT-14 REMAIN THE SAME

0 500 1000 2000
SCALE: 1" = 1000'

LEGEND:

- BASE BOUNDARY
- FENCE
- TRIAD TEMPORARY WELL GROUNDWATER SAMPLE
- PERMANENT WELL
- WELLS WITH BACKGROUNDWATER DATA WITH MCL EXCEEDANCES AND WITH METALS
- FT08-MW304 ALSO ABOVE BACKGROUND
- SURFACE WATER FLOW
- GROUNDWATER FLOW
- GROUNDWATER CONTOUR, 2-FT INTERVAL (DASHED WHERE INFERRED)
- ORIGINAL RI SITE BOUNDARY
- BENZENE & TCE PLUME IN SHALLOW PERMANENT & TEMPORARY WELLS
- UPDATED FT-08 SITE BOUNDARY

JOINT BASE McGUIRE - DIX - LAKEHURST
ENVIRONMENTAL RESTORATION PROGRAM
NEW HANOVER TOWNSHIP, NEW JERSEY

RECOMMENDED OU-8 SITE BOUNDARIES

DRAWN BY:	REV. NO./DATE:	CAD FILE:
P. HOLM	0/03-05-14	12050/DWGS/P10-OU8_FIG8-2

Figure 8-2.
Recommended OU-8 Site Boundaries

APPENDIX A
WELL INVENTORY

Table A-1. Operable Unit #8 - Triangle Area

Horizontal Datum: NJSPCS, NAD 83 Vertical Datum: NAVD 88

Well	Well Construction												
Well ID	NJDEP Permit #	Actual Screen Interval	Easting	Northing	T.O.C. Elev.	Top of Housing Elev.	Ground Elev.	Casing	Housing Type	Total Depth (feet bgs)	Installed	Surface Completion	Developed
Site AT28:													
AT28-MW101	P201117524	3-10	465435.87	432169.18	111.03	111.45	111.4	2" PVC	Flush	10	2/2/2012	2/2/2012	2/14/2012
AT28-MW201	P201117527	3-10	465587.31	432570.98	108.44	108.66	108.6	2" PVC	Flush	10	1/31/2012	1/31/2012	2/13/2012
AT28-MW301	P201117530	3-10	465648.91	432250.49	109.33	109.68	109.6	2" PVC	Flush	10	2/1/2012	2/1/2012	2/13/2012
AT28-MW302	P201117532	10-20	465647.07	432255.75	109.23	109.60	109.5	2" PVC	Flush	20	2/1/2012	2/1/2012	2/13/2012
AT28-MW401	P201117534	3-10	466111.11	432275.36	109.85	110.22	110.2	2" PVC	Flush	10	1/31/2012	1/31/2012	2/14/2012
Site AT29:													
AT29-MW101	P201117520	3-10	468482.26	429242.29	106.53	106.94	106.9	2" PVC	Flush	10	2/7/2012	2/7/2012	2/20/2012
AT29-MW201	P201117521	3-10	468737.46	429287.23	103.59	104.08	104.0	2" PVC	Flush	10	2/7/2012	2/7/2012	2/20/2012
AT29-MW301	P201117522	3-10	468977.45	429687.03	106.64	107.10	107.0	2" PVC	Flush	10	2/6/2012	2/6/2012	2/17/2012
AT29-MW401	P201117523	3-10	469546.87	428633.55	106.38	106.67	103.5	2" PVC	Stick-up	10	12/10/2012	12/10/2012	12/17/2012
AT29-MW402	P201117559	10-20	469547.39	428638.04	106.17	106.42	103.4	2" PVC	Stick-up	20	12/10/2012	12/10/2012	12/18/2012
AT29-MW501	P201117581	3-10	468523.36	429532.01	106.00	106.28	106.2	2" PVC	Flush	10	2/13/2012	2/13/2012	2/20/2012
Site FT08:													
01-MW-014	2813815	30-40	464379.41	432803.88	115.58	115.86	115.8	3" PVC	Reconstructed Flush	40	3/21/2013	3/21/2013	3/25/2013
FT08-MW101	P201117537	3-10	464186.23	433153.18	116.01	116.47	116.4	2" PVC	Flush	10	11/6/2012	11/6/2012	11/26/2012
FT08-MW102	P201117538	10-20	464193.16	433151.97	116.03	116.38	116.3	2" PVC	Flush	20	11/6/2012	11/6/2012	11/26/2012
FT08-MW103	P201117539	20-30	464191.74	433145.55	116.00	116.35	116.3	2" PVC	Flush	30	11/7/2021	11/8/2012	11/26/2012
FT08-MW104	P201117540	30-40	464189.37	433149.37	115.80	116.37	116.3	2" PVC	Flush	40	2/3/2012	2/3/2012	2/15/2012
FT08-MW201	P201117541	3-10	464843.59	433010.75	113.84	114.00	114.0	2" PVC	Flush	10	11/6/2012	11/6/2012	11/8/2012
FT08-MW202	P201117542	10-20	464835.60	433013.17	113.37	113.89	113.8	2" PVC	Flush	20	11/6/2012	11/6/2012	11/8/2012
FT08-MW203	P201117543	20-30	464833.45	433006.91	113.70	113.86	113.8	2" PVC	Flush	30	11/7/2012	11/7/2012	11/28/2012
FT08-MW204	P201117544	30-40	464838.43	433008.78	113.67	113.88	113.8	2" PVC	Flush	40	1/27/2012	1/27/2012	2/15/2012
FT08-MW301	P201117545	3-10	464562.18	432660.69	115.01	115.20	115.1	2" PVC	Flush	10	11/14/2012	11/14/2012	11/28/2012
FT08-MW302	P201117546	10-20	464563.52	432667.91	114.96	115.33	115.3	2" PVC	Flush	20	11/14/2012	11/14/2012	11/29/2012
FT08-MW303	P201117547	20-30	464554.67	432661.68	114.80	115.02	114.9	2" PVC	Flush	30	11/15/2012	11/15/2012	11/28/2012
FT08-MW304	P201117548	30-40	464559.09	432665.14	114.81	115.17	115.1	2" PVC	Flush	40	2/13/2012	2/13/2012	2/16/2012
FT08-MW305	P201302314	40-50	464554.64	432669.57	114.74	115.06	115.0	2" PVC	Flush	50	3/6/2013	3/6/2013	3/11/2013
FT08-MW401	P201117549	3-10	464277.50	432452.31	115.53	115.92	115.9	2" PVC	Flush	10	11/16/2012	11/16/2012	11/27/2012
FT08-MW402	P201117550	10-20	464282.57	432446.88	115.53	115.72	115.6	2" PVC	Flush	20	11/15/2012	11/16/2012	12/3/2012
FT08-MW403	P201117551	20-30	464287.82	432451.69	115.34	115.57	115.5	2" PVC	Flush	30	11/20/2012	11/20/2012	11/27/2012
FT08-MW404	P201117552	30-40	464282.67	432452.12	115.13	115.38	115.0	2" PVC	Flush	40	2/16/2012	2/16/2012	2/21/2012

Table A-1. Operable Unit #8 - Triangle Area (continued)

Horizontal Datum: NJSPCS, NAD 83 Vertical Datum: NAVD 88

Well	Well Construction												
Well ID	NJDEP Permit #	Actual Screen Interval	Easting	Northing	T.O.C. Elev.	Top of Housing Elev.	Ground Elev.	Casing	Housing Type	Total Depth (feet bgs)	Installed	Surface Completion	Developed
FT08-MW501	P201117553	3-10	464860.21	432352.89	107.93	108.27	105.1	2" PVC	Stick-up	10	11/16/2012	11/16/2012	11/26/2012
FT08-MW502	P201117554	10-20	464849.35	432351.31	107.89	108.21	105.1	2" PVC	Stick-up	20	11/19/2012	11/19/2012	11/26/2012
FT08-MW503	P201117555	20-30	464855.57	432359.93	107.72	107.83	104.8	2" PVC	Stick-up	30	11/19/2012	11/19/2012	11/26/2012
FT08-MW504	P201117556	30-40	464848.74	432358.19	107.60	107.81	104.9	2" PVC	Stick-up	40	2/15/2012	2/15/2012	2/16/2012
FT08-MW601	P201117558	3-10	464590.61	432881.66	113.87	114.34	114.3	2" PVC	Flush	10	11/13/2012	11/13/2012	11/27/2012
FT08-MW602	P201117525	10-20	464581.41	432875.62	114.15	114.59	114.5	2" PVC	Flush	20	11/13/2012	11/13/2012	11/27/2012
FT08-MW603	P201117526	20-30	464588.78	432874.53	113.78	114.39	114.3	2" PVC	Flush	30	11/14/2012	11/14/2012	11/27/2012
FT08-MW604	P201117528	30-40	464585.97	432878.63	114.04	114.38	114.3	2" PVC	Flush	40	2/14/2012	2/14/2012	2/15/2012
FT08-MW605	P201302375	40-50	464581.75	432883.82	113.70	114.27	114.2	2" PVC	Flush	50	3/7/2013	3/7/2013	3/11/2013
FT08-MW701	P201117529	3-10	464917.71	432556.80	109.52	109.80	109.7	2" PVC	Flush	10	11/14/2012	11/14/2012	12/3/2012
FT08-MW702	P201117533	10-20	464911.88	432552.66	109.76	110.06	110.0	2" PVC	Flush	20	11/15/2012	11/16/2012	11/28/2012
FT08-MW703	P201117535	20-30	464915.28	432545.51	109.48	109.82	109.7	2" PVC	Flush	30	11/15/2012	11/15/2012	11/28/2012
FT08-MW704	P201117536	30-40	464916.35	432551.08	109.55	109.80	109.7	2" PVC	Flush	40	2/16/2012	2/16/2012	2/21/2012
FT08-MW804	P201302377	30-40	464633.39	432483.47	107.54	107.95	107.9	2" PVC	Flush	40	3/20/2013	3/20/2013	3/27/2013
Site FT11:													
FT11-MW101	P201117557	3-10	470321.77	431543.16	108.84	109.11	109.1	2" PVC	Flush	10	11/29/2012	11/29/2012	12/4/2012
FT11-MW102	P201117561	3-10	470810.97	431260.21	101.44	101.78	101.7	2" PVC	Flush	10	11/28/2012	11/28/2012	12/4/2012
FT11-MW103	P201117576	3-10	470490.04	431291.34	105.66	106.05	106.0	2" PVC	Flush	10	11/28/2012	11/28/2012	12/4/2012
FT11-MW104	P201117580	3-10	470435.54	430890.04	103.29	103.8	103.7	2" PVC	Flush	10	11/28/2012	11/28/2012	12/4/2012
Site OT14:													
OT14-MW101	P201117588	3-10	468542.05	431514.08	112.12	112.4	112.3	2" PVC	Flush	10	11/26/2012	11/26/2012	12/4/2012
OT14-MW201	P201117590	3-10	468068.62	431145.26	109.50	109.8	109.7	2" PVC	Flush	10	11/26/2012	11/26/2012	12/3/2012
OT14-MW301	P201117592	3-10	467851.02	431311.55	113.39	114.2	114.1	2" PVC	Flush	10	11/26/2012	11/26/2012	12/4/2012
OT14-MW401	P201117594	3-10	468420.46	430800.72	110.70	111.2	111.1	2" PVC	Flush	10	11/27/2012	11/27/2012	12/4/2012
OT14-MW501	P201117596	3-10	467821.81	430848.98	110.46	110.9	110.8	2" PVC	Flush	10	11/27/2012	11/27/2012	12/3/2012

bgs = below ground surface
Elev. = Elevation
NAD = North American Datum
NAVD = North American Vertical Datum
NJDEP = New Jersey Department of Environmental Protection
NJSPCS = New Jersey State Plane Coordinate System
T.O.C. = Top of Casing

APPENDIX I
HUMAN HEALTH RISK CHARACTERIZATION RAGS–D TABLES

Table 1-1.
Selection of Exposure Pathways
Triangle Area OU (OU-8) - Joint Base McGuire, Dix, Lakehurst

Scenario Time Frame	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/ Future	Surface Soil	Surface Soil	FT-08, AT-28, OT-14, FT-11, AT-29	Routine Worker	Adult	Ingestion	None	Routine Workers are not present at OU-8 Sites.
						Dermal	None	
				Maintenance Worker	Adult	Ingestion	Quant	Maintenance Workers could contact surface soil and be exposed to COPCs via incidental ingestion and dermal contact.
						Dermal	Quant	
		Air	Ambient Air at FT-08, AT-28, OT-14, FT-11, AT-29	Routine Worker	Adult	Inhalation	None	Routine Workers are not present at OU-8 Sites.
				Maintenance Worker	Adult	Inhalation	Quant	Maintenance Workers could be exposed to dust/vapors released from surface soil.
	Total Soil	Total Soil	FT-08, FT-11, AT-28, AT-29, OT-14	Construction Worker	Adult	Ingestion	None	There is no current excavation at OU-8 Sites.
						Dermal	None	
		Air	Indoor Air at OU-8	Routine Worker	Adult	Inhalation	None	Routine Workers and buildings are not present at OU-8 Sites.
	Surface Water	Surface Water	FT-08/AT-28, OT-14/FT-11/AT-29	Routine Worker	Adult	Ingestion	None	Routine Workers are not present at OU-8 Sites.
						Dermal	None	
				Maintenance Worker	Adult	Ingestion	Quant	Maintenance Workers could have incidental contact with surface water.
						Dermal	Quant	
	Sediment	Sediment	FT-08/AT-28, OT-14/FT-11/AT-29	Routine Worker	Adult	Ingestion	None	Routine Workers are not present at OU-8 Sites.
						Dermal	None	
				Maintenance Worker	Adult	Ingestion	Quant	Maintenance Workers could have incidental contact with sediment.
						Dermal	Quant	
	Groundwater	Groundwater	FT-08, AT-28, OT-14, FT-11, AT-29	Routine Worker	Adult	Ingestion	None	Groundwater is not currently being used. Therefore, there is no direct contact with groundwater.
						Dermal	None	
				Construction Worker	Adult	Ingestion	None	There is no current excavation at OU-8 Sites.
						Dermal	None	
		Air	Indoor Air at OU-8	Routine Worker	Adult	Inhalation	None	Routine Workers and buildings are not present at OU-8 Sites.
			Trench Vapors at OU-8	Construction Worker	Adult	Inhalation	None	There is no current excavation at OU-8 Sites.
	Surface Soil	Surface Soil	FT-08, AT-28, OT-14, FT-11, AT-29	Routine Worker	Adult	Ingestion	Quant	Routine Workers could contact surface soil and be exposed to COPCs via incidental ingestion and dermal contact.
						Dermal	Quant	
				Resident	Adult	Ingestion	Quant	Residents could be exposed to COPCs in surface soil at the Sites via incidental ingestion and dermal contact.
						Dermal	Quant	
					Child	Ingestion	Quant	
						Dermal	Quant	
		Air	Ambient Air at FT-08, AT-28, OT-14, FT-11, AT-29	Routine Worker	Adult	Inhalation	Quant	Routine Workers could be exposed to dust/vapors released from surface soil.
				Resident	Adult	Inhalation	Quant	Residents could be exposed to dust/vapors released from surface soil.
					Child	Inhalation	Quant	
	Total Soil	Total Soil	FT-08, AT-28, OT-14, FT-11, AT-29	Construction Worker	Adult	Ingestion	Quant	Construction Workers could contact total soil and be exposed to COPCs via incidental ingestion and dermal contact.
						Dermal	Quant	
				Resident	Adult	Ingestion	Quant	Residents could be exposed to COPCs in total soil via incidental ingestion and dermal contact if development included excavation at the sites.
						Dermal	Quant	
					Child	Ingestion	Quant	
						Dermal	Quant	
		Air	Ambient Air at FT-08, AT-28, OT-14, FT-11, AT-29	Resident	Adult	Inhalation	Quant	Residents could be exposed to dust/vapors released from surface soil.
					Child	Inhalation	Quant	

Table 1-1.
Selection of Exposure Pathways
Triangle Area OU (OU-8) - Joint Base McGuire, Dix, Lakehurst

Scenario Time Frame	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future (con't)		Air	Indoor Air at OU-8	Routine Worker	Adult	Inhalation	None	Pathway cannot be quantified, buildings are not present and cannot be sampled.
				Resident	Adult	Inhalation	None	Pathway cannot be quantified, residential buildings are not present and cannot be sampled.
					Child	Inhalation	None	
			Trench Vapors at OU-8	Construction Worker	Adult	Inhalation	Quant	Construction Workers could be exposed to vapors and dust released from total soil.
	Surface Water	Surface Water	FT-08/AT-28, OT-14/FT-11/AT-29	Routine Worker	Adult	Ingestion	Quant	Routine Workers may occassionally visit surface water bodies.
						Dermal	Quant	
				Residential	Adult	Ingestion	Quant	Future resident wading in surface water may result in incidental ingestion and dermal contact. Drainage ditches at OU-8 are not adequate to provide potential potable water supply, however, hypothetical potable use of surface water is evaluated for information.
						Dermal	Quant	
					Child	Ingestion	Quant	
						Dermal	Quant	
	Sediment	Sediment	FT-08/AT-28, OT-14/FT-11/AT-29	Routine Worker	Adult	Ingestion	Quant	Routine Workers may occassionally visit surface water bodies.
						Dermal	Quant	
				Residential	Adult	Ingestion	Quant	Future resident could contact sediment while wading.
						Dermal	Quant	
					Child	Ingestion	Quant	
						Dermal	Quant	
	Groundwater	Groundwater	FT-0AT-28, OT-14, FT-11, AT-29	Routine Worker	Adult	Ingestion	Quant	No future use of groundwater is anticipated. Hypothetical exposures are considered due to the aquifer designation as a potable water supply.
						Dermal	Quant	
				Construction Worker	Adult	Ingestion	None	Due to the depth of the groundwater at the site, potential future construction/ utility workers could contact the water table during excavation, construction, or utility-related activities in a trench or pit. However, the groundwater is assumed to be pooled at the bottom of the trench or pit. Therefore, exposures to COPCs in groundwater via incidental ingestion or dermal contact from splashing and hand-to-mouth contact are likely to be negligible.
						Dermal	None	
				Residential	Adult	Ingestion	Quant	No future use of groundwater is anticipated. Hypothetical exposures are considered due to the aquifer designation as a potable water supply.
						Dermal	Quant	
					Child	Ingestion	Quant	
						Dermal	Quant	
		Air	Indoor Air at OU-8	Routine Worker	Adult	Inhalation	None	Pathway cannot be quantified, buildings are not present and cannot be sampled.
				Residential	Adult	Inhalation	None	Volatile COPCs from groundwater could potentially migrate into new buildings via vapor intrusion, however, such buildings currently do not exist.
					Child	Inhalation	None	
			Trench Vapors at OU-8	Construction Worker	Adult	Inhalation	Quant	Volatiles in groundwater could potentially migrate into a construction or utility trench via vapor intrusion.
			Household Use of Groundwater	Residential	Adult	Inhalation	Quant	Volatile COPCs in groundwater could partition to indoor air during normal household use of groundwater (showering, dish washing, etc).
					Child	Inhalation	Quant	

Table 9-1.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Current/Future Base Maintenance Worker, OU-8 Site FT-08

Scenario Timeframe:	Current/Future
Receptor Population:	Base Maintenance Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Soil	Surface Soil	FT-08	Aluminum	--	--	--	--	CNS	2.5E-03	8.2E-06	--	2.5E-03
			Arsenic	4.1E-07	4.1E-08	--	4.5E-07	Skin, vascular system	2.6E-03	2.5E-04	--	2.8E-03
			Beryllium	--	--	--	--	GI tract	5.2E-05	2.5E-05	--	7.7E-05
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	1.8E-03	5.9E-06	--	1.8E-03
			Iron	--	--	--	--	GI tract	4.8E-03	1.6E-05	--	4.8E-03
			Thallium	--	--	--	--	Skin	1.6E-02	5.4E-05	--	1.7E-02
			2,3,7,8-TCDD equivalents	2.8E-07	2.8E-08	--	3.1E-07	Reproductive	8.7E-03	8.6E-04	--	9.5E-03
			Benzo(a)pyrene equivalents	1.1E-05	4.9E-06	--	1.6E-05	NA	--	--	--	--
			Chlordane	4.0E-09	5.2E-10	--	4.5E-09	Liver	6.3E-05	8.4E-06	--	7.2E-05
			Dieldrin	7.1E-06	2.3E-06	--	9.4E-06	Liver	2.5E-02	8.2E-03	--	3.3E-02
			alpha-Chlordane	2.0E-09	2.6E-10	--	2.3E-09	Liver	3.2E-05	4.2E-06	--	3.6E-05
			gamma-Chlordane	1.6E-09	2.1E-10	--	1.8E-09	Liver	2.5E-05	3.3E-06	--	2.9E-05
			Chemical Total	1.9E-05	7.3E-06	--	2.7E-05		6.2E-02	9.4E-03	--	7.1E-02
		Exposure Point Total					2.7E-05					7.1E-02
	Exposure Media Total						2.7E-05					7.1E-02
	Air (Particulates and Volatiles)	FT-08	Aluminum	--	--	--	--	CNS	--	--	8.4E-05	8.4E-05
			Arsenic	--	--	2.0E-10	2.0E-10	Developmental, cardiovascular, CNS	--	--	8.8E-06	8.8E-06
			Beryllium	--	--	1.5E-11	1.5E-11	Respiratory tract	--	--	8.9E-07	8.9E-07
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	2.9E-10	2.9E-10	Respiratory tract, lung	--	--	1.5E-05	1.5E-05
			Iron	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	NA	--	--	--	--
			2,3,7,8-TCDD equivalents	--	--	1.4E-11	1.4E-11	Reproductive	--	--	2.6E-08	2.6E-08
			Benzo(a)pyrene equivalents	--	--	2.9E-10	2.9E-10	NA	--	--	--	--
			Chlordane	--	--	1.9E-13	1.9E-13	Liver	--	--	7.7E-09	7.7E-09
			Dieldrin	--	--	3.5E-10	3.5E-10	NA	--	--	--	--
			alpha-Chlordane	--	--	9.8E-14	9.8E-14	Liver	--	--	3.9E-09	3.9E-09
			gamma-Chlordane	--	--	7.7E-14	7.7E-14	Liver	--	--	3.1E-09	3.1E-09
			Chemical Total	--	--	1.2E-09	1.2E-09		--	--	1.1E-04	1.1E-04
		Exposure Point Total					1.2E-09					1.1E-04
	Exposure Media Total						1.2E-09					1.1E-04
Surface Soil Total							2.7E-05					7.1E-02
Surface Water	Surface Water	FT08/AT28	Aluminum	--	--	--	--	CNS	3.2E-03	2.3E-04	--	3.5E-03
			Arsenic	1.2E-06	8.4E-08	--	1.3E-06	Skin, vascular system	7.3E-03	5.3E-04	--	7.8E-03
			Beryllium	--	--	--	--	GI tract	1.8E-04	1.9E-03	--	2.1E-03
			Cadmium	--	--	--	--	Kidney	1.0E-03	1.4E-03	--	2.4E-03
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	5.9E-03	1.7E-04	--	6.1E-03

Table 9-1.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Current/Future Base Maintenance Worker, OU-8 Site FT-08

Scenario Timeframe:	Current/Future
Receptor Population:	Base Maintenance Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
			Iron	--	--	--	--	GI tract	2.0E-02	1.4E-03	--	2.1E-02
			Lead	--	--	--	--	NA	--	--	--	--
			Manganese	--	--	--	--	CNS	2.1E-03	3.9E-03	--	6.0E-03
			Mercury	--	--	--	--	Immune system	9.2E-05	9.4E-05	--	1.9E-04
			Thallium	--	--	--	--	Skin	1.9E-01	1.3E-02	--	2.0E-01
			Vanadium	--	--	--	--	Hair	2.6E-03	7.2E-03	--	9.7E-03
			4,4'-DDT	1.7E-10	3.4E-08	--	3.4E-08	Liver	2.8E-06	5.6E-04	--	5.7E-04
			Dieldrin	1.3E-08	1.8E-07	--	1.9E-07	Liver	4.5E-05	6.3E-04	--	6.7E-04
			Chemical Total	1.2E-06	3.0E-07	--	1.5E-06		2.3E-01	3.1E-02	--	2.6E-01
		Exposure Point Total					1.5E-06					2.6E-01
	Exposure Media Total						1.5E-06					2.6E-01
Surface Water Total							1.5E-06					2.6E-01
Sediment	Sediment	FT08/AT28	Arsenic	1.1E-07	2.6E-08	--	1.3E-07	Skin, vascular system	6.6E-04	1.6E-04	--	8.2E-04
			Beryllium	--	--	--	--	GI tract	1.8E-05	2.1E-05	--	3.9E-05
			Chromium	--	--	--	--	NA	--	--	--	--
			Iron	--	--	--	--	GI tract	9.2E-04	7.6E-06	--	9.2E-04
			2,3,7,8-TCDD equivalents	5.1E-08	1.3E-08	--	6.3E-08	Reproductive	1.6E-03	3.9E-04	--	1.9E-03
			Benzo(a)pyrene equivalents	1.2E-07	1.3E-07	--	2.5E-07	NA	--	--	--	--
			Chemical Total	2.8E-07	1.7E-07	--	4.5E-07		3.1E-03	5.8E-04	--	3.7E-03
		Exposure Point Total					4.5E-07					3.7E-03
	Exposure Media Total						4.5E-07					3.7E-03
Sediment Total							4.5E-07					3.7E-03
Receptor Total							2.9E-05					3.4E-01

Table 9-2.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Routine Worker, OU-8 Site FT-08

Scenario Timeframe:	Future
Receptor Population:	Routine Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Soil	Surface Soil	FT-08	Aluminum	--	--	--	--	CNS	7.9E-03	2.6E-05	--	8.0E-03
			Arsenic	1.3E-06	1.3E-07	--	1.5E-06	Skin, vascular system	8.3E-03	8.2E-04	--	9.1E-03
			Beryllium	--	--	--	--	GI tract	1.7E-04	7.9E-05	--	2.5E-04
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	5.7E-03	1.9E-05	--	5.7E-03
			Iron	--	--	--	--	GI tract	1.5E-02	5.1E-05	--	1.5E-02
			Thallium	--	--	--	--	Skin	5.3E-02	1.7E-04	--	5.3E-02
			2,3,7,8-TCDD equivalents	9.0E-07	8.9E-08	--	9.9E-07	Reproductive	2.8E-02	2.8E-03	--	3.1E-02
			Benzo(a)pyrene equivalents	3.7E-05	1.6E-05	--	5.2E-05	NA	--	--	--	--
			Chlordane	1.3E-08	1.7E-09	--	1.4E-08	Liver	2.0E-04	2.7E-05	--	2.3E-04
			Dieldrin	2.3E-05	7.5E-06	--	3.0E-05	Liver	8.0E-02	2.6E-02	--	1.1E-01
			alpha-Chlordane	6.4E-09	8.5E-10	--	7.3E-09	Liver	1.0E-04	1.4E-05	--	1.2E-04
			gamma-Chlordane	5.1E-09	6.7E-10	--	5.7E-09	Liver	8.1E-05	1.1E-05	--	9.2E-05
			Chemical Total	6.2E-05	2.3E-05	--	8.5E-05		2.0E-01	3.0E-02	--	2.3E-01
		Exposure Point Total					8.5E-05					2.3E-01
	Exposure Media Total						8.5E-05					2.3E-01
	Air (Particulates and Volatiles)	FT-08	Aluminum	--	--	--	--	CNS	--	--	2.7E-04	2.7E-04
			Arsenic	--	--	6.5E-10	6.5E-10	Developmental, cardiovascular, CNS	--	--	2.8E-05	2.8E-05
			Beryllium	--	--	4.9E-11	4.9E-11	Respiratory tract	--	--	2.8E-06	2.8E-06
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	9.4E-10	9.4E-10	Respiratory tract, lung	--	--	4.9E-05	4.9E-05
			Iron	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	NA	--	--	--	--
			2,3,7,8-TCDD equivalents	--	--	4.5E-11	4.5E-11	Reproductive	--	--	8.3E-08	8.3E-08
			Benzo(a)pyrene equivalents	--	--	9.4E-10	9.4E-10	NA	--	--	--	--
			Chlordane	--	--	6.2E-13	6.2E-13	Liver	--	--	2.5E-08	2.5E-08
			Dieldrin	--	--	1.1E-09	1.1E-09	NA	--	--	--	--
			alpha-Chlordane	--	--	3.1E-13	3.1E-13	Liver	--	--	1.3E-08	1.3E-08
			gamma-Chlordane	--	--	2.5E-13	2.5E-13	Liver	--	--	9.8E-09	9.8E-09
			Chemical Total	--	--	3.7E-09	3.7E-09		--	--	3.5E-04	3.5E-04
		Exposure Point Total					3.7E-09					3.5E-04
	Exposure Media Total						3.7E-09					3.5E-04
Surface Soil Total							8.5E-05					2.3E-01
Surface Water	Surface Water	FT08/AT28	Aluminum	--	--	--	--	CNS	1.6E-03	5.8E-05	--	1.7E-03
			Arsenic	5.8E-07	2.1E-08	--	6.1E-07	Skin, vascular system	3.6E-03	1.3E-04	--	3.8E-03
			Beryllium	--	--	--	--	GI tract	9.2E-05	4.7E-04	--	5.6E-04
			Cadmium	--	--	--	--	Kidney	5.0E-04	3.6E-04	--	8.6E-04
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	3.0E-03	4.3E-05	--	3.0E-03

Table 9-2.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Routine Worker, OU-8 Site FT-08

Scenario Timeframe:	Future
Receptor Population:	Routine Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
			Iron	--	--	--	--	GI tract	9.8E-03	3.5E-04	--	1.0E-02
			Lead	--	--	--	--	NA	--	--	--	--
			Manganese	--	--	--	--	CNS	1.1E-03	9.6E-04	--	2.0E-03
			Mercury	--	--	--	--	Immune system	4.6E-05	2.4E-05	--	6.9E-05
			Thallium	--	--	--	--	Skin	9.3E-02	3.4E-03	--	9.7E-02
			Vanadium	--	--	--	--	Hair	1.3E-03	1.8E-03	--	3.1E-03
			4,4'-DDT	8.5E-11	1.2E-08	--	1.2E-08	Liver	1.4E-06	2.0E-04	--	2.0E-04
			Dieldrin	6.4E-09	6.3E-08	--	7.0E-08	Liver	2.2E-05	2.2E-04	--	2.4E-04
			Chemical Total	5.9E-07	9.7E-08	--	6.9E-07		1.1E-01	8.0E-03	--	1.2E-01
		Exposure Point Total					6.9E-07					1.2E-01
	Exposure Media Total						6.9E-07					1.2E-01
Surface Water Total							6.9E-07					1.2E-01
Sediment	Sediment	FT08/AT28	Arsenic	5.3E-08	1.3E-08	--	6.6E-08	Skin, vascular system	3.3E-04	8.2E-05	--	4.1E-04
			Beryllium	--	--	--	--	GI tract	9.0E-06	1.1E-05	--	2.0E-05
			Chromium	--	--	--	--	NA	--	--	--	--
			Iron	--	--	--	--	GI tract	4.6E-04	3.8E-06	--	4.6E-04
			2,3,7,8-TCDD equivalents	2.5E-08	6.3E-09	--	3.2E-08	Reproductive	7.8E-04	1.9E-04	--	9.7E-04
			Benzo(a)pyrene equivalents	6.1E-08	6.6E-08	--	1.3E-07	NA	--	--	--	--
			Chemical Total	1.4E-07	8.5E-08	--	2.2E-07		1.6E-03	2.9E-04	--	1.9E-03
		Exposure Point Total					2.2E-07					1.9E-03
	Exposure Media Total						2.2E-07					1.9E-03
Sediment Total							2.2E-07					1.9E-03
Groundwater	Groundwater	FT-08	Aluminum	--	--	--	--	CNS	6.9E-01	1.4E-03	--	6.9E-01
			Arsenic	1.9E-04	3.9E-07	--	1.9E-04	Skin, vascular system	1.2E+00	2.4E-03	--	1.2E+00
			Beryllium	--	--	--	--	GI tract	1.1E-01	3.3E-02	--	1.4E-01
			Cadmium	--	--	--	--	Kidney	5.9E-01	2.4E-02	--	6.1E-01
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	8.7E-01	7.2E-04	--	8.7E-01
			Copper	--	--	--	--	GI tract	7.6E-03	1.6E-05	--	7.6E-03
			Iron	--	--	--	--	GI tract	2.1E+00	4.3E-03	--	2.1E+00
			Lead	--	--	--	--	NA	--	--	--	--
			Manganese	--	--	--	--	CNS	1.3E-01	6.5E-03	--	1.3E-01
			Mercury	--	--	--	--	Immune system	9.8E-03	2.9E-04	--	1.0E-02
			Nickel	--	--	--	--	Weight	1.1E-01	1.2E-03	--	1.1E-01
			Selenium	--	--	--	--	Selenosis	1.4E-02	2.9E-05	--	1.4E-02
			Thallium	--	--	--	--	Skin	3.5E+00	7.3E-03	--	3.5E+00
			Vanadium	--	--	--	--	Hair	5.4E-01	4.2E-02	--	5.8E-01
			Zinc	--	--	--	--	Blood chemistry	2.3E-02	2.9E-05	--	2.3E-02
			1,2-Dichloroethane	7.0E-07	1.1E-08	--	7.1E-07	Kidney	3.6E-03	5.5E-05	--	3.6E-03

Table 9-2.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Routine Worker, OU-8 Site FT-08

Scenario Timeframe:	Future
Receptor Population:	Routine Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
			Benzene	1.1E-05	5.1E-07	--	1.1E-05	Blood	1.4E-01	6.6E-03	--	1.4E-01
			Endrin Aldehyde	--	--	--	--	NA	--	--	--	--
			Trichloroethene	8.1E-05	4.1E-06	--	8.5E-05	Heart, thymus	9.9E+00	5.0E-01	--	1.0E+01
			cis-1,2-Dichloroethene	--	--	--	--	Liver	3.5E-02	1.4E-03	--	3.7E-02
			Chemical Total	2.8E-04	5.0E-06	--	2.9E-04		2.0E+01	6.3E-01	--	2.1E+01
		Exposure Point Total					2.9E-04					2.1E+01
	Exposure Media Total						2.9E-04					2.1E+01
Groundwater Total							2.9E-04					2.1E+01
Receptor Total							3.7E-04					2.1E+01

Total Skin HI across all media =	4.9E+00
Total GI tract HI across all media =	2.3E+00
Total CNS HI across all media =	8.3E-01
Total Kidney HI across all media =	6.2E-01
Total Liver HI across all media =	1.4E-01
Total Respiratory tract HI across all media =	5.1E-05

Table 9-3.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Construction Worker, OU-8 Site FT-08

Scenario Timeframe:	Future
Receptor Population:	Construction Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Total Soil	Total Soil	FT-08	Aluminum	--	--	--	--	CNS	1.1E-02	3.4E-05	--	1.1E-02
			Arsenic	6.4E-08	5.8E-09	--	7.0E-08	Skin, vascular system	1.0E-02	9.0E-04	--	1.1E-02
			Beryllium	--	--	--	--	GI tract	9.8E-05	4.2E-05	--	1.4E-04
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	6.9E-04	2.1E-06	--	7.0E-04
			Iron	--	--	--	--	GI tract	2.2E-02	6.6E-05	--	2.2E-02
			Thallium	--	--	--	--	Skin	2.2E-02	6.6E-05	--	2.2E-02
			2,3,7,8-TCDD equivalents	3.6E-08	3.2E-09	--	3.9E-08	Reproductive	9.6E-04	8.6E-05	--	1.0E-03
			Benzo(a)pyrene equivalents	8.1E-07	3.2E-07	--	1.1E-06	NA	--	--	--	--
			Chlordane	3.6E-10	4.3E-11	--	4.0E-10	Liver	1.2E-04	1.4E-05	--	1.3E-04
			Dieldrin	9.1E-07	2.7E-07	--	1.2E-06	Liver	4.0E-02	1.2E-02	--	5.2E-02
			alpha-Chlordane	1.8E-10	2.2E-11	--	2.1E-10	Liver	6.1E-05	7.4E-06	--	6.9E-05
			gamma-Chlordane	1.3E-10	1.6E-11	--	1.5E-10	Liver	4.5E-05	5.4E-06	--	5.0E-05
			Chemical Total	1.8E-06	6.0E-07	--	2.4E-06		1.1E-01	1.3E-02	--	1.2E-01
		Exposure Point Total					2.4E-06					1.2E-01
	Exposure Media Total						2.4E-06					1.2E-01
	Air (Particulates and Volatiles)	FT-08	Aluminum	--	--	--	--	CNS	--	--	1.2E-04	1.2E-04
			Arsenic	--	--	9.5E-12	9.5E-12	Developmental, cardiovascular, CNS	--	--	1.0E-05	1.0E-05
			Beryllium	--	--	8.7E-13	8.7E-13	Respiratory tract	--	--	1.3E-06	1.3E-06
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	1.4E-11	1.4E-11	Respiratory tract, lung	--	--	5.4E-06	5.4E-06
			Iron	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	NA	--	--	--	--
			2,3,7,8-TCDD equivalents	--	--	5.4E-13	5.4E-13	Reproductive	--	--	2.5E-08	2.5E-08
			Benzo(a)pyrene equivalents	--	--	6.3E-12	6.3E-12	NA	--	--	--	--
			Chlordane	--	--	5.3E-15	5.3E-15	Liver	--	--	1.9E-08	1.9E-08
			Dieldrin	--	--	1.3E-11	1.3E-11	NA	--	--	--	--
			alpha-Chlordane	--	--	2.7E-15	2.7E-15	Liver	--	--	9.5E-09	9.5E-09
			gamma-Chlordane	--	--	2.0E-15	2.0E-15	Liver	--	--	6.9E-09	6.9E-09
			Chemical Total	--	--	4.4E-11	4.4E-11		--	--	1.3E-04	1.3E-04
		Exposure Point Total					4.4E-11					1.3E-04
	Exposure Media Total						4.4E-11					1.3E-04
Total Soil Total							2.4E-06					1.2E-01
Groundwater	Groundwater	FT-08	Aluminum	--	--	--	--	CNS	3.4E-03	7.1E-04	--	4.1E-03
			Arsenic	3.8E-08	7.8E-09	--	4.6E-08	Skin, vascular system	3.5E-04	7.3E-05	--	4.2E-04
			Beryllium	--	--	--	--	GI tract	2.2E-04	6.6E-03	--	6.8E-03
			Cadmium	--	--	--	--	Kidney	2.9E-03	1.2E-02	--	1.5E-02
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	4.4E-04	3.6E-05	--	4.7E-04

Table 9-3.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Construction Worker, OU-8 Site FT-08

Scenario Timeframe:	Future
Receptor Population:	Construction Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
			Copper	--	--	--	--	GI tract	1.5E-04	3.1E-05	--	1.8E-04
			Iron	--	--	--	--	GI tract	1.0E-02	2.2E-03	--	1.3E-02
			Lead	--	--	--	--	NA	--	--	--	--
			Manganese	--	--	--	--	CNS	6.3E-04	3.2E-03	--	3.9E-03
			Mercury	--	--	--	--	Immune system	7.4E-06	2.2E-05	--	2.9E-05
			Nickel	--	--	--	--	Weight	5.7E-04	5.8E-04	--	1.2E-03
			Selenium	--	--	--	--	Selenosis	7.1E-05	1.5E-05	--	8.6E-05
			Thallium	--	--	--	--	Skin	4.4E-03	9.1E-04	--	5.3E-03
			Vanadium	--	--	--	--	Hair	1.4E-03	1.1E-02	--	1.2E-02
			Zinc	--	--	--	--	Blood chemistry	1.2E-04	1.4E-05	--	1.3E-04
			1,2-Dichloroethane	1.4E-10	2.1E-10	--	3.5E-10	Kidney	5.4E-06	8.2E-06	--	1.4E-05
			Benzene	2.2E-09	1.0E-08	--	1.2E-08	Blood	2.8E-04	1.3E-03	--	1.6E-03
			Endrin Aldehyde	--	--	--	--	NA	--	--	--	--
			Trichloroethene	1.6E-08	8.2E-08	--	9.8E-08	Heart, thymus	4.9E-02	2.5E-01	--	3.0E-01
			cis-1,2-Dichloroethene	--	--	--	--	Liver	1.8E-05	7.0E-05	--	8.7E-05
			Chemical Total	5.6E-08	1.0E-07	--	1.6E-07		7.5E-02	2.9E-01	--	3.6E-01
		Exposure Point Total					1.6E-07					3.6E-01
Exposure Media Total							1.6E-07					3.6E-01
	Air (Volatiles)	FT-08	Aluminum	--	--	--	--	CNS	--	--	--	--
			Arsenic	--	--	--	--	Developmental, cardiovascular, CNS	--	--	--	--
			Beryllium	--	--	--	--	Respiratory tract	--	--	--	--
			Cadmium	--	--	--	--	Kidney, respiratory tract	--	--	--	--
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Respiratory tract, lung	--	--	--	--
			Copper	--	--	--	--	NA	--	--	--	--
			Iron	--	--	--	--	NA	--	--	--	--
			Lead	--	--	--	--	NA	--	--	--	--
			Manganese	--	--	--	--	CNS	--	--	--	--
			Mercury	--	--	--	--	CNS	--	--	--	--
			Nickel	--	--	--	--	Weight	--	--	--	--
			Selenium	--	--	--	--	Selenosis	--	--	--	--
			Thallium	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	NA	--	--	--	--
			Zinc	--	--	--	--	NA	--	--	--	--
			1,2-Dichloroethane	--	--	1.9E-07	1.9E-07	Kidney	--	--	7.2E-03	7.2E-03
			Benzene	--	--	1.7E-06	1.7E-06	Blood	--	--	1.9E-01	1.9E-01
			Endrin Aldehyde	--	--	--	--	NA	--	--	--	--
			Trichloroethene	--	--	6.1E-06	6.1E-06	Heart, thymus	--	--	5.2E+01	5.2E+01
			cis-1,2-Dichloroethene	--	--	--	--	NA	--	--	--	--

Table 9-3.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Construction Worker, OU-8 Site FT-08

Scenario Timeframe:	Future
Receptor Population:	Construction Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
			Chemical Total	--	--	8.0E-06	8.0E-06		--	--	5.2E+01	5.2E+01
		Exposure Point Total					8.0E-06					5.2E+01
	Exposure Media Total						8.0E-06					5.2E+01
Groundwater Total							8.1E-06					5.3E+01
Receptor Total							1.1E-05					5.3E+01

Total Liver HI across all media =	5.2E-02
Total GI tract HI across all media =	4.2E-02
Total Skin HI across all media =	3.9E-02
Total Kidney HI across all media =	2.2E-02
Total CNS HI across all media =	2.0E-02
Total Respiratory tract HI across all media =	6.6E-06

Table 9-4.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Resident Adult, OU-8 Site FT-08

Scenario Timeframe:	Future
Receptor Population:	Resident Adult
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Soil	Surface Soil	FT-08	Aluminum	--	--	--	--	CNS	1.1E-02	2.6E-05	--	1.1E-02
			Arsenic	1.8E-06	1.2E-07	--	1.9E-06	Skin, vascular system	1.2E-02	8.0E-04	--	1.2E-02
			Beryllium	--	--	--	--	GI tract	2.3E-04	7.7E-05	--	3.1E-04
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	8.0E-03	1.8E-05	--	8.0E-03
			Iron	--	--	--	--	GI tract	2.2E-02	5.0E-05	--	2.2E-02
			Thallium	--	--	--	--	Skin	7.4E-02	1.7E-04	--	7.4E-02
			2,3,7,8-TCDD equivalents	1.2E-06	8.4E-08	--	1.3E-06	Reproductive	3.9E-02	2.7E-03	--	4.2E-02
			Benzo(a)pyrene equivalents	4.9E-05	1.5E-05	--	6.4E-05	NA	--	--	--	--
			Chlordane	1.7E-08	1.6E-09	--	1.9E-08	Liver	2.8E-04	2.6E-05	--	3.1E-04
			Dieldrin	3.1E-05	7.1E-06	--	3.8E-05	Liver	1.1E-01	2.6E-02	--	1.4E-01
			alpha-Chlordane	8.6E-09	8.0E-10	--	9.4E-09	Liver	1.4E-04	1.3E-05	--	1.6E-04
			gamma-Chlordane	6.8E-09	6.3E-10	--	7.4E-09	Liver	1.1E-04	1.0E-05	--	1.2E-04
			Chemical Total	8.3E-05	2.2E-05	--	1.1E-04		2.8E-01	3.0E-02	--	3.1E-01
		Exposure Point Total					1.1E-04					3.1E-01
	Exposure Media Total						1.1E-04					3.1E-01
	Air (Particulates and Volatiles)	FT-08	Aluminum	--	--	--	--	CNS	--	--	1.1E-03	1.1E-03
			Arsenic	--	--	2.6E-09	2.6E-09	Developmental, cardiovascular, CNS	--	--	1.2E-04	1.2E-04
			Beryllium	--	--	2.0E-10	2.0E-10	Respiratory tract	--	--	1.2E-05	1.2E-05
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	3.8E-09	3.8E-09	Respiratory tract, lung	--	--	2.0E-04	2.0E-04
			Iron	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	NA	--	--	--	--
			2,3,7,8-TCDD equivalents	--	--	1.8E-10	1.8E-10	Reproductive	--	--	3.5E-07	3.5E-07
			Benzo(a)pyrene equivalents	--	--	3.8E-09	3.8E-09	NA	--	--	--	--
			Chlordane	--	--	2.5E-12	2.5E-12	Liver	--	--	1.0E-07	1.0E-07
			Dieldrin	--	--	4.5E-09	4.5E-09	NA	--	--	--	--
			alpha-Chlordane	--	--	1.3E-12	1.3E-12	Liver	--	--	5.3E-08	5.3E-08
			gamma-Chlordane	--	--	9.9E-13	9.9E-13	Liver	--	--	4.1E-08	4.1E-08
			Chemical Total	--	--	1.5E-08	1.5E-08		--	--	1.5E-03	1.5E-03
		Exposure Point Total					1.5E-08					1.5E-03
	Exposure Media Total						1.5E-08					1.5E-03
Surface Soil Total							1.1E-04					3.1E-01
Surface Water	Surface Water	FT08/AT28	Aluminum	--	--	--	--	CNS	3.2E-03	2.3E-04	--	3.5E-03
			Arsenic	1.1E-06	8.1E-08	--	1.2E-06	Skin, vascular system	7.3E-03	5.3E-04	--	7.8E-03
			Beryllium	--	--	--	--	GI tract	1.8E-04	1.9E-03	--	2.1E-03
			Cadmium	--	--	--	--	Kidney	1.0E-03	1.4E-03	--	2.4E-03
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	5.9E-03	1.7E-04	--	6.1E-03
			Iron	--	--	--	--	GI tract	2.0E-02	1.4E-03	--	2.1E-02

Table 9-4.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Resident Adult, OU-8 Site FT-08

Scenario Timeframe:	Future
Receptor Population:	Resident Adult
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
			Lead	--	--	--	--	NA	--	--	--	--
			Manganese	--	--	--	--	CNS	2.1E-03	3.9E-03	--	6.0E-03
			Mercury	--	--	--	--	Immune system	9.2E-05	9.4E-05	--	1.9E-04
			Thallium	--	--	--	--	Skin	1.9E-01	1.3E-02	--	2.0E-01
			Vanadium	--	--	--	--	Hair	2.6E-03	7.2E-03	--	9.7E-03
			4,4'-DDT	1.6E-10	3.3E-08	--	3.3E-08	Liver	2.8E-06	5.6E-04	--	5.7E-04
			Dieldrin	1.2E-08	1.7E-07	--	1.8E-07	Liver	4.5E-05	6.3E-04	--	6.7E-04
			Chemical Total	1.1E-06	2.9E-07	--	1.4E-06		2.3E-01	3.1E-02	--	2.6E-01
		Exposure Point Total					1.4E-06					2.6E-01
	Exposure Media Total						1.4E-06					2.6E-01
Surface Water Total							1.4E-06					2.6E-01
Sediment	Sediment	FT08/AT28	Arsenic	2.0E-07	2.3E-08	--	2.3E-07	Skin, vascular system	1.3E-03	1.5E-04	--	1.5E-03
			Beryllium	--	--	--	--	GI tract	3.6E-05	1.9E-05	--	5.5E-05
			Chromium	--	--	--	--	NA	--	--	--	--
			Iron	--	--	--	--	GI tract	1.8E-03	7.0E-06	--	1.8E-03
			2,3,7,8-TCDD equivalents	9.7E-08	1.1E-08	--	1.1E-07	Reproductive	3.1E-03	3.5E-04	--	3.5E-03
			Benzo(a)pyrene equivalents	2.3E-07	1.2E-07	--	3.5E-07	NA	--	--	--	--
			Chemical Total	5.3E-07	1.5E-07	--	6.8E-07		6.3E-03	5.3E-04	--	6.8E-03
		Exposure Point Total					6.8E-07					6.8E-03
	Exposure Media Total						6.8E-07					6.8E-03
Sediment Total							6.8E-07					6.8E-03
Groundwater	Groundwater	FT-08	Aluminum	--	--	--	--	CNS	9.6E-01	8.7E-03	--	9.7E-01
			Arsenic	2.5E-04	2.3E-06	--	2.6E-04	Skin, vascular system	1.6E+00	1.5E-02	--	1.7E+00
			Beryllium	--	--	--	--	GI tract	1.6E-01	2.0E-01	--	3.6E-01
			Cadmium	--	--	--	--	Kidney	8.2E-01	1.5E-01	--	9.7E-01
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	1.2E+00	4.4E-03	--	1.2E+00
			Copper	--	--	--	--	GI tract	1.1E-02	9.6E-05	--	1.1E-02
			Iron	--	--	--	--	GI tract	2.9E+00	2.6E-02	--	3.0E+00
			Lead	--	--	--	--	NA	--	--	--	--
			Manganese	--	--	--	--	CNS	1.8E-01	4.0E-02	--	2.2E-01
			Mercury	--	--	--	--	Immune system	1.4E-02	1.8E-03	--	1.6E-02
			Nickel	--	--	--	--	Weight	1.6E-01	7.2E-03	--	1.7E-01
			Selenium	--	--	--	--	Selenosis	2.0E-02	1.8E-04	--	2.0E-02
			Thallium	--	--	--	--	Skin	5.0E+00	4.5E-02	--	5.0E+00
			Vanadium	--	--	--	--	Hair	7.5E-01	2.6E-01	--	1.0E+00
			Zinc	--	--	--	--	Blood chemistry	3.3E-02	1.8E-04	--	3.3E-02
			1,2-Dichloroethane	9.4E-07	6.3E-08	--	1.0E-06	Kidney	5.0E-03	3.3E-04	--	5.4E-03
			Benzene	1.5E-05	3.0E-06	--	1.8E-05	Blood	1.9E-01	4.0E-02	--	2.3E-01
			Endrin Aldehyde	--	--	--	--	NA	--	--	--	--

Table 9-4.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Resident Adult, OU-8 Site FT-08

Scenario Timeframe:	Future
Receptor Population:	Resident Adult
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
			Trichloroethene	1.1E-04	2.4E-05	--	1.3E-04	Heart, thymus	1.4E+01	3.0E+00	--	1.7E+01
			cis-1,2-Dichloroethene	--	--	--	--	Liver	4.9E-02	8.5E-03	--	5.8E-02
			Chemical Total	3.8E-04	2.9E-05	--	4.1E-04		2.8E+01	3.8E+00	--	3.2E+01
		Exposure Point Total					4.1E-04					3.2E+01
	Exposure Media Total						4.1E-04					3.2E+01
	Air (Volatiles)	FT-08	Aluminum	--	--	--	--	CNS	--	--	--	--
			Arsenic	--	--	--	--	Developmental, cardiovascular, CNS	--	--	--	--
			Beryllium	--	--	--	--	Respiratory tract	--	--	--	--
			Cadmium	--	--	--	--	Kidney, respiratory tract	--	--	--	--
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Respiratory tract, lung	--	--	--	--
			Copper	--	--	--	--	NA	--	--	--	--
			Iron	--	--	--	--	NA	--	--	--	--
			Lead	--	--	--	--	NA	--	--	--	--
			Manganese	--	--	--	--	CNS	--	--	--	--
			Mercury	--	--	--	--	CNS	--	--	--	--
			Nickel	--	--	--	--	Weight	--	--	--	--
			Selenium	--	--	--	--	Selenosis	--	--	--	--
			Thallium	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	NA	--	--	--	--
			Zinc	--	--	--	--	NA	--	--	--	--
			1,2-Dichloroethane	--	--	4.7E-06	4.7E-06	Kidney	--	--	7.5E-02	7.5E-02
			Benzene	--	--	3.6E-05	3.6E-05	Blood	--	--	4.5E-01	4.5E-01
			Endrin Aldehyde	--	--	--	--	NA	--	--	--	--
			Trichloroethene	--	--	1.7E-04	1.7E-04	Heart, thymus	--	--	6.0E+01	6.0E+01
			cis-1,2-Dichloroethene	--	--	--	--	NA	--	--	--	--
			Chemical Total	--	--	2.1E-04	2.1E-04		--	--	6.1E+01	6.1E+01
		Exposure Point Total					2.1E-04					6.1E+01
	Exposure Media Total						2.1E-04					6.1E+01
Groundwater Total							6.2E-04					9.3E+01
Receptor Total							7.3E-04					9.3E+01

Total Skin HI across all media =	7.0E+00
Total GI tract HI across all media =	3.4E+00
Total CNS HI across all media =	1.2E+00
Total Kidney HI across all media =	1.1E+00
Total Liver HI across all media =	2.0E-01
Total Respiratory tract HI across all media =	2.2E-04

Table 9-5.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Lifetime Resident, OU-8 Site FT-08

Scenario Timeframe:	Future
Receptor Population:	Lifetime Resident
Receptor Age:	Adult and Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Soil	Surface Soil	FT-08	Aluminum	--	--	--	--					
			Arsenic	5.9E-06	4.7E-07	--	6.4E-06					
			Beryllium	--	--	--	--					
			Chromium	--	--	--	--					
			Cobalt	--	--	--	--					
			Iron	--	--	--	--					
			Thallium	--	--	--	--					
			2,3,7,8-TCDD equivalents	4.1E-06	3.2E-07	--	4.4E-06					
			Benzo(a)pyrene equivalents	7.0E-04	2.5E-04	--	9.6E-04					
			Chlordane	5.7E-08	6.0E-09	--	6.3E-08					
			Dieldrin	1.0E-04	2.7E-05	--	1.3E-04					
			alpha-Chlordane	2.9E-08	3.1E-09	--	3.2E-08					
			gamma-Chlordane	2.3E-08	2.4E-09	--	2.5E-08					
			Chemical Total	8.2E-04	2.8E-04	--	1.1E-03					
		Exposure Point Total					1.1E-03					
	Exposure Media Total						1.1E-03					
	Air (Particulates and Volatiles)	FT-08	Aluminum	--	--	--	--					
			Arsenic	--	--	3.3E-09	3.3E-09					
			Beryllium	--	--	2.5E-10	2.5E-10					
			Chromium	--	--	--	--					
			Cobalt	--	--	4.7E-09	4.7E-09					
			Iron	--	--	--	--					
			Thallium	--	--	--	--					
			2,3,7,8-TCDD equivalents	--	--	2.3E-10	2.3E-10					
			Benzo(a)pyrene equivalents	--	--	1.2E-08	1.2E-08					
			Chlordane	--	--	3.1E-12	3.1E-12					
			Dieldrin	--	--	5.6E-09	5.6E-09					
			alpha-Chlordane	--	--	1.6E-12	1.6E-12					
			gamma-Chlordane	--	--	1.2E-12	1.2E-12					
			Chemical Total	--	--	2.6E-08	2.6E-08					
		Exposure Point Total					2.6E-08					
	Exposure Media Total						2.6E-08					
Surface Soil Total							1.1E-03					
Surface Water	Surface Water	FT08/AT28	Aluminum	--	--	--	--					
			Arsenic	2.4E-06	1.8E-07	--	2.6E-06					
			Beryllium	--	--	--	--					
			Cadmium	--	--	--	--					
			Chromium	--	--	--	--					
			Cobalt	--	--	--	--					

Table 9-5.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Lifetime Resident, OU-8 Site FT-08

Scenario Timeframe:	Future
Receptor Population:	Lifetime Resident
Receptor Age:	Adult and Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
			Iron	--	--	--	--					
			Lead	--	--	--	--					
			Manganese	--	--	--	--					
			Mercury	--	--	--	--					
			Thallium	--	--	--	--					
			Vanadium	--	--	--	--					
			4,4'-DDT	3.5E-10	7.2E-08	--	7.2E-08					
			Dieldrin	2.6E-08	3.8E-07	--	4.0E-07					
			Chemical Total	2.5E-06	6.3E-07	--	3.1E-06					
		Exposure Point Total					3.1E-06					
	Exposure Media Total						3.1E-06					
Surface Water Total							3.1E-06					
Sediment	Sediment	FT08/AT28	Arsenic	6.8E-07	6.8E-08	--	7.4E-07					
			Beryllium	--	--	--	--					
			Chromium	--	--	--	--					
			Iron	--	--	--	--					
			2,3,7,8-TCDD equivalents	3.2E-07	3.3E-08	--	3.6E-07					
			Benzo(a)pyrene equivalents	3.3E-06	1.4E-06	--	4.7E-06					
			Chemical Total	4.3E-06	1.5E-06	--	5.8E-06					
		Exposure Point Total					5.8E-06					
	Exposure Media Total						5.8E-06					
Sediment Total							5.8E-06					
Groundwater	Groundwater	FT-08	Aluminum	--	--	--	--					
			Arsenic	4.0E-04	3.3E-06	--	4.0E-04					
			Beryllium	--	--	--	--					
			Cadmium	--	--	--	--					
			Chromium	--	--	--	--					
			Cobalt	--	--	--	--					
			Copper	--	--	--	--					
			Iron	--	--	--	--					
			Lead	--	--	--	--					
			Manganese	--	--	--	--					
			Mercury	--	--	--	--					
			Nickel	--	--	--	--					
			Selenium	--	--	--	--					
			Thallium	--	--	--	--					
			Vanadium	--	--	--	--					
			Zinc	--	--	--	--					
			1,2-Dichloroethane	1.5E-06	8.9E-08	--	1.6E-06					

Table 9-5.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Lifetime Resident, OU-8 Site FT-08

Scenario Timeframe:	Future
Receptor Population:	Lifetime Resident
Receptor Age:	Adult and Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
			Benzene	2.3E-05	4.3E-06	--	2.7E-05					
			Endrin Aldehyde	--	--	--	--					
			Trichloroethene	2.5E-04	4.7E-05	--	2.9E-04					
			cis-1,2-Dichloroethene	--	--	--	--					
			Chemical Total	6.7E-04	5.5E-05	--	7.3E-04					
		Exposure Point Total					7.3E-04					
	Exposure Media Total						7.3E-04					
	Air (Volatiles)	FT-08	Aluminum	--	--	--	--					
			Arsenic	--	--	--	--					
			Beryllium	--	--	--	--					
			Cadmium	--	--	--	--					
			Chromium	--	--	--	--					
			Cobalt	--	--	--	--					
			Copper	--	--	--	--					
			Iron	--	--	--	--					
			Lead	--	--	--	--					
			Manganese	--	--	--	--					
			Mercury	--	--	--	--					
			Nickel	--	--	--	--					
			Selenium	--	--	--	--					
			Thallium	--	--	--	--					
			Vanadium	--	--	--	--					
			Zinc	--	--	--	--					
			1,2-Dichloroethane	--	--	5.9E-06	5.9E-06					
			Benzene	--	--	4.5E-05	4.5E-05					
			Endrin Aldehyde	--	--	--	--					
			Trichloroethene	--	--	2.9E-04	2.9E-04					
			cis-1,2-Dichloroethene	--	--	--	--					
			Chemical Total	--	--	3.4E-04	3.4E-04					
		Exposure Point Total					3.4E-04					
	Exposure Media Total						3.4E-04					
Groundwater Total							1.1E-03					
Receptor Total							2.2E-03					

Table 9-6.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Resident Child, OU-8 Site FT-08

Scenario Timeframe:	Future
Receptor Population:	Resident Child
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Soil	Surface Soil	FT-08	Aluminum	--	--	--	--	CNS	1.0E-01	2.9E-04	--	1.0E-01
			Arsenic	4.2E-06	3.5E-07	--	4.5E-06	Skin, vascular system	1.1E-01	9.1E-03	--	1.2E-01
			Beryllium	--	--	--	--	GI tract	2.2E-03	8.7E-04	--	3.1E-03
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	7.5E-02	2.1E-04	--	7.5E-02
			Iron	--	--	--	--	GI tract	2.0E-01	5.6E-04	--	2.0E-01
			Thallium	--	--	--	--	Skin	6.9E-01	1.9E-03	--	6.9E-01
			2,3,7,8-TCDD equivalents	2.8E-06	2.4E-07	--	3.1E-06	Reproductive	3.6E-01	3.1E-02	--	3.9E-01
			Benzo(a)pyrene equivalents	1.2E-04	4.2E-05	--	1.6E-04	NA	--	--	--	--
			Chlordane	4.0E-08	4.5E-09	--	4.4E-08	Liver	2.7E-03	3.0E-04	--	3.0E-03
			Dieldrin	7.1E-05	2.0E-05	--	9.1E-05	Liver	1.0E+00	2.9E-01	--	1.3E+00
			alpha-Chlordane	2.0E-08	2.3E-09	--	2.2E-08	Liver	1.3E-03	1.5E-04	--	1.5E-03
			gamma-Chlordane	1.6E-08	1.8E-09	--	1.8E-08	Liver	1.1E-03	1.2E-04	--	1.2E-03
			Chemical Total	1.9E-04	6.3E-05	--	2.6E-04		2.6E+00	3.4E-01	--	2.9E+00
		Exposure Point Total					2.6E-04					2.9E+00
	Exposure Media Total						2.6E-04					2.9E+00
	Air (Particulates and Volatiles)	FT-08	Aluminum	--	--	--	--	CNS	--	--	1.1E-03	1.1E-03
			Arsenic	--	--	6.5E-10	6.5E-10	Developmental, cardiovascular, CNS	--	--	1.2E-04	1.2E-04
			Beryllium	--	--	4.9E-11	4.9E-11	Respiratory tract	--	--	1.2E-05	1.2E-05
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	9.4E-10	9.4E-10	Respiratory tract, lung	--	--	2.0E-04	2.0E-04
			Iron	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	NA	--	--	--	--
			2,3,7,8-TCDD equivalents	--	--	4.5E-11	4.5E-11	Reproductive	--	--	3.5E-07	3.5E-07
			Benzo(a)pyrene equivalents	--	--	9.5E-10	9.5E-10	NA	--	--	--	--
			Chlordane	--	--	6.2E-13	6.2E-13	Liver	--	--	1.0E-07	1.0E-07
			Dieldrin	--	--	1.1E-09	1.1E-09	NA	--	--	--	--
			alpha-Chlordane	--	--	3.2E-13	3.2E-13	Liver	--	--	5.3E-08	5.3E-08
			gamma-Chlordane	--	--	2.5E-13	2.5E-13	Liver	--	--	4.1E-08	4.1E-08
			Chemical Total	--	--	3.8E-09	3.8E-09		--	--	1.5E-03	1.5E-03
		Exposure Point Total					3.8E-09					1.5E-03
	Exposure Media Total						3.8E-09					1.5E-03
Surface Soil Total							2.6E-04					2.9E+00
Surface Water	Surface Water	FT08/AT28	Aluminum	--	--	--	--	CNS	1.5E-02	1.1E-03	--	1.6E-02
			Arsenic	1.3E-06	9.7E-08	--	1.4E-06	Skin, vascular system	3.4E-02	2.5E-03	--	3.6E-02
			Beryllium	--	--	--	--	GI tract	8.5E-04	9.0E-03	--	9.9E-03
			Cadmium	--	--	--	--	Kidney	4.6E-03	6.9E-03	--	1.2E-02
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	2.8E-02	8.2E-04	--	2.8E-02
			Iron	--	--	--	--	GI tract	9.1E-02	6.8E-03	--	9.8E-02

Table 9-6.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Resident Child, OU-8 Site FT-08

Scenario Timeframe:	Future
Receptor Population:	Resident Child
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
			Lead	--	--	--	--	NA	--	--	--	--
			Manganese	--	--	--	--	CNS	1.0E-02	1.8E-02	--	2.8E-02
			Mercury	--	--	--	--	Immune system	4.3E-04	4.5E-04	--	8.8E-04
			Thallium	--	--	--	--	Skin	8.7E-01	6.4E-02	--	9.3E-01
			Vanadium	--	--	--	--	Hair	1.2E-02	3.4E-02	--	4.6E-02
			4,4'-DDT	1.9E-10	3.9E-08	--	3.9E-08	Liver	1.3E-05	2.7E-03	--	2.7E-03
			Dieldrin	1.4E-08	2.1E-07	--	2.2E-07	Liver	2.1E-04	3.0E-03	--	3.2E-03
			Chemical Total	1.3E-06	3.4E-07	--	1.7E-06		1.1E+00	1.5E-01	--	1.2E+00
		Exposure Point Total					1.7E-06					1.2E+00
	Exposure Media Total						1.7E-06					1.2E+00
Surface Water Total							1.7E-06					1.2E+00
Sediment	Sediment	FT08/AT28	Arsenic	4.7E-07	4.5E-08	--	5.2E-07	Skin, vascular system	1.2E-02	1.2E-03	--	1.3E-02
			Beryllium	--	--	--	--	GI tract	3.3E-04	1.5E-04	--	4.9E-04
			Chromium	--	--	--	--	NA	--	--	--	--
			Iron	--	--	--	--	GI tract	1.7E-02	5.5E-05	--	1.7E-02
			2,3,7,8-TCDD equivalents	2.3E-07	2.2E-08	--	2.5E-07	Reproductive	2.9E-02	2.8E-03	--	3.2E-02
			Benzo(a)pyrene equivalents	5.4E-07	2.3E-07	--	7.7E-07	NA	--	--	--	--
			Chemical Total	1.2E-06	2.9E-07	--	1.5E-06		5.9E-02	4.2E-03	--	6.3E-02
		Exposure Point Total					1.5E-06					6.3E-02
	Exposure Media Total						1.5E-06					6.3E-02
Sediment Total							1.5E-06					6.3E-02
Groundwater	Groundwater	FT-08	Aluminum	--	--	--	--	CNS	2.2E+00	1.5E-02	--	2.3E+00
			Arsenic	1.5E-04	9.8E-07	--	1.5E-04	Skin, vascular system	3.8E+00	2.5E-02	--	3.9E+00
			Beryllium	--	--	--	--	GI tract	3.6E-01	3.4E-01	--	7.1E-01
			Cadmium	--	--	--	--	Kidney	1.9E+00	2.5E-01	--	2.2E+00
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	2.9E+00	7.5E-03	--	2.9E+00
			Copper	--	--	--	--	GI tract	2.5E-02	1.6E-04	--	2.5E-02
			Iron	--	--	--	--	GI tract	6.8E+00	4.5E-02	--	6.9E+00
			Lead	--	--	--	--	NA	--	--	--	--
			Manganese	--	--	--	--	CNS	4.1E-01	6.8E-02	--	4.8E-01
			Mercury	--	--	--	--	Immune system	3.2E-02	3.0E-03	--	3.5E-02
			Nickel	--	--	--	--	Weight	3.7E-01	1.2E-02	--	3.8E-01
			Selenium	--	--	--	--	Selenosis	4.7E-02	3.1E-04	--	4.7E-02
			Thallium	--	--	--	--	Skin	1.2E+01	7.6E-02	--	1.2E+01
			Vanadium	--	--	--	--	Hair	1.8E+00	4.4E-01	--	2.2E+00
			Zinc	--	--	--	--	Blood chemistry	7.6E-02	3.0E-04	--	7.6E-02
			1,2-Dichloroethane	5.5E-07	2.7E-08	--	5.8E-07	Kidney	1.2E-02	5.7E-04	--	1.2E-02
			Benzene	8.5E-06	1.3E-06	--	9.8E-06	Blood	4.5E-01	6.9E-02	--	5.2E-01
			Endrin Aldehyde	--	--	--	--	NA	--	--	--	--

Table 9-6.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Resident Child, OU-8 Site FT-08

Scenario Timeframe:	Future
Receptor Population:	Resident Child
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
			Trichloroethene	6.4E-05	1.0E-05	--	7.4E-05	Heart, thymus	3.2E+01	5.2E+00	--	3.7E+01
			cis-1,2-Dichloroethene	--	--	--	--	Liver	1.2E-01	1.5E-02	--	1.3E-01
			Chemical Total	2.2E-04	1.3E-05	--	2.3E-04		6.5E+01	6.6E+00	--	7.2E+01
		Exposure Point Total					2.3E-04					7.2E+01
	Exposure Media Total						2.3E-04					7.2E+01
	Air (Volatiles)	FT-08	Aluminum	--	--	--	--	CNS	--	--	--	--
			Arsenic	--	--	--	--	Developmental, cardiovascular, CNS	--	--	--	--
			Beryllium	--	--	--	--	Respiratory tract	--	--	--	--
			Cadmium	--	--	--	--	Kidney, respiratory tract	--	--	--	--
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Respiratory tract, lung	--	--	--	--
			Copper	--	--	--	--	NA	--	--	--	--
			Iron	--	--	--	--	NA	--	--	--	--
			Lead	--	--	--	--	NA	--	--	--	--
			Manganese	--	--	--	--	CNS	--	--	--	--
			Mercury	--	--	--	--	CNS	--	--	--	--
			Nickel	--	--	--	--	Weight	--	--	--	--
			Selenium	--	--	--	--	Selenosis	--	--	--	--
			Thallium	--	--	--	--	NA	--	--	--	--
			Vanadium	--	--	--	--	NA	--	--	--	--
			Zinc	--	--	--	--	NA	--	--	--	--
			1,2-Dichloroethane	--	--	1.2E-06	1.2E-06	Kidney	--	--	7.5E-02	7.5E-02
			Benzene	--	--	9.0E-06	9.0E-06	Blood	--	--	4.5E-01	4.5E-01
			Endrin Aldehyde	--	--	--	--	NA	--	--	--	--
			Trichloroethene	--	--	4.2E-05	4.2E-05	Heart, thymus	--	--	6.0E+01	6.0E+01
			cis-1,2-Dichloroethene	--	--	--	--	NA	--	--	--	--
			Chemical Total	--	--	5.3E-05	5.3E-05		--	--	6.1E+01	6.1E+01
		Exposure Point Total					5.3E-05					6.1E+01
	Exposure Media Total						5.3E-05					6.1E+01
Groundwater Total							2.9E-04					1.3E+02
Receptor Total							5.5E-04					1.4E+02

Total Skin HI across all media =	1.7E+01
Total GI tract HI across all media =	8.0E+00
Total CNS HI across all media =	2.9E+00
Total Kidney HI across all media =	2.3E+00
Total Liver HI across all media =	1.5E+00
Total Respiratory tract HI across all media =	2.2E-04

Table 9-7.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Resident Adult Exposed to Total Soil, OU-8 Site FT-08

Scenario Timeframe:	Future
Receptor Population:	Resident Adult
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Total Soil	Total Soil	FT-08	Aluminum	--	--	--	--	CNS	9.7E-03	2.2E-05	--	9.7E-03
			Arsenic	1.3E-06	9.1E-08	--	1.4E-06	Skin, vascular system	8.5E-03	5.9E-04	--	9.1E-03
			Beryllium	--	--	--	--	GI tract	2.1E-04	6.9E-05	--	2.8E-04
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	5.9E-03	1.4E-05	--	5.9E-03
			Iron	--	--	--	--	GI tract	1.9E-02	4.3E-05	--	1.9E-02
			Thallium	--	--	--	--	Skin	7.4E-02	1.7E-04	--	7.5E-02
			2,3,7,8-TCDD equivalents	7.3E-07	5.0E-08	--	7.8E-07	Reproductive	2.3E-02	1.6E-03	--	2.5E-02
			Benzo(a)pyrene equivalents	1.6E-05	5.0E-06	--	2.1E-05	NA	--	--	--	--
			Chlordane	7.3E-09	6.8E-10	--	8.0E-09	Liver	1.2E-04	1.1E-05	--	1.3E-04
			Dieldrin	1.8E-05	4.3E-06	--	2.3E-05	Liver	6.7E-02	1.6E-02	--	8.3E-02
			alpha-Chlordane	3.7E-09	3.5E-10	--	4.1E-09	Liver	6.2E-05	5.8E-06	--	6.8E-05
			gamma-Chlordane	2.7E-09	2.5E-10	--	3.0E-09	Liver	4.5E-05	4.2E-06	--	5.0E-05
			Chemical Total	3.7E-05	9.4E-06	--	4.6E-05		2.1E-01	1.8E-02	--	2.3E-01
		Exposure Point Total					4.6E-05					2.3E-01
	Exposure Media Total						4.6E-05					2.3E-01
	Air (Particulates and Volatiles)	FT-08	Aluminum	--	--	--	--	CNS	--	--	9.9E-04	9.9E-04
			Arsenic	--	--	1.9E-09	1.9E-09	Developmental, cardiovascular, CNS	--	--	8.7E-05	8.7E-05
			Beryllium	--	--	1.8E-10	1.8E-10	Respiratory tract	--	--	1.1E-05	1.1E-05
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	2.8E-09	2.8E-09	Respiratory tract, lung	--	--	1.5E-04	1.5E-04
			Iron	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	NA	--	--	--	--
			2,3,7,8-TCDD equivalents	--	--	1.1E-10	1.1E-10	Reproductive	--	--	2.1E-07	2.1E-07
			Benzo(a)pyrene equivalents	--	--	1.3E-09	1.3E-09	NA	--	--	--	--
			Chlordane	--	--	1.1E-12	1.1E-12	Liver	--	--	4.4E-08	4.4E-08
			Dieldrin	--	--	2.7E-09	2.7E-09	NA	--	--	--	--
			alpha-Chlordane	--	--	5.5E-13	5.5E-13	Liver	--	--	2.3E-08	2.3E-08
			gamma-Chlordane	--	--	4.0E-13	4.0E-13	Liver	--	--	1.7E-08	1.7E-08
			Chemical Total	--	--	9.0E-09	9.0E-09		--	--	1.2E-03	1.2E-03
		Exposure Point Total					9.0E-09					1.2E-03
	Exposure Media Total						9.0E-09					1.2E-03
Total Soil Total							4.6E-05					2.3E-01
Receptor Total							4.6E-05					2.3E-01

Table 9-8.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Lifetime Resident Exposed to Total Soil, OU-8 Site FT-08

Scenario Timeframe:	Future
Receptor Population:	Lifetime Resident
Receptor Age:	Adult and Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Total Soil	Total Soil	FT-08	Aluminum	--	--	--	--					
			Arsenic	4.4E-06	3.5E-07	--	4.7E-06					
			Beryllium	--	--	--	--					
			Chromium	--	--	--	--					
			Cobalt	--	--	--	--					
			Iron	--	--	--	--					
			Thallium	--	--	--	--					
			2,3,7,8-TCDD equivalents	2.4E-06	1.9E-07	--	2.6E-06					
			Benzo(a)pyrene equivalents	2.4E-04	8.4E-05	--	3.2E-04					
			Chlordane	2.4E-08	2.6E-09	--	2.7E-08					
			Dieldrin	6.2E-05	1.6E-05	--	7.8E-05					
			alpha-Chlordane	1.2E-08	1.3E-09	--	1.4E-08					
			gamma-Chlordane	9.1E-09	9.7E-10	--	1.0E-08					
			Chemical Total	3.0E-04	1.0E-04	--	4.0E-04					
		Exposure Point Total					4.0E-04					
	Exposure Media Total						4.0E-04					
	Air (Particulates and Volatiles)	FT-08	Aluminum	--	--	--	--					
			Arsenic	--	--	2.4E-09	2.4E-09					
			Beryllium	--	--	2.2E-10	2.2E-10					
			Chromium	--	--	--	--					
			Cobalt	--	--	3.5E-09	3.5E-09					
			Iron	--	--	--	--					
			Thallium	--	--	--	--					
			2,3,7,8-TCDD equivalents	--	--	1.4E-10	1.4E-10					
			Benzo(a)pyrene equivalents	--	--	4.0E-09	4.0E-09					
			Chlordane	--	--	1.3E-12	1.3E-12					
			Dieldrin	--	--	3.4E-09	3.4E-09					
			alpha-Chlordane	--	--	6.8E-13	6.8E-13					
			gamma-Chlordane	--	--	5.0E-13	5.0E-13					
			Chemical Total	--	--	1.4E-08	1.4E-08					
		Exposure Point Total					1.4E-08					
	Exposure Media Total						1.4E-08					
Total Soil Total							4.0E-04					
Receptor Total							4.0E-04					

Table 9-9.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Resident Child Exposed to Total Soil, OU-8 Site FT-08

Scenario Timeframe:	Future
Receptor Population:	Resident Child
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Total Soil	Total Soil	FT-08	Aluminum	--	--	--	--	CNS	9.0E-02	2.5E-04	--	9.1E-02
			Arsenic	3.1E-06	2.6E-07	--	3.3E-06	Skin, vascular system	7.9E-02	6.7E-03	--	8.6E-02
			Beryllium	--	--	--	--	GI tract	1.9E-03	7.8E-04	--	2.7E-03
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	5.5E-02	1.5E-04	--	5.5E-02
			Iron	--	--	--	--	GI tract	1.7E-01	4.9E-04	--	1.7E-01
			Thallium	--	--	--	--	Skin	6.9E-01	1.9E-03	--	7.0E-01
			2,3,7,8-TCDD equivalents	1.7E-06	1.4E-07	--	1.8E-06	Reproductive	2.2E-01	1.8E-02	--	2.4E-01
			Benzo(a)pyrene equivalents	3.8E-05	1.4E-05	--	5.2E-05	NA	--	--	--	--
			Chlordane	1.7E-08	1.9E-09	--	1.9E-08	Liver	1.1E-03	1.3E-04	--	1.3E-03
			Dieldrin	4.3E-05	1.2E-05	--	5.5E-05	Liver	6.3E-01	1.8E-01	--	8.1E-01
			alpha-Chlordane	8.7E-09	9.8E-10	--	9.7E-09	Liver	5.8E-04	6.5E-05	--	6.5E-04
			gamma-Chlordane	6.4E-09	7.1E-10	--	7.1E-09	Liver	4.2E-04	4.8E-05	--	4.7E-04
			Chemical Total	8.6E-05	2.6E-05	--	1.1E-04		1.9E+00	2.0E-01	--	2.1E+00
		Exposure Point Total					1.1E-04					2.1E+00
	Exposure Media Total						1.1E-04					2.1E+00
	Air (Particulates and Volatiles)	FT-08	Aluminum	--	--	--	--	CNS	--	--	9.9E-04	9.9E-04
			Arsenic	--	--	4.8E-10	4.8E-10	Developmental, cardiovascular, CNS	--	--	8.7E-05	8.7E-05
			Beryllium	--	--	4.4E-11	4.4E-11	Respiratory tract	--	--	1.1E-05	1.1E-05
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	7.0E-10	7.0E-10	Respiratory tract, lung	--	--	1.5E-04	1.5E-04
			Iron	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	NA	--	--	--	--
			2,3,7,8-TCDD equivalents	--	--	2.7E-11	2.7E-11	Reproductive	--	--	2.1E-07	2.1E-07
			Benzo(a)pyrene equivalents	--	--	3.2E-10	3.2E-10	NA	--	--	--	--
			Chlordane	--	--	2.7E-13	2.7E-13	Liver	--	--	4.4E-08	4.4E-08
			Dieldrin	--	--	6.8E-10	6.8E-10	NA	--	--	--	--
			alpha-Chlordane	--	--	1.4E-13	1.4E-13	Liver	--	--	2.3E-08	2.3E-08
			gamma-Chlordane	--	--	9.9E-14	9.9E-14	Liver	--	--	1.7E-08	1.7E-08
			Chemical Total	--	--	2.2E-09	2.2E-09		--	--	1.2E-03	1.2E-03
		Exposure Point Total					2.2E-09					1.2E-03
	Exposure Media Total						2.2E-09					1.2E-03
Total Soil Total							1.1E-04					2.1E+00
Receptor Total							1.1E-04					2.1E+00

Total Liver HI across all media =	8.1E-01
Total Skin HI across all media =	7.8E-01
Total GI tract HI across all media =	1.8E-01
Total CNS HI across all media =	9.2E-02
Total Respiratory tract HI across all media =	1.6E-04

Table 9-11.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Routine Worker, OU-8 Site AT-28

Scenario Timeframe:	Future
Receptor Population:	Routine Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Soil	Surface Soil	AT-28	Aluminum	--	--	--	--	CNS	6.6E-03	2.2E-05	--	6.7E-03
			Arsenic	1.5E-06	1.4E-07	--	1.6E-06	Skin, vascular system	9.1E-03	9.0E-04	--	1.0E-02
			Beryllium	--	--	--	--	GI tract	1.3E-04	6.1E-05	--	1.9E-04
			Chromium	--	--	--	--	NA	--	--	--	--
			Iron	--	--	--	--	GI tract	1.3E-02	4.2E-05	--	1.3E-02
			Lead	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	Skin	4.8E-02	1.6E-04	--	4.8E-02
			1,2,4-Trimethylbenzene	--	--	--	--	NA	--	--	--	--
			2,3,7,8-TCDD equivalents	5.3E-06	5.2E-07	--	5.8E-06	Reproductive	1.6E-01	1.6E-02	--	1.8E-01
			4,4'-DDD	2.0E-08	6.5E-09	--	2.6E-08	NA	--	--	--	--
			4,4'-DDE	1.8E-07	5.8E-08	--	2.4E-07	NA	--	--	--	--
			Benzo(a)pyrene equivalents	6.7E-07	2.9E-07	--	9.6E-07	NA	--	--	--	--
			Chlordane	9.1E-09	1.2E-09	--	1.0E-08	Liver	1.5E-04	1.9E-05	--	1.7E-04
			Dieldrin	1.9E-07	6.4E-08	--	2.6E-07	Liver	6.8E-04	2.2E-04	--	9.0E-04
			alpha-Chlordane	2.6E-09	3.5E-10	--	3.0E-09	Liver	4.2E-05	5.5E-06	--	4.7E-05
			gamma-Chlordane	1.5E-09	2.0E-10	--	1.7E-09	Liver	2.5E-05	3.3E-06	--	2.8E-05
			Chemical Total	7.8E-06	1.1E-06	--	8.9E-06		2.4E-01	1.7E-02	--	2.6E-01
		Exposure Point Total					8.9E-06					2.6E-01
	Exposure Media Total						8.9E-06					2.6E-01
	Air (Particulates and Volatiles)	AT-28	Aluminum	--	--	--	--	CNS	--	--	2.3E-04	2.3E-04
			Arsenic	--	--	7.1E-10	7.1E-10	Developmental, cardiovascular, CNS	--	--	3.1E-05	3.1E-05
			Beryllium	--	--	3.8E-11	3.8E-11	Respiratory tract	--	--	2.2E-06	2.2E-06
			Chromium	--	--	--	--	NA	--	--	--	--
			Iron	--	--	--	--	NA	--	--	--	--
			Lead	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	NA	--	--	--	--
			1,2,4-Trimethylbenzene	--	--	--	--	Weight	--	--	5.9E-03	5.9E-03
			2,3,7,8-TCDD equivalents	--	--	2.6E-10	2.6E-10	Reproductive	--	--	4.8E-07	4.8E-07
			4,4'-DDD	--	--	9.7E-13	9.7E-13	NA	--	--	--	--
			4,4'-DDE	--	--	8.6E-12	8.6E-12	NA	--	--	--	--
			Benzo(a)pyrene equivalents	--	--	1.7E-11	1.7E-11	NA	--	--	--	--
			Chlordane	--	--	4.4E-13	4.4E-13	Liver	--	--	1.8E-08	1.8E-08
			Dieldrin	--	--	9.4E-12	9.4E-12	NA	--	--	--	--
			alpha-Chlordane	--	--	1.3E-13	1.3E-13	Liver	--	--	5.1E-09	5.1E-09
			gamma-Chlordane	--	--	7.5E-14	7.5E-14	Liver	--	--	3.0E-09	3.0E-09
			Chemical Total	--	--	1.0E-09	1.0E-09		--	--	6.2E-03	6.2E-03
		Exposure Point Total					1.0E-09					6.2E-03
	Exposure Media Total						1.0E-09					6.2E-03
Surface Soil Total							8.9E-06					2.6E-01

Table 9-11.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Routine Worker, OU-8 Site AT-28

Scenario Timeframe:	Future
Receptor Population:	Routine Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Surface Water	FT08/AT28	Aluminum	--	--	--	--	CNS	1.6E-03	5.8E-05	--	1.7E-03
			Arsenic	5.8E-07	2.1E-08	--	6.1E-07	Skin, vascular system	3.6E-03	1.3E-04	--	3.8E-03
			Beryllium	--	--	--	--	GI tract	9.2E-05	4.7E-04	--	5.6E-04
			Cadmium	--	--	--	--	Kidney	5.0E-04	3.6E-04	--	8.6E-04
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	3.0E-03	4.3E-05	--	3.0E-03
			Iron	--	--	--	--	GI tract	9.8E-03	3.5E-04	--	1.0E-02
			Lead	--	--	--	--	NA	--	--	--	--
			Manganese	--	--	--	--	CNS	1.1E-03	9.6E-04	--	2.0E-03
			Mercury	--	--	--	--	Immune system	4.6E-05	2.4E-05	--	6.9E-05
			Thallium	--	--	--	--	Skin	9.3E-02	3.4E-03	--	9.7E-02
			Vanadium	--	--	--	--	Hair	1.3E-03	1.8E-03	--	3.1E-03
			4,4'-DDT	8.5E-11	1.2E-08	--	1.2E-08	Liver	1.4E-06	2.0E-04	--	2.0E-04
			Dieldrin	6.4E-09	6.3E-08	--	7.0E-08	Liver	2.2E-05	2.2E-04	--	2.4E-04
			Chemical Total	5.9E-07	9.7E-08	--	6.9E-07		1.1E-01	8.0E-03	--	1.2E-01
		Exposure Point Total					6.9E-07					1.2E-01
	Exposure Media Total						6.9E-07					1.2E-01
Surface Water Total							6.9E-07					1.2E-01
Sediment	Sediment	FT08/AT28	Arsenic	5.3E-08	1.3E-08	--	6.6E-08	Skin, vascular system	3.3E-04	8.2E-05	--	4.1E-04
			Beryllium	--	--	--	--	GI tract	9.0E-06	1.1E-05	--	2.0E-05
			Chromium	--	--	--	--	NA	--	--	--	--
			Iron	--	--	--	--	GI tract	4.6E-04	3.8E-06	--	4.6E-04
			2,3,7,8-TCDD equivalents	2.5E-08	6.3E-09	--	3.2E-08	Reproductive	7.8E-04	1.9E-04	--	9.7E-04
			Benzo(a)pyrene equivalents	6.1E-08	6.6E-08	--	1.3E-07	NA	--	--	--	--
			Chemical Total	1.4E-07	8.5E-08	--	2.2E-07		1.6E-03	2.9E-04	--	1.9E-03
		Exposure Point Total					2.2E-07					1.9E-03
	Exposure Media Total						2.2E-07					1.9E-03
Sediment Total							2.2E-07					1.9E-03
Groundwater	Groundwater	AT-28	Aluminum	--	--	--	--	CNS	5.4E-02	1.1E-04	--	5.4E-02
			Arsenic	3.7E-05	7.6E-08	--	3.7E-05	Skin, vascular system	2.3E-01	4.7E-04	--	2.3E-01
			Beryllium	--	--	--	--	GI tract	1.3E-03	3.7E-04	--	1.6E-03
			Cadmium	--	--	--	--	Kidney	4.3E-02	1.8E-03	--	4.5E-02
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	9.1E-02	7.5E-05	--	9.1E-02
			Iron	--	--	--	--	GI tract	3.4E-01	7.1E-04	--	3.4E-01
			Manganese	--	--	--	--	CNS	3.2E-01	1.7E-02	--	3.4E-01
			Vanadium	--	--	--	--	Hair	4.3E-02	3.4E-03	--	4.7E-02
			1,2,4-Trimethylbenzene	--	--	--	--	NA	--	--	--	--
			1,3,5-Trimethylbenzene	--	--	--	--	Liver	9.2E-02	--	--	9.2E-02

Table 9-11.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Routine Worker, OU-8 Site AT-28

Scenario Timeframe:	Future
Receptor Population:	Routine Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
			2-Methylnaphthalene	--	--	--	--	Lung	1.0E-01	--	--	1.0E-01
			4,4'-DDD	3.5E-07	1.0E-06	--	1.4E-06	NA	--	--	--	--
			Diphenyl	7.3E-08	--	--	7.3E-08	Kidney	5.1E-04	--	--	5.1E-04
			Ethylbenzene	6.4E-06	1.2E-06	--	7.5E-06	Kidney, liver	1.6E-02	3.0E-03	--	1.9E-02
			Naphthalene	--	--	--	--	Weight	3.7E-02	7.4E-03	--	4.5E-02
			Pentachlorophenol	2.3E-06	2.7E-06	--	5.0E-06	Kidney	3.2E-03	3.8E-03	--	7.0E-03
			Toluene	--	--	--	--	Kidney	2.2E-02	2.3E-03	--	2.4E-02
			Xylene, Total	--	--	--	--	CNS, weight	4.1E-02	--	--	4.1E-02
			beta-BHC	7.9E-07	--	--	7.9E-07	NA	--	--	--	--
			m-and/or p-Xylene	--	--	--	--	CNS, weight	2.6E-02	--	--	2.6E-02
			o-xylene	--	--	--	--	CNS, weight	1.5E-02	--	--	1.5E-02
			Chemical Total	4.7E-05	5.0E-06	--	5.2E-05		1.5E+00	4.0E-02	--	1.5E+00
		Exposure Point Total					5.2E-05					1.5E+00
	Exposure Media Total						5.2E-05					1.5E+00
	Exposure Media Total						5.2E-05					1.5E+00
Groundwater Total							5.2E-05					1.5E+00
Receptor Total							6.1E-05					1.9E+00

Total CNS HI across all media =	4.8E-01
Total Skin HI across all media =	3.9E-01
Total GI tract HI across all media =	3.7E-01
Total Weight HI across all media =	1.3E-01
Total Liver HI across all media =	1.1E-01
Total Kidney HI across all media =	9.7E-02

Table 9-12.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Construction Worker, OU-8 Site AT-28

Scenario Timeframe:	Future
Receptor Population:	Construction Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Total Soil	Total Soil	AT-28	Aluminum	--	--	--	--	CNS	8.1E-03	2.4E-05	--	8.2E-03
			Arsenic	7.9E-08	7.1E-09	--	8.6E-08	Skin, vascular system	1.2E-02	1.1E-03	--	1.3E-02
			Beryllium	--	--	--	--	GI tract	6.3E-05	2.7E-05	--	8.9E-05
			Chromium	--	--	--	--	NA	--	--	--	--
			Iron	--	--	--	--	GI tract	1.3E-02	4.0E-05	--	1.3E-02
			Lead	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	Skin	3.4E-02	1.0E-04	--	3.4E-02
			1,2,4-Trimethylbenzene	--	--	--	--	NA	--	--	--	--
			2,3,7,8-TCDD equivalents	2.1E-07	1.9E-08	--	2.2E-07	Reproductive	5.5E-03	5.0E-04	--	6.0E-03
			4,4'-DDD	9.4E-09	2.8E-09	--	1.2E-08	NA	--	--	--	--
			4,4'-DDE	8.8E-09	2.6E-09	--	1.1E-08	NA	--	--	--	--
			Benzene	1.3E-11	3.8E-13	--	1.3E-11	Blood	1.6E-06	4.8E-08	--	1.7E-06
			Benzo(a)pyrene equivalents	3.6E-08	1.4E-08	--	5.0E-08	NA	--	--	--	--
			Chlordane	4.6E-10	5.5E-11	--	5.2E-10	Liver	1.5E-04	1.8E-05	--	1.7E-04
			Dieldrin	7.1E-09	2.1E-09	--	9.2E-09	Liver	3.1E-04	9.3E-05	--	4.0E-04
			Ethylbenzene	2.1E-10	6.4E-12	--	2.2E-10	Kidney, liver	2.7E-05	8.1E-07	--	2.8E-05
			alpha-Chlordane	1.1E-10	1.3E-11	--	1.2E-10	Liver	3.5E-05	4.2E-06	--	3.9E-05
			gamma-Chlordane	6.1E-11	7.3E-12	--	6.8E-11	Liver	2.0E-05	2.4E-06	--	2.3E-05
			Chemical Total	3.5E-07	4.7E-08	--	3.9E-07		7.4E-02	1.9E-03	--	7.6E-02
		Exposure Point Total					3.9E-07					7.6E-02
	Exposure Media Total						3.9E-07					7.6E-02
	Air (Particulates and Volatiles)	AT-28	Aluminum	--	--	--	--	CNS	--	--	8.4E-05	8.4E-05
			Arsenic	--	--	1.2E-11	1.2E-11	Developmental, cardiovascular, CNS	--	--	1.3E-05	1.3E-05
			Beryllium	--	--	5.5E-13	5.5E-13	Respiratory tract	--	--	8.1E-07	8.1E-07
			Chromium	--	--	--	--	NA	--	--	--	--
			Iron	--	--	--	--	NA	--	--	--	--
			Lead	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	NA	--	--	--	--
			1,2,4-Trimethylbenzene	--	--	--	--	Weight	--	--	2.8E-03	2.8E-03
			2,3,7,8-TCDD equivalents	--	--	3.1E-12	3.1E-12	Reproductive	--	--	1.4E-07	1.4E-07
			4,4'-DDD	--	--	1.4E-13	1.4E-13	NA	--	--	--	--
			4,4'-DDE	--	--	1.3E-13	1.3E-13	NA	--	--	--	--
			Benzene	--	--	2.6E-10	2.6E-10	Blood	--	--	2.9E-05	2.9E-05
			Benzo(a)pyrene equivalents	--	--	2.8E-13	2.8E-13	NA	--	--	--	--
			Chlordane	--	--	6.8E-15	6.8E-15	Liver	--	--	2.4E-08	2.4E-08
			Dieldrin	--	--	1.1E-13	1.1E-13	NA	--	--	--	--
			Ethylbenzene	--	--	4.3E-09	4.3E-09	Developmental	--	--	1.4E-05	1.4E-05
			alpha-Chlordane	--	--	1.6E-15	1.6E-15	Liver	--	--	5.5E-09	5.5E-09
			gamma-Chlordane	--	--	9.0E-16	9.0E-16	Liver	--	--	3.1E-09	3.1E-09

Table 9-12.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Construction Worker, OU-8 Site AT-28

Scenario Timeframe:	Future
Receptor Population:	Construction Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
			Chemical Total	--	--	4.6E-09	4.6E-09		--	--	3.0E-03	3.0E-03
		Exposure Point Total					4.6E-09					3.0E-03
	Exposure Media Total						4.6E-09					3.0E-03
Total Soil Total							4.0E-07					7.9E-02
Groundwater	Groundwater	AT-28	Aluminum	--	--	--	--	CNS	2.7E-04	5.5E-05	--	3.2E-04
			Arsenic	7.3E-09	1.5E-09	--	8.9E-09	Skin, vascular system	1.1E-03	2.4E-04	--	1.4E-03
			Beryllium	--	--	--	--	GI tract	2.5E-06	7.5E-05	--	7.7E-05
			Cadmium	--	--	--	--	Kidney	2.2E-04	9.0E-04	--	1.1E-03
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	4.6E-05	3.8E-06	--	4.9E-05
			Iron	--	--	--	--	GI tract	1.7E-03	3.5E-04	--	2.1E-03
			Manganese	--	--	--	--	CNS	1.6E-03	8.3E-03	--	9.9E-03
			Vanadium	--	--	--	--	Hair	1.1E-04	8.6E-04	--	9.7E-04
			1,2,4-Trimethylbenzene	--	--	--	--	NA	--	--	--	--
			1,3,5-Trimethylbenzene	--	--	--	--	Liver	4.6E-05	--	--	4.6E-05
			2-Methylnaphthalene	--	--	--	--	Lung	5.1E-04	--	--	5.1E-04
			4,4'-DDD	7.0E-11	2.1E-08	--	2.1E-08	NA	--	--	--	--
			Diphenyl	1.5E-11	--	--	1.5E-11	Kidney	1.3E-06	--	--	1.3E-06
			Ethylbenzene	1.3E-09	2.3E-08	--	2.5E-08	Kidney, liver	1.6E-04	3.0E-03	--	3.1E-03
			Naphthalene	--	--	--	--	Weight	6.2E-06	1.2E-04	--	1.3E-04
			Pentachlorophenol	4.6E-10	5.4E-08	--	5.5E-08	Kidney	8.0E-05	9.5E-03	--	9.6E-03
			Toluene	--	--	--	--	Kidney	1.1E-05	1.2E-04	--	1.3E-04
			Xylene, Total	--	--	--	--	CNS, weight	1.0E-04	--	--	1.0E-04
			beta-BHC	1.6E-10	--	--	1.6E-10	NA	1.0E-05	--	--	1.0E-05
			m-and/or p-Xylene	--	--	--	--	CNS, weight	6.6E-05	--	--	6.6E-05
			o-xylene	--	--	--	--	CNS, weight	7.3E-05	--	--	7.3E-05
			Chemical Total	9.3E-09	1.0E-07	--	1.1E-07		6.2E-03	2.3E-02	--	3.0E-02
		Exposure Point Total					1.1E-07					3.0E-02
	Exposure Media Total						1.1E-07					3.0E-02
	Air (Volatiles)	AT-28	Aluminum	--	--	--	--	CNS	--	--	--	--
			Arsenic	--	--	--	--	Developmental, cardiovascular, CNS	--	--	--	--
			Beryllium	--	--	--	--	Respiratory tract	--	--	--	--
			Cadmium	--	--	--	--	Kidney, respiratory tract	--	--	--	--
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Respiratory tract, lung	--	--	--	--
			Iron	--	--	--	--	NA	--	--	--	--
			Manganese	--	--	--	--	CNS	--	--	--	--
			Vanadium	--	--	--	--	NA	--	--	--	--
			1,2,4-Trimethylbenzene	--	--	--	--	Weight	--	--	8.0E-01	8.0E-01

Table 9-12.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Construction Worker, OU-8 Site AT-28

Scenario Timeframe:	Future
Receptor Population:	Construction Worker
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
			1,3,5-Trimethylbenzene	--	--	--	--	Liver	--	--	2.0E+00	2.0E+00
			2-Methylnaphthalene	--	--	--	--	NA	--	--	--	--
			4,4'-DDD	--	--	--	--	NA	--	--	--	--
			Diphenyl	--	--	--	--	Kidney	--	--	--	--
			Ethylbenzene	--	--	1.4E-06	1.4E-06	Developmental	--	--	4.2E-03	4.2E-03
			Naphthalene	--	--	--	--	Weight	--	--	--	--
			Pentachlorophenol	--	--	--	--	NA	--	--	--	--
			Toluene	--	--	--	--	Kidney	--	--	8.8E-03	8.8E-03
			Xylene, Total	--	--	--	--	CNS, weight	--	--	4.8E-01	4.8E-01
			beta-BHC	--	--	--	--	NA	--	--	--	--
			m-and/or p-Xylene	--	--	--	--	CNS, weight	--	--	3.1E-01	3.1E-01
			o-xylene	--	--	--	--	CNS, weight	--	--	6.9E-01	6.9E-01
			Chemical Total	--	--	1.4E-06	1.4E-06		--	--	4.3E+00	4.3E+00
		Exposure Point Total					1.4E-06					4.3E+00
	Exposure Media Total						1.4E-06					4.3E+00
Groundwater Total							1.5E-06					4.3E+00
Receptor Total							1.9E-06					4.4E+00

Total Weight HI across all media =	2.3E+00
Total Liver HI across all media =	2.0E+00
Total CNS HI across all media =	1.5E+00
Total Skin HI across all media =	4.9E-02
Total Kidney HI across all media =	2.3E-02
Total GI tract HI across all media =	1.6E-02
Total Developmental HI across all media =	4.3E-03

Table 9-13.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Resident Adult, OU-8 Site AT-28

Scenario Timeframe:	Future
Receptor Population:	Resident Adult
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Soil	Surface Soil	AT-28	Aluminum	--	--	--	--	CNS	9.3E-03	2.1E-05	--	9.3E-03
			Arsenic	2.0E-06	1.4E-07	--	2.1E-06	Skin, vascular system	1.3E-02	8.8E-04	--	1.4E-02
			Beryllium	--	--	--	--	GI tract	1.8E-04	6.0E-05	--	2.4E-04
			Chromium	--	--	--	--	NA	--	--	--	--
			Iron	--	--	--	--	GI tract	1.8E-02	4.1E-05	--	1.8E-02
			Lead	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	Skin	6.7E-02	1.6E-04	--	6.7E-02
			1,2,4-Trimethylbenzene	--	--	--	--	NA	--	--	--	--
			2,3,7,8-TCDD equivalents	7.1E-06	4.9E-07	--	7.6E-06	Reproductive	2.3E-01	1.6E-02	--	2.4E-01
			4,4'-DDD	2.6E-08	6.1E-09	--	3.3E-08	NA	--	--	--	--
			4,4'-DDE	2.4E-07	5.5E-08	--	2.9E-07	NA	--	--	--	--
			Benzo(a)pyrene equivalents	9.0E-07	2.7E-07	--	1.2E-06	NA	--	--	--	--
			Chlordane	1.2E-08	1.1E-09	--	1.3E-08	Liver	2.0E-04	1.9E-05	--	2.2E-04
			Dieldrin	2.6E-07	6.0E-08	--	3.2E-07	Liver	9.5E-04	2.2E-04	--	1.2E-03
			alpha-Chlordane	3.5E-09	3.3E-10	--	3.8E-09	Liver	5.9E-05	5.4E-06	--	6.4E-05
			gamma-Chlordane	2.1E-09	1.9E-10	--	2.3E-09	Liver	3.5E-05	3.2E-06	--	3.8E-05
			Chemical Total	1.0E-05	1.0E-06	--	1.1E-05		3.4E-01	1.7E-02	--	3.5E-01
		Exposure Point Total					1.1E-05					3.5E-01
	Exposure Media Total						1.1E-05					3.5E-01
	Air (Particulates and Volatiles)	AT-28	Aluminum	--	--	--	--	CNS	--	--	9.5E-04	9.5E-04
			Arsenic	--	--	2.9E-09	2.9E-09	Developmental, cardiovascular, CNS	--	--	1.3E-04	1.3E-04
			Beryllium	--	--	1.5E-10	1.5E-10	Respiratory tract	--	--	9.3E-06	9.3E-06
			Chromium	--	--	--	--	NA	--	--	--	--
			Iron	--	--	--	--	NA	--	--	--	--
			Lead	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	NA	--	--	--	--
			1,2,4-Trimethylbenzene	--	--	--	--	Weight	--	--	2.3E-02	2.3E-02
			2,3,7,8-TCDD equivalents	--	--	1.1E-09	1.1E-09	Reproductive	--	--	2.0E-06	2.0E-06
			4,4'-DDD	--	--	3.9E-12	3.9E-12	NA	--	--	--	--
			4,4'-DDE	--	--	3.5E-11	3.5E-11	NA	--	--	--	--
			Benzo(a)pyrene equivalents	--	--	6.9E-11	6.9E-11	NA	--	--	--	--
			Chlordane	--	--	1.8E-12	1.8E-12	Liver	--	--	7.5E-08	7.5E-08
			Dieldrin	--	--	3.8E-11	3.8E-11	NA	--	--	--	--
			alpha-Chlordane	--	--	5.1E-13	5.1E-13	Liver	--	--	2.1E-08	2.1E-08
			gamma-Chlordane	--	--	3.0E-13	3.0E-13	Liver	--	--	1.3E-08	1.3E-08
			Chemical Total	--	--	4.2E-09	4.2E-09		--	--	2.4E-02	2.4E-02
		Exposure Point Total					4.2E-09					2.4E-02
	Exposure Media Total						4.2E-09					2.4E-02
Surface Soil Total							1.2E-05					3.8E-01
Surface Water	Surface Water	FT08/AT28	Aluminum	--	--	--	--	CNS	3.2E-03	2.3E-04	--	3.5E-03
			Arsenic	1.1E-06	8.1E-08	--	1.2E-06	Skin, vascular system	7.3E-03	5.3E-04	--	7.8E-03
			Beryllium	--	--	--	--	GI tract	1.8E-04	1.9E-03	--	2.1E-03
			Cadmium	--	--	--	--	Kidney	1.0E-03	1.4E-03	--	2.4E-03

Table 9-13.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Resident Adult, OU-8 Site AT-28

Scenario Timeframe:	Future
Receptor Population:	Resident Adult
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	5.9E-03	1.7E-04	--	6.1E-03
			Iron	--	--	--	--	GI tract	2.0E-02	1.4E-03	--	2.1E-02
			Lead	--	--	--	--	NA	--	--	--	--
			Manganese	--	--	--	--	CNS	2.1E-03	3.9E-03	--	6.0E-03
			Mercury	--	--	--	--	Immune system	9.2E-05	9.4E-05	--	1.9E-04
			Thallium	--	--	--	--	Skin	1.9E-01	1.3E-02	--	2.0E-01
			Vanadium	--	--	--	--	Hair	2.6E-03	7.2E-03	--	9.7E-03
			4,4'-DDT	1.6E-10	3.3E-08	--	3.3E-08	Liver	2.8E-06	5.6E-04	--	5.7E-04
			Dieldrin	1.2E-08	1.7E-07	--	1.8E-07	Liver	4.5E-05	6.3E-04	--	6.7E-04
			Chemical Total	1.1E-06	2.9E-07	--	1.4E-06		2.3E-01	3.1E-02	--	2.6E-01
		Exposure Point Total					1.4E-06					2.6E-01
	Exposure Media Total						1.4E-06					2.6E-01
Surface Water Total							1.4E-06					2.6E-01
Sediment	Sediment	FT08/AT28	Arsenic	2.0E-07	2.3E-08	--	2.3E-07	Skin, vascular system	1.3E-03	1.5E-04	--	1.5E-03
			Beryllium	--	--	--	--	GI tract	3.6E-05	1.9E-05	--	5.5E-05
			Chromium	--	--	--	--	NA	--	--	--	--
			Iron	--	--	--	--	GI tract	1.8E-03	7.0E-06	--	1.8E-03
			2,3,7,8-TCDD equivalents	9.7E-08	1.1E-08	--	1.1E-07	Reproductive	3.1E-03	3.5E-04	--	3.5E-03
			Benzo(a)pyrene equivalents	2.3E-07	1.2E-07	--	3.5E-07	NA	--	--	--	--
			Chemical Total	5.3E-07	1.5E-07	--	6.8E-07		6.3E-03	5.3E-04	--	6.8E-03
		Exposure Point Total					6.8E-07					6.8E-03
	Exposure Media Total						6.8E-07					6.8E-03
Sediment Total							6.8E-07					6.8E-03
Groundwater	Groundwater	AT-28	Aluminum	--	--	--	--	CNS	7.5E-02	6.8E-04	--	7.6E-02
			Arsenic	4.9E-05	4.4E-07	--	5.0E-05	Skin, vascular system	3.2E-01	2.9E-03	--	3.2E-01
			Beryllium	--	--	--	--	GI tract	1.8E-03	2.3E-03	--	4.1E-03
			Cadmium	--	--	--	--	Kidney	6.1E-02	1.1E-02	--	7.2E-02
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	1.3E-01	4.6E-04	--	1.3E-01
			Iron	--	--	--	--	GI tract	4.8E-01	4.3E-03	--	4.9E-01
			Manganese	--	--	--	--	CNS	4.5E-01	1.0E-01	--	5.5E-01
			Vanadium	--	--	--	--	Hair	6.0E-02	2.1E-02	--	8.1E-02
			1,2,4-Trimethylbenzene	--	--	--	--	NA	--	--	--	--
			1,3,5-Trimethylbenzene	--	--	--	--	Liver	1.3E-01	--	--	1.3E-01
			2-Methylnaphthalene	--	--	--	--	Lung	1.4E-01	--	--	1.4E-01
			4,4'-DDD	4.7E-07	6.1E-06	--	6.6E-06	NA	--	--	--	--
			Diphenyl	9.8E-08	--	--	9.8E-08	Kidney	7.1E-04	--	--	7.1E-04
			Ethylbenzene	8.6E-06	6.8E-06	--	1.5E-05	Kidney, liver	2.3E-02	1.8E-02	--	4.1E-02
			Naphthalene	--	--	--	--	Weight	5.2E-02	4.5E-02	--	9.7E-02
			Pentachlorophenol	3.1E-06	1.6E-05	--	1.9E-05	Kidney	4.5E-03	2.3E-02	--	2.8E-02
			Toluene	--	--	--	--	Kidney	3.0E-02	1.4E-02	--	4.5E-02
			Xylene, Total	--	--	--	--	CNS, weight	5.8E-02	--	--	5.8E-02

Table 9-13.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Resident Adult, OU-8 Site AT-28

Scenario Timeframe:	Future
Receptor Population:	Resident Adult
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
			beta-BHC	1.1E-06	--	--	1.1E-06	NA	--	--	--	--
			m-and/or p-Xylene	--	--	--	--	CNS, weight	3.7E-02	--	--	3.7E-02
			o-xylene	--	--	--	--	CNS, weight	2.1E-02	--	--	2.1E-02
			Chemical Total	6.3E-05	2.9E-05	--	9.2E-05		2.1E+00	2.4E-01	--	2.3E+00
		Exposure Point Total					9.2E-05					2.3E+00
	Exposure Media Total						9.2E-05					2.3E+00
	Air (Volatiles)	AT-28	Aluminum	--	--	--	--	CNS	--	--	--	--
			Arsenic	--	--	--	--	Developmental, cardiovascular, CNS	--	--	--	--
			Beryllium	--	--	--	--	Respiratory tract	--	--	--	--
			Cadmium	--	--	--	--	Kidney, respiratory tract	--	--	--	--
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Respiratory tract, lung	--	--	--	--
			Iron	--	--	--	--	NA	--	--	--	--
			Manganese	--	--	--	--	CNS	--	--	--	--
			Vanadium	--	--	--	--	NA	--	--	--	--
			1,2,4-Trimethylbenzene	--	--	--	--	Weight	--	--	8.9E+00	8.9E+00
			1,3,5-Trimethylbenzene	--	--	--	--	Liver	--	--	--	--
			2-Methylnaphthalene	--	--	--	--	NA	--	--	--	--
			4,4'-DDD	--	--	--	--	NA	--	--	--	--
			Diphenyl	--	--	--	--	Kidney	--	--	--	--
			Ethylbenzene	--	--	3.4E-05	3.4E-05	Developmental	--	--	4.0E-02	4.0E-02
			Naphthalene	--	--	--	--	Weight	--	--	--	--
			Pentachlorophenol	--	--	--	--	NA	--	--	--	--
			Toluene	--	--	--	--	Kidney	--	--	8.5E-03	8.5E-03
			Xylene, Total	--	--	--	--	CNS, weight	--	--	2.0E+00	2.0E+00
			beta-BHC	--	--	--	--	NA	--	--	--	--
			m-and/or p-Xylene	--	--	--	--	CNS, weight	--	--	1.3E+00	1.3E+00
			o-xylene	--	--	--	--	CNS, weight	--	--	7.2E-01	7.2E-01
			Chemical Total	--	--	3.4E-05	3.4E-05		--	--	1.3E+01	1.3E+01
		Exposure Point Total					3.4E-05					1.3E+01
	Exposure Media Total						3.4E-05					1.3E+01
Groundwater Total							1.3E-04					1.5E+01
Receptor Total							1.4E-04					1.6E+01

Total Weight HI across all media =	1.3E+01
Total CNS HI across all media =	4.8E+00
Total Skin HI across all media =	6.1E-01
Total GI tract HI across all media =	5.3E-01
Total Kidney HI across all media =	2.0E-01
Total Liver HI across all media =	1.7E-01
Total Developmental HI across all media =	4.0E-02

Table 9-14.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Lifetime Resident, OU-8 Site AT-28

Scenario Timeframe:	Future
Receptor Population:	Lifetime Resident
Receptor Age:	Adult and Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Soil	Surface Soil	AT-28	Aluminum	--	--	--	--					
			Arsenic	6.5E-06	5.2E-07	--	7.0E-06					
			Beryllium	--	--	--	--					
			Chromium	--	--	--	--					
			Iron	--	--	--	--					
			Lead	--	--	--	--					
			Thallium	--	--	--	--					
			1,2,4-Trimethylbenzene	--	--	--	--					
			2,3,7,8-TCDD equivalents	2.4E-05	1.9E-06	--	2.5E-05					
			4,4'-DDD	8.8E-08	2.3E-08	--	1.1E-07					
			4,4'-DDE	7.9E-07	2.1E-07	--	1.0E-06					
			Benzo(a)pyrene equivalents	1.3E-05	4.6E-06	--	1.7E-05					
			Chlordane	4.1E-08	4.3E-09	--	4.5E-08					
			Dieldrin	8.6E-07	2.3E-07	--	1.1E-06					
			alpha-Chlordane	1.2E-08	1.2E-09	--	1.3E-08					
			gamma-Chlordane	6.9E-09	7.3E-10	--	7.6E-09					
			Chemical Total	4.5E-05	7.4E-06	--	5.2E-05					
		Exposure Point Total					5.2E-05					
	Exposure Media Total						5.2E-05					
	Air (Particulates and Volatiles)	AT-28	Aluminum	--	--	--	--					
			Arsenic	--	--	3.6E-09	3.6E-09					
			Beryllium	--	--	1.9E-10	1.9E-10					
			Chromium	--	--	--	--					
			Iron	--	--	--	--					
			Lead	--	--	--	--					
			Thallium	--	--	--	--					
			1,2,4-Trimethylbenzene	--	--	--	--					
			2,3,7,8-TCDD equivalents	--	--	1.3E-09	1.3E-09					
			4,4'-DDD	--	--	4.9E-12	4.9E-12					
			4,4'-DDE	--	--	4.3E-11	4.3E-11					
			Benzo(a)pyrene equivalents	--	--	2.2E-10	2.2E-10					
			Chlordane	--	--	2.2E-12	2.2E-12					
			Dieldrin	--	--	4.8E-11	4.8E-11					
			alpha-Chlordane	--	--	6.4E-13	6.4E-13					
			gamma-Chlordane	--	--	3.8E-13	3.8E-13					
			Chemical Total	--	--	5.4E-09	5.4E-09					
		Exposure Point Total					5.4E-09					
	Exposure Media Total						5.4E-09					
Surface Soil Total							5.2E-05					

Table 9-14.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Lifetime Resident, OU-8 Site AT-28

Scenario Timeframe:	Future
Receptor Population:	Lifetime Resident
Receptor Age:	Adult and Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Water	Surface Water	FT08/AT28	Aluminum	--	--	--	--					
			Arsenic	2.4E-06	1.8E-07	--	2.6E-06					
			Beryllium	--	--	--	--					
			Cadmium	--	--	--	--					
			Chromium	--	--	--	--					
			Cobalt	--	--	--	--					
			Iron	--	--	--	--					
			Lead	--	--	--	--					
			Manganese	--	--	--	--					
			Mercury	--	--	--	--					
			Thallium	--	--	--	--					
			Vanadium	--	--	--	--					
			4,4'-DDT	3.5E-10	7.2E-08	--	7.2E-08					
			Dieldrin	2.6E-08	3.8E-07	--	4.0E-07					
			Chemical Total	2.5E-06	6.3E-07	--	3.1E-06					
		Exposure Point Total					3.1E-06					
	Exposure Media Total						3.1E-06					
Surface Water Total							3.1E-06					
Sediment	Sediment	FT08/AT28	Arsenic	6.8E-07	6.8E-08	--	7.4E-07					
			Beryllium	--	--	--	--					
			Chromium	--	--	--	--					
			Iron	--	--	--	--					
			2,3,7,8-TCDD equivalents	3.2E-07	3.3E-08	--	3.6E-07					
			Benzo(a)pyrene equivalents	3.3E-06	1.4E-06	--	4.7E-06					
			Chemical Total	4.3E-06	1.5E-06	--	5.8E-06					
		Exposure Point Total					5.8E-06					
	Exposure Media Total						5.8E-06					
Sediment Total							5.8E-06					
Groundwater	Groundwater	AT-28	Aluminum	--	--	--	--					
			Arsenic	7.8E-05	6.3E-07	--	7.9E-05					
			Beryllium	--	--	--	--					
			Cadmium	--	--	--	--					
			Chromium	--	--	--	--					
			Cobalt	--	--	--	--					
			Iron	--	--	--	--					
			Manganese	--	--	--	--					
			Vanadium	--	--	--	--					
			1,2,4-Trimethylbenzene	--	--	--	--					
			1,3,5-Trimethylbenzene	--	--	--	--					
			2-Methylnaphthalene	--	--	--	--					

Table 9-14.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Lifetime Resident, OU-8 Site AT-28

Scenario Timeframe:	Future
Receptor Population:	Lifetime Resident
Receptor Age:	Adult and Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
			4,4'-DDD	7.5E-07	8.7E-06	--	9.5E-06					
			Diphenyl	1.5E-07	--	--	1.5E-07					
			Ethylbenzene	1.4E-05	9.7E-06	--	2.3E-05					
			Naphthalene	--	--	--	--					
			Pentachlorophenol	4.9E-06	2.3E-05	--	2.8E-05					
			Toluene	--	--	--	--					
			Xylene, Total	--	--	--	--					
			beta-BHC	1.7E-06	--	--	1.7E-06					
			m-and/or p-Xylene	--	--	--	--					
			o-xylene	--	--	--	--					
			Chemical Total	9.9E-05	4.2E-05	--	1.4E-04					
		Exposure Point Total					1.4E-04					
	Exposure Media Total						1.4E-04					
	Air (Volatiles)	AT-28	Aluminum	--	--	--	--					
			Arsenic	--	--	--	--					
			Beryllium	--	--	--	--					
			Cadmium	--	--	--	--					
			Chromium	--	--	--	--					
			Cobalt	--	--	--	--					
			Iron	--	--	--	--					
			Manganese	--	--	--	--					
			Vanadium	--	--	--	--					
			1,2,4-Trimethylbenzene	--	--	--	--					
			1,3,5-Trimethylbenzene	--	--	--	--					
			2-Methylnaphthalene	--	--	--	--					
			4,4'-DDD	--	--	--	--					
			Diphenyl	--	--	--	--					
			Ethylbenzene	--	--	4.3E-05	4.3E-05					
			Naphthalene	--	--	--	--					
			Pentachlorophenol	--	--	--	--					
			Toluene	--	--	--	--					
			Xylene, Total	--	--	--	--					
			beta-BHC	--	--	--	--					
			m-and/or p-Xylene	--	--	--	--					
			o-xylene	--	--	--	--					
			Chemical Total	--	--	4.3E-05	4.3E-05					
		Exposure Point Total					4.3E-05					
	Exposure Media Total						4.3E-05					
Groundwater Total							1.8E-04					
Receptor Total							2.4E-04					

Table 9-15.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Resident Child, OU-8 Site AT-28

Scenario Timeframe:	Future
Receptor Population:	Resident Child
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Surface Soil	Surface Soil	AT-28	Aluminum	--	--	--	--	CNS	8.7E-02	2.4E-04	--	8.7E-02
			Arsenic	4.6E-06	3.8E-07	--	5.0E-06	Skin, vascular system	1.2E-01	1.0E-02	--	1.3E-01
			Beryllium	--	--	--	--	GI tract	1.7E-03	6.8E-04	--	2.4E-03
			Chromium	--	--	--	--	NA	--	--	--	--
			Iron	--	--	--	--	GI tract	1.7E-01	4.6E-04	--	1.7E-01
			Lead	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	Skin	6.3E-01	1.8E-03	--	6.3E-01
			1,2,4-Trimethylbenzene	--	--	--	--	NA	--	--	--	--
			2,3,7,8-TCDD equivalents	1.7E-05	1.4E-06	--	1.8E-05	Reproductive	2.1E+00	1.8E-01	--	2.3E+00
			4,4'-DDD	6.2E-08	1.7E-08	--	7.9E-08	NA	--	--	--	--
			4,4'-DDE	5.6E-07	1.6E-07	--	7.1E-07	NA	--	--	--	--
			Benzo(a)pyrene equivalents	2.1E-06	7.6E-07	--	2.9E-06	NA	--	--	--	--
			Chlordane	2.9E-08	3.2E-09	--	3.2E-08	Liver	1.9E-03	2.1E-04	--	2.1E-03
			Dieldrin	6.0E-07	1.7E-07	--	7.7E-07	Liver	8.8E-03	2.5E-03	--	1.1E-02
			alpha-Chlordane	8.2E-09	9.2E-10	--	9.1E-09	Liver	5.5E-04	6.1E-05	--	6.1E-04
			gamma-Chlordane	4.8E-09	5.4E-10	--	5.4E-09	Liver	3.2E-04	3.6E-05	--	3.6E-04
			Chemical Total	2.4E-05	2.9E-06	--	2.7E-05		3.1E+00	1.9E-01	--	3.3E+00
		Exposure Point Total					2.7E-05					3.3E+00
	Exposure Media Total						2.7E-05					3.3E+00
	Air (Particulates and Volatiles)	AT-28	Aluminum	--	--	--	--	CNS	--	--	9.5E-04	9.5E-04
			Arsenic	--	--	7.2E-10	7.2E-10	Developmental, cardiovascular, CNS	--	--	1.3E-04	1.3E-04
			Beryllium	--	--	3.8E-11	3.8E-11	Respiratory tract	--	--	9.3E-06	9.3E-06
			Chromium	--	--	--	--	NA	--	--	--	--
			Iron	--	--	--	--	NA	--	--	--	--
			Lead	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	NA	--	--	--	--
			1,2,4-Trimethylbenzene	--	--	--	--	Weight	--	--	5.1E-02	5.1E-02
			2,3,7,8-TCDD equivalents	--	--	2.6E-10	2.6E-10	Reproductive	--	--	2.0E-06	2.0E-06
			4,4'-DDD	--	--	9.7E-13	9.7E-13	NA	--	--	--	--
			4,4'-DDE	--	--	8.7E-12	8.7E-12	NA	--	--	--	--
			Benzo(a)pyrene equivalents	--	--	1.7E-11	1.7E-11	NA	--	--	--	--
			Chlordane	--	--	4.5E-13	4.5E-13	Liver	--	--	7.5E-08	7.5E-08
			Dieldrin	--	--	9.5E-12	9.5E-12	NA	--	--	--	--
			alpha-Chlordane	--	--	1.3E-13	1.3E-13	Liver	--	--	2.1E-08	2.1E-08
			gamma-Chlordane	--	--	7.6E-14	7.6E-14	Liver	--	--	1.3E-08	1.3E-08
			Chemical Total	--	--	1.1E-09	1.1E-09		--	--	5.2E-02	5.2E-02
		Exposure Point Total					1.1E-09					5.2E-02
	Exposure Media Total						1.1E-09					5.2E-02
Surface Soil Total							2.7E-05					3.4E+00
Surface Water	Surface Water	FT08/AT28	Aluminum	--	--	--	--	CNS	1.5E-02	1.1E-03	--	1.6E-02
			Arsenic	1.3E-06	9.7E-08	--	1.4E-06	Skin, vascular system	3.4E-02	2.5E-03	--	3.6E-02
			Beryllium	--	--	--	--	GI tract	8.5E-04	9.0E-03	--	9.9E-03
			Cadmium	--	--	--	--	Kidney	4.6E-03	6.9E-03	--	1.2E-02

Table 9-15.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Resident Child, OU-8 Site AT-28

Scenario Timeframe:	Future
Receptor Population:	Resident Child
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	2.8E-02	8.2E-04	--	2.8E-02
			Iron	--	--	--	--	GI tract	9.1E-02	6.8E-03	--	9.8E-02
			Lead	--	--	--	--	NA	--	--	--	--
			Manganese	--	--	--	--	CNS	1.0E-02	1.8E-02	--	2.8E-02
			Mercury	--	--	--	--	Immune system	4.3E-04	4.5E-04	--	8.8E-04
			Thallium	--	--	--	--	Skin	8.7E-01	6.4E-02	--	9.3E-01
			Vanadium	--	--	--	--	Hair	1.2E-02	3.4E-02	--	4.6E-02
			4,4'-DDT	1.9E-10	3.9E-08	--	3.9E-08	Liver	1.3E-05	2.7E-03	--	2.7E-03
			Dieldrin	1.4E-08	2.1E-07	--	2.2E-07	Liver	2.1E-04	3.0E-03	--	3.2E-03
			Chemical Total	1.3E-06	3.4E-07	--	1.7E-06		1.1E+00	1.5E-01	--	1.2E+00
		Exposure Point Total					1.7E-06					1.2E+00
	Exposure Media Total						1.7E-06					1.2E+00
Surface Water Total							1.7E-06					1.2E+00
Sediment	Sediment	FT08/AT28	Arsenic	4.7E-07	4.5E-08	--	5.2E-07	Skin, vascular system	1.2E-02	1.2E-03	--	1.3E-02
			Beryllium	--	--	--	--	GI tract	3.3E-04	1.5E-04	--	4.9E-04
			Chromium	--	--	--	--	NA	--	--	--	--
			Iron	--	--	--	--	GI tract	1.7E-02	5.5E-05	--	1.7E-02
			2,3,7,8-TCDD equivalents	2.3E-07	2.2E-08	--	2.5E-07	Reproductive	2.9E-02	2.8E-03	--	3.2E-02
			Benzo(a)pyrene equivalents	5.4E-07	2.3E-07	--	7.7E-07	NA	--	--	--	--
			Chemical Total	1.2E-06	2.9E-07	--	1.5E-06		5.9E-02	4.2E-03	--	6.3E-02
		Exposure Point Total					1.5E-06					6.3E-02
	Exposure Media Total						1.5E-06					6.3E-02
Sediment Total							1.5E-06					6.3E-02
Groundwater	Groundwater	AT-28	Aluminum	--	--	--	--	CNS	1.8E-01	1.2E-03	--	1.8E-01
			Arsenic	2.9E-05	1.9E-07	--	2.9E-05	Skin, vascular system	7.5E-01	4.9E-03	--	7.5E-01
			Beryllium	--	--	--	--	GI tract	4.2E-03	3.9E-03	--	8.1E-03
			Cadmium	--	--	--	--	Kidney	1.4E-01	1.9E-02	--	1.6E-01
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Thyroid	3.0E-01	7.9E-04	--	3.0E-01
			Iron	--	--	--	--	GI tract	1.1E+00	7.4E-03	--	1.1E+00
			Manganese	--	--	--	--	CNS	1.0E+00	1.7E-01	--	1.2E+00
			Vanadium	--	--	--	--	Hair	1.4E-01	3.6E-02	--	1.8E-01
			1,2,4-Trimethylbenzene	--	--	--	--	NA	--	--	--	--
			1,3,5-Trimethylbenzene	--	--	--	--	Liver	3.0E-01	--	--	3.0E-01
			2-Methylnaphthalene	--	--	--	--	Lung	3.4E-01	--	--	3.4E-01
			4,4'-DDD	2.8E-07	2.6E-06	--	2.9E-06	NA	--	--	--	--
			Diphenyl	5.7E-08	--	--	5.7E-08	Kidney	1.7E-03	--	--	1.7E-03
			Ethylbenzene	5.0E-06	2.9E-06	--	7.9E-06	Kidney, liver	5.3E-02	3.1E-02	--	8.4E-02
			Naphthalene	--	--	--	--	Weight	1.2E-01	7.7E-02	--	2.0E-01
			Pentachlorophenol	1.8E-06	6.8E-06	--	8.6E-06	Kidney	1.0E-02	4.0E-02	--	5.0E-02
			Toluene	--	--	--	--	Kidney	7.1E-02	2.5E-02	--	9.6E-02
			Xylene, Total	--	--	--	--	CNS, weight	1.3E-01	--	--	1.3E-01

Table 9-15.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Resident Child, OU-8 Site AT-28

Scenario Timeframe:	Future
Receptor Population:	Resident Child
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
			beta-BHC	6.2E-07	--	--	6.2E-07	NA	--	--	--	--
			m-and/or p-Xylene	--	--	--	--	CNS, weight	8.6E-02	--	--	8.6E-02
			o-xylene	--	--	--	--	CNS, weight	4.8E-02	--	--	4.8E-02
			Chemical Total	3.7E-05	1.3E-05	--	4.9E-05		4.8E+00	4.2E-01	--	5.3E+00
		Exposure Point Total					4.9E-05					5.3E+00
	Exposure Media Total						4.9E-05					5.3E+00
	Air (Volatiles)	AT-28	Aluminum	--	--	--	--	CNS	--	--	--	--
			Arsenic	--	--	--	--	Developmental, cardiovascular, CNS	--	--	--	--
			Beryllium	--	--	--	--	Respiratory tract	--	--	--	--
			Cadmium	--	--	--	--	Kidney, respiratory tract	--	--	--	--
			Chromium	--	--	--	--	NA	--	--	--	--
			Cobalt	--	--	--	--	Respiratory tract, lung	--	--	--	--
			Iron	--	--	--	--	NA	--	--	--	--
			Manganese	--	--	--	--	CNS	--	--	--	--
			Vanadium	--	--	--	--	NA	--	--	--	--
			1,2,4-Trimethylbenzene	--	--	--	--	Weight	--	--	8.9E+00	8.9E+00
			1,3,5-Trimethylbenzene	--	--	--	--	Liver	--	--	--	--
			2-Methylnaphthalene	--	--	--	--	NA	--	--	--	--
			4,4'-DDD	--	--	--	--	NA	--	--	--	--
			Diphenyl	--	--	--	--	Kidney	--	--	--	--
			Ethylbenzene	--	--	8.5E-06	8.5E-06	Developmental	--	--	4.0E-02	4.0E-02
			Naphthalene	--	--	--	--	Weight	--	--	--	--
			Pentachlorophenol	--	--	--	--	NA	--	--	--	--
			Toluene	--	--	--	--	Kidney	--	--	8.5E-03	8.5E-03
			Xylene, Total	--	--	--	--	CNS, weight	--	--	2.0E+00	2.0E+00
			beta-BHC	--	--	--	--	NA	--	--	--	--
			m-and/or p-Xylene	--	--	--	--	CNS, weight	--	--	1.3E+00	1.3E+00
			o-xylene	--	--	--	--	CNS, weight	--	--	7.2E-01	7.2E-01
			Chemical Total	--	--	8.5E-06	8.5E-06		--	--	1.3E+01	1.3E+01
		Exposure Point Total					8.5E-06					1.3E+01
	Exposure Media Total						8.5E-06					1.3E+01
Groundwater Total							5.8E-05					1.8E+01
Receptor Total							8.8E-05					2.3E+01

Total Weight HI across all media =	1.3E+01
Total CNS HI across all media =	5.8E+00
Total Skin HI across all media =	2.5E+00
Total GI tract HI across all media =	1.4E+00
Total Kidney HI across all media =	4.1E-01
Total Liver HI across all media =	4.0E-01
Total Developmental HI across all media =	4.0E-02

Table 9-16.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Resident Adult Exposed to Total Soil, OU-8 Site AT-28

Scenario Timeframe:	Future
Receptor Population:	Resident Adult
Receptor Age:	Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Total Soil	Total Soil	AT-28	Aluminum	--	--	--	--	CNS	6.9E-03	1.6E-05	--	6.9E-03
			Arsenic	1.6E-06	1.1E-07	--	1.7E-06	Skin, vascular system	1.0E-02	7.2E-04	--	1.1E-02
			Beryllium	--	--	--	--	GI tract	1.3E-04	4.4E-05	--	1.8E-04
			Chromium	--	--	--	--	NA	--	--	--	--
			Iron	--	--	--	--	GI tract	1.1E-02	2.6E-05	--	1.1E-02
			Lead	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	Skin	1.1E-01	2.6E-04	--	1.1E-01
			1,2,4-Trimethylbenzene	--	--	--	--	NA	--	--	--	--
			2,3,7,8-TCDD equivalents	4.2E-06	2.9E-07	--	4.5E-06	Reproductive	1.3E-01	9.3E-03	--	1.4E-01
			4,4'-DDD	1.9E-07	4.4E-08	--	2.4E-07	NA	--	--	--	--
			4,4'-DDE	1.8E-07	4.1E-08	--	2.2E-07	NA	--	--	--	--
			Benzene	2.6E-10	6.0E-12	--	2.6E-10	Blood	3.4E-06	7.9E-08	--	3.5E-06
			Benzo(a)pyrene equivalents	7.3E-07	2.2E-07	--	9.5E-07	NA	--	--	--	--
			Chlordane	9.4E-09	8.7E-10	--	1.0E-08	Liver	1.6E-04	1.4E-05	--	1.7E-04
			Dieldrin	1.4E-07	3.3E-08	--	1.8E-07	Liver	5.3E-04	1.2E-04	--	6.5E-04
			Ethylbenzene	4.3E-09	1.0E-10	--	4.4E-09	Kidney, liver	1.2E-05	2.7E-07	--	1.2E-05
			alpha-Chlordane	2.2E-09	2.0E-10	--	2.4E-09	Liver	3.6E-05	3.3E-06	--	3.9E-05
			gamma-Chlordane	1.2E-09	1.1E-10	--	1.4E-09	Liver	2.1E-05	1.9E-06	--	2.3E-05
			Chemical Total	7.1E-06	7.4E-07	--	7.8E-06		2.8E-01	1.1E-02	--	2.9E-01
		Exposure Point Total					7.8E-06					2.9E-01
	Exposure Media Total						7.8E-06					2.9E-01
	Air (Particulates and Volatiles)	AT-28	Aluminum	--	--	--	--	CNS	--	--	7.1E-04	7.1E-04
			Arsenic	--	--	2.4E-09	2.4E-09	Developmental, cardiovascular, CNS	--	--	1.1E-04	1.1E-04
			Beryllium	--	--	1.1E-10	1.1E-10	Respiratory tract	--	--	6.8E-06	6.8E-06
			Chromium	--	--	--	--	NA	--	--	--	--
			Iron	--	--	--	--	NA	--	--	--	--
			Lead	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	NA	--	--	--	--
			1,2,4-Trimethylbenzene	--	--	--	--	Weight	--	--	4.3E-02	4.3E-02
			2,3,7,8-TCDD equivalents	--	--	6.3E-10	6.3E-10	Reproductive	--	--	1.2E-06	1.2E-06
			4,4'-DDD	--	--	2.8E-11	2.8E-11	NA	--	--	--	--
			4,4'-DDE	--	--	2.6E-11	2.6E-11	NA	--	--	--	--
			Benzene	--	--	1.1E-08	1.1E-08	Blood	--	--	1.2E-04	1.2E-04
			Benzo(a)pyrene equivalents	--	--	5.6E-11	5.6E-11	NA	--	--	--	--
			Chlordane	--	--	1.4E-12	1.4E-12	Liver	--	--	5.7E-08	5.7E-08
			Dieldrin	--	--	2.1E-11	2.1E-11	NA	--	--	--	--
			Ethylbenzene	--	--	1.8E-07	1.8E-07	Developmental	--	--	1.9E-04	1.9E-04
			alpha-Chlordane	--	--	3.1E-13	3.1E-13	Liver	--	--	1.3E-08	1.3E-08
			gamma-Chlordane	--	--	1.8E-13	1.8E-13	Liver	--	--	7.5E-09	7.5E-09
			Chemical Total	--	--	1.9E-07	1.9E-07		--	--	4.4E-02	4.4E-02
		Exposure Point Total					1.9E-07					4.4E-02
	Exposure Media Total						1.9E-07					4.4E-02
Total Soil Total							8.0E-06					3.3E-01
Receptor Total							8.0E-06					3.3E-01

Table 9-17.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Lifetime Resident Exposed to Total Soil, OU-8 Site AT-28

Scenario Timeframe:	Future
Receptor Population:	Lifetime Resident
Receptor Age:	Adult and Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Total Soil	Total Soil	AT-28	Aluminum	--	--	--	--					
			Arsenic	5.4E-06	4.3E-07	--	5.8E-06					
			Beryllium	--	--	--	--					
			Chromium	--	--	--	--					
			Iron	--	--	--	--					
			Lead	--	--	--	--					
			Thallium	--	--	--	--					
			1,2,4-Trimethylbenzene	--	--	--	--					
			2,3,7,8-TCDD equivalents	1.4E-05	1.1E-06	--	1.5E-05					
			4,4'-DDD	6.4E-07	1.7E-07	--	8.1E-07					
			4,4'-DDE	6.0E-07	1.6E-07	--	7.5E-07					
			Benzene	8.6E-10	2.3E-11	--	8.8E-10					
			Benzo(a)pyrene equivalents	1.0E-05	3.7E-06	--	1.4E-05					
			Chlordane	3.1E-08	3.3E-09	--	3.5E-08					
			Dieldrin	4.8E-07	1.3E-07	--	6.1E-07					
			Ethylbenzene	1.4E-08	3.8E-10	--	1.5E-08					
			alpha-Chlordane	7.2E-09	7.6E-10	--	7.9E-09					
			gamma-Chlordane	4.1E-09	4.4E-10	--	4.6E-09					
			Chemical Total	3.1E-05	5.7E-06	--	3.7E-05					
		Exposure Point Total					3.7E-05					
	Exposure Media Total						3.7E-05					
	Air (Particulates and Volatiles)	AT-28	Aluminum	--	--	--	--					
			Arsenic	--	--	3.0E-09	3.0E-09					
			Beryllium	--	--	1.4E-10	1.4E-10					
			Chromium	--	--	--	--					
			Iron	--	--	--	--					
			Lead	--	--	--	--					
			Thallium	--	--	--	--					
			1,2,4-Trimethylbenzene	--	--	--	--					
			2,3,7,8-TCDD equivalents	--	--	7.8E-10	7.8E-10					
			4,4'-DDD	--	--	3.5E-11	3.5E-11					
			4,4'-DDE	--	--	3.3E-11	3.3E-11					
			Benzene	--	--	1.2E-08	1.2E-08					
			Benzo(a)pyrene equivalents	--	--	1.8E-10	1.8E-10					
			Chlordane	--	--	1.7E-12	1.7E-12					
			Dieldrin	--	--	2.6E-11	2.6E-11					
			Ethylbenzene	--	--	2.0E-07	2.0E-07					
			alpha-Chlordane	--	--	3.9E-13	3.9E-13					
			gamma-Chlordane	--	--	2.3E-13	2.3E-13					
			Chemical Total	--	--	2.2E-07	2.2E-07					
		Exposure Point Total					2.2E-07					
	Exposure Media Total						2.2E-07					
Total Soil Total							3.7E-05					
Receptor Total							3.7E-05					

Table 9-18.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Resident Child Exposed to Total Soil, OU-8 Site AT-28

Scenario Timeframe:	Future
Receptor Population:	Resident Child
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
Total Soil	Total Soil	AT-28	Aluminum	--	--	--	--	CNS	6.4E-02	1.8E-04	--	6.5E-02
			Arsenic	3.8E-06	3.2E-07	--	4.1E-06	Skin, vascular system	9.8E-02	8.2E-03	--	1.1E-01
			Beryllium	--	--	--	--	GI tract	1.2E-03	5.0E-04	--	1.7E-03
			Chromium	--	--	--	--	NA	--	--	--	--
			Iron	--	--	--	--	GI tract	1.1E-01	3.0E-04	--	1.1E-01
			Lead	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	Skin	1.1E+00	3.0E-03	--	1.1E+00
			1,2,4-Trimethylbenzene	--	--	--	--	NA	--	--	--	--
			2,3,7,8-TCDD equivalents	9.8E-06	8.2E-07	--	1.1E-05	Reproductive	1.3E+00	1.1E-01	--	1.4E+00
			4,4'-DDD	4.5E-07	1.3E-07	--	5.7E-07	NA	--	--	--	--
			4,4'-DDE	4.2E-07	1.2E-07	--	5.3E-07	NA	--	--	--	--
			Benzene	6.0E-10	1.7E-11	--	6.2E-10	Blood	3.2E-05	8.9E-07	--	3.3E-05
			Benzo(a)pyrene equivalents	1.7E-06	6.2E-07	--	2.3E-06	NA	--	--	--	--
			Chlordane	2.2E-08	2.5E-09	--	2.4E-08	Liver	1.5E-03	1.6E-04	--	1.6E-03
			Dieldrin	3.4E-07	9.4E-08	--	4.3E-07	Liver	4.9E-03	1.4E-03	--	6.3E-03
			Ethylbenzene	1.0E-08	2.8E-10	--	1.0E-08	Kidney, liver	1.1E-04	3.0E-06	--	1.1E-04
			alpha-Chlordane	5.0E-09	5.6E-10	--	5.6E-09	Liver	3.3E-04	3.8E-05	--	3.7E-04
			gamma-Chlordane	2.9E-09	3.2E-10	--	3.2E-09	Liver	1.9E-04	2.2E-05	--	2.1E-04
			Chemical Total	1.6E-05	2.1E-06	--	1.9E-05		2.6E+00	1.2E-01	--	2.7E+00
		Exposure Point Total					1.9E-05					2.7E+00
	Exposure Media Total						1.9E-05					2.7E+00
	Air (Particulates and Volatiles)	AT-28	Aluminum	--	--	--	--	CNS	--	--	7.1E-04	7.1E-04
			Arsenic	--	--	5.9E-10	5.9E-10	Developmental, cardiovascular, CNS	--	--	1.1E-04	1.1E-04
			Beryllium	--	--	2.8E-11	2.8E-11	Respiratory tract	--	--	6.8E-06	6.8E-06
			Chromium	--	--	--	--	NA	--	--	--	--
			Iron	--	--	--	--	NA	--	--	--	--
			Lead	--	--	--	--	NA	--	--	--	--
			Thallium	--	--	--	--	NA	--	--	--	--
			1,2,4-Trimethylbenzene	--	--	--	--	Weight	--	--	9.6E-02	9.6E-02
			2,3,7,8-TCDD equivalents	--	--	1.6E-10	1.6E-10	Reproductive	--	--	1.2E-06	1.2E-06
			4,4'-DDD	--	--	7.0E-12	7.0E-12	NA	--	--	--	--
			4,4'-DDE	--	--	6.5E-12	6.5E-12	NA	--	--	--	--
			Benzene	--	--	5.3E-09	5.3E-09	Blood	--	--	2.7E-04	2.7E-04
			Benzo(a)pyrene equivalents	--	--	1.4E-11	1.4E-11	NA	--	--	--	--
			Chlordane	--	--	3.4E-13	3.4E-13	Liver	--	--	5.7E-08	5.7E-08
			Dieldrin	--	--	5.3E-12	5.3E-12	NA	--	--	--	--
			Ethylbenzene	--	--	8.9E-08	8.9E-08	Developmental	--	--	4.2E-04	4.2E-04
			alpha-Chlordane	--	--	7.9E-14	7.9E-14	Liver	--	--	1.3E-08	1.3E-08
			gamma-Chlordane	--	--	4.5E-14	4.5E-14	Liver	--	--	7.5E-09	7.5E-09

Table 9-18.
Summary of Receptor Risks and Hazards for COPCs
Reasonable Maximum Exposure
Future Resident Child Exposed to Total Soil, OU-8 Site AT-28

Scenario Timeframe:	Future
Receptor Population:	Resident Child
Receptor Age:	Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk				Non-Carcinogenic Hazard Quotient				
				Ingestion	Dermal	Inhalation	Exposure Routes Total	Primary Target Organ	Ingestion	Dermal	Inhalation	Exposure Routes Total
			Chemical Total	--	--	9.6E-08	9.6E-08		--	--	9.8E-02	9.8E-02
		Exposure Point Total					9.6E-08					9.8E-02
	Exposure Media Total						9.6E-08					9.8E-02
Total Soil Total							1.9E-05					2.8E+00
Receptor Total							1.9E-05					2.8E+00

Total Skin HI across all media =	1.2E+00
Total GI tract HI across all media =	1.1E-01
Total CNS HI across all media =	6.5E-02
Total Liver HI across all media =	8.6E-03
Total Developmental HI across all media =	5.2E-04

DRAFT RIR Field Data

SiteName	StationName	Location_LL_LX	Location_LL_LY	Location_CX	Location_CY	DeliveryGroup	FieldSampleID	LabSampleID	SampleDate_D	SampleMatrixCode	SampleTop	SampleBottom	QCSampleCode	SampleEventName	LongName	Value	FlagCode	Reporting Units	DilutionFactor	Detected Result	ReportableResult	Detect	LimitType	Detect2	LimitType2	Detect3	LimitType3	AnalyticMethod
MG	FT013P-SB20	-74.5952925	40.01953861	465437.844	432046.4036	C535764	FT013P-SS20-032825-00	APMD12	03/28/2025 11:30:	SS	0	0.5	O	MOD1	Moisture	12	V	%	1	Y	Y	0.5	DL		LOD	1	LOQ	% MOISTURE
MG	FT013P-SB20	-74.5952925	40.01953861	465437.844	432046.4036	C535764	FT013P-SB2005-032825-00	APMD13	03/28/2025 11:35:	SB	4	5	O	MOD1	Moisture	8	V	%	1	Y	Y	0.5	DL		LOD	1	LOQ	% MOISTURE
MG	FT013P-SB20	-74.5952925	40.01953861	465437.844	432046.4036	C535764	FT013P-SB2008-032825-00	APMD14	03/28/2025 11:40:	SB	7	8	O	MOD1	Moisture	13	V	%	1	Y	Y	0.5	DL		LOD	1	LOQ	% MOISTURE
MG	FT013P-SB21	-74.59690182	40.01882789	464986.8626	431788.0081	C535758	FT013P-SS21-032825-00	APMC67	03/28/2025 09:10:	SS	0	0.5	O	MOD1	Moisture	18	V	%	1	Y	Y	0.5	DL		LOD	1	LOQ	% MOISTURE
MG	FT013P-SB21	-74.59690182	40.01882789	464986.8626	431788.0081	C535758	FT013P-SS21-032825-00	APMC67	03/28/2025 09:10:	SS	0	0.5	O	MOD1	Perfluorooctanesulfonic acid (PFOS)	1.4	V	ug/kg	1	Y	Y	0.29	DL	0.8	LOD	1.064585	LOQ	E537
MG	FT013P-SB21	-74.59690182	40.01882789	464986.8626	431788.0081	C535758	FT013P-SB2103-032825-00	APMC68	03/28/2025 09:15:	SB	2	3	O	MOD1	Moisture	11	V	%	1	Y	Y	0.5	DL		LOD	1	LOQ	% MOISTURE
MG	FT013P-SB21	-74.59690182	40.01882789	464986.8626	431788.0081	C535758	FT013P-SB2106-032825-00	APMC69	03/28/2025 09:20:	SB	5	6	O	MOD1	Moisture	1.8	V	%	1	Y	Y	0.5	DL		LOD	1	LOQ	% MOISTURE
MG	SS051P-GWS17	-74.59925349	40.02020873	464328.8192	432291.7044	C388062	SS051P-GWS17-10-00	VKK389	03/28/2023 11:00:	GW	0	10	O	RI Data	Perfluorobutanoic acid (PFBA)	2.8	V	ng/l	1	Y	Y	0.77	DL	1.8	LOD	2.6	LOQ	E537
MG	SS051P-GWS17	-74.59925349	40.02020873	464328.8192	432291.7044	C388062	SS051P-GWS17-10-00	VKK389	03/28/2023 11:00:	GW	0	10	O	RI Data	Perfluorohexanesulfonic acid (PFHxS)	30	V	ng/l	1	Y	Y	0.36	DL	1.3	LOD	2.6	LOQ	E537
MG	SS051P-GWS17	-74.59925349	40.02020873	464328.8192	432291.7044	C388062	SS051P-GWS17-10-00	VKK389	03/28/2023 11:00:	GW	0	10	O	RI Data	Perfluorooctanoic acid (PFOA)	13	V	ng/l	1	Y	Y	0.53	DL	1.3	LOD	2.6	LOQ	E537
MG	SS051P-GWS17	-74.59925349	40.02020873	464328.8192	432291.7044	C388062	SS051P-GWS17-10-00	VKK389	03/28/2023 11:00:	GW	0	10	O	RI Data	Perfluorooctanesulfonic acid (PFOS)	8	V	ng/l	1	Y	Y	0.61	DL	1.3	LOD	2.6	LOQ	E537
MG	SS051P-GWS17	-74.59925349	40.02020873	464328.8192	432291.7044	C388062	SS051P-GWS17-10-00	VKK389	03/28/2023 11:00:	GW	0	10	O	RI Data	Perfluoropentanesulfonic acid (PFPeS)	4.6	V	ng/l	1	Y	Y	0.44	DL	1.3	LOD	2.6	LOQ	E537
MG	SS051P-GWS17	-74.59925349	40.02020873	464328.8192	432291.7044	C388062	SS051P-GWS17-10-00	VKK389	03/28/2023 11:00:	GW	0	10	O	RI Data	Perfluorohexanoic acid (PFHxA)	7.8	V	ng/l	1	Y	Y	0.26	DL	0.91	LOD	2.6	LOQ	E537
MG	SS051P-GWS17	-74.59925349	40.02020873	464328.8192	432291.7044	C388062	SS051P-GWS17-10-00	VKK389	03/28/2023 11:00:	GW	0	10	O	RI Data	Perfluoropentanoic acid (PFPeA)	5.4	V	ng/l	1	Y	Y	0.29	DL	0.91	LOD	2.6	LOQ	E537
MG	SS051P-GWS17	-74.59925349	40.02020873	464328.8192	432291.7044	C388062	SS051P-GWS17-10-00	VKK389	03/28/2023 11:00:	GW	0	10	O	RI Data	Perfluoroheptanoic acid (PFHpA)	3.6	V	ng/l	1	Y	Y	0.36	DL	1.3	LOD	2.6	LOQ	E537
MG	SS051P-GWS17	-74.59925349	40.02020873	464328.8192	432291.7044	C388062	SS051P-GWS17-25-00	VKK390	03/28/2023 11:05:	GW	0	25	O	RI Data	Perfluorohexanesulfonic acid (PFHxS)	15	V	ng/l	1	Y	Y	0.39	DL	1.4	LOD	2.8	LOQ	E537
MG	SS051P-GWS17	-74.59925349	40.02020873	464328.8192	432291.7044	C388062	SS051P-GWS17-40-00	VKK391	03/28/2023 11:10:	GW	0	40	O	RI Data	Perfluorooctanesulfonic acid (PFOS)	4.5	V	ng/l	1	Y	Y	0.61	DL	1.3	LOD	2.6	LOQ	E537
MG	SS051P-GWS17	-74.59925349	40.02020873	464328.8192	432291.7044	C388062	SS051P-GWS17-40-00	VKK391	03/28/2023 11:10:	GW	0	40	O	RI Data	Perfluoropentanesulfonic acid (PFPeS)	4.4	V	ng/l	1	Y	Y	0.44	DL	1.3	LOD	2.6	LOQ	E537
MG	SS051P-GWS17	-74.59925349	40.02020873	464328.8192	432291.7044	C388062	SS051P-GWS17-40-00	VKK391	03/28/2023 11:10:	GW	0	40	O	RI Data	Perfluorohexanesulfonic acid (PFHxS)	7.2	V	ng/l	1	Y	Y	0.36	DL	1.3	LOD	2.6	LOQ	E537
MG	SS051P-GWS17	-74.59925349	40.02020873	464328.8192	432291.7044	C388062	SS051P-GWS17-40-00	VKK391	03/28/2023 11:10:	GW	0	40	O	RI Data	Perfluorohexanoic acid (PFHxA)	5.7	V	ng/l	1	Y	Y	0.26	DL	0.91	LOD	2.6	LOQ	E537
MG	SS051P-GWS17	-74.59925349	40.02020873	464328.8192	432291.7044	C388062	SS051P-GWS17-40-00	VKK391	03/28/2023 11:10:	GW	0	40	O	RI Data	Perfluoropentanoic acid (PFPeA)	4.1	V	ng/l	1	Y	Y	0.29	DL	0.91	LOD	2.6	LOQ	E537
MG	SS051P-MW06D	-74.60380631	40.02305523	463054.9999	433330.0001	C441182	SS051P-MW06D-00-020524	YIQ310	02/05/2024 10:15:	GW	14	14	O	RI Data	Perfluorobutanoic acid (PFBA)	2.5	V	ng/l	1	Y	Y	0.66	DL	1.6	LOD	2.222222	LOQ	E537
MG	SS051P-MW06D	-74.60380631	40.02305523	463054.9999	433330.0001	C441182	SS051P-MW06D-00-020524	YIQ310	02/05/2024 10:15:	GW	14	14	O	RI Data	Perfluorooctanoic acid (PFOA)	2.7	V	ng/l	1	Y	Y	0.46	DL	1.1	LOD	2.222222	LOQ	E537
MG	SS051P-MW06D	-74.60380631	40.02305523	463054.9999	433330.0001	C441182	SS051P-MW06D-00-020524	YIQ310	02/05/2024 10:15:	GW	14	14	O	RI Data	Perfluorohexanoic acid (PFHxA)	3	V	ng/l	1	Y	Y	0.22	DL	0.78	LOD	2.222222	LOQ	E537
MG	SS051P-MW06D	-74.60380631	40.02305523	463054.9999	433330.0001	C441182	SS051P-MW06D-00-020524	YIQ310	02/05/2024 10:15:	GW	14	14	O	RI Data	Perfluorohexanesulfonic acid (PFHxS)	9.9	V	ng/l	1	Y	Y	0.31	DL	1.1	LOD	2.222222	LOQ	E537
MG	SS051P-MW06D	-74.60380631	40.02305523	463054.9999	433330.0001	C441182	SS051P-MW06D-00-020524	YIQ310	02/05/2024 10:15:	GW	14	14	O	RI Data	Perfluoropentanoic acid (PFPeA)	3.1	V	ng/l	1	Y	Y	0.24	DL	0.78	LOD	2.222222	LOQ	E537
MG	SS051P-MW06D	-74.60380631	40.02305523	463054.9999	433330.0001	C441182	SS051P-MW06D-00-020524	YIQ310	02/05/2024 10:15:	GW	14	14	O	RI Data	Perfluorooctanesulfonic acid (PFOS)	6.5	V	ng/l	1	Y	Y	0.52	DL	1.1	LOD	2.222222	LOQ	E537
MG	SS051P-MW06D	-74.60380631	40.02305523	463054.9999	433330.0001	C4H2181	SS051P-MW06D-00-060324	ZJS693	06/03/2024 12:10:	GW	14	14	O	RI Data	Perfluorooctanesulfonic acid (PFOS)	7.7	V	ng/l	1	Y	Y	0.52	DL	1.1	LOD	2.222222	LOQ	E537
MG	SS051P-MW06D	-74.60380631	40.02305523	463054.9999	433330.0001	C4H2181	SS051P-MW06D-00-060324	ZJS693	06/03/2024 12:10:	GW	14	14	O	RI Data	Perfluorooctanoic acid (PFOA)	2.8	V	ng/l	1	Y	Y	0.46	DL	1.1	LOD	2.222222	LOQ	E537
MG	SS051P-MW06D	-74.60380631	40.02305523	463054.9999	433330.0001	C4H2181	SS051P-MW06D-00-060324	ZJS693	06/03/2024 12:10:	GW	14	14	O	RI Data	Perfluoropentanoic acid (PFPeA)	3.3	V	ng/l	1	Y	Y	0.24	DL	0.78	LOD	2.222222	LOQ	E537
MG	SS051P-MW06D	-74.60380631	40.02305523	463054.9999	433330.0001	C4H2181	SS051P-MW06D-00-060324	ZJS693	06/03/2024 12:10:	GW	14	14	O	RI Data	Perfluorohexanesulfonic acid (PFHxS)	10	V	ng/l	1	Y	Y	0.31	DL	1.1	LOD	2.222222	LOQ	E537
MG	SS051P-MW06D	-74.60380631	40.02305523	463054.9999	433330.0001	C4H2181	SS051P-MW06D-00-060324	ZJS693	06/03/2024 12:10:	GW	14	14	O	RI Data	Perfluorobutanoic acid (PFBA)	2.7	V	ng/l	1	Y	Y	0.66	DL	1.6	LOD	2.222222	LOQ	E537
MG	SS051P-MW06D	-74.60380631	40.02305523	463054.9999	433330.0001	C4H2181	SS051P-MW06D-00-060324	ZJS693	06/03/2024 12:10:	GW	14	14	O	RI Data	Perfluorohexanoic acid (PFHxA)	3.3	V	ng/l	1	Y	Y	0.22	DL	0.78	LOD	2.222222	LOQ	E537
MG	SS051P-MW06S	-74.60380651	40.02318701	463055.0001	433378.0001	C441182	SS051P-MW06S-00-020524	YIQ311	02/05/2024 10:50:	GW	8	8	O	RI Data	Perfluorooctanesulfonic acid (PFOS)	2.8	V	ng/l	1	Y	Y	0.52	DL	1.1	LOD	2.222222	LOQ	E537
MG	SS051P-MW06S	-74.60380651	40.02318701	463055.0001	433378.0001	C441182	SS051P-MW06S-00-020524	YIQ311	02/05/2024 10:50:	GW	8	8	O	RI Data	Perfluorohexanesulfonic acid (PFHxS)	3.2	V	ng/l	1	Y	Y	0.31	DL	1.1	LOD	2.222222	LOQ	E537
MG	SS051P-MW06S	-74.60380651	40.02318701	463055.0001	433378.0001	C441182	SS051P-MW06S-00-020524	YIQ311	02/05/2024 10:50:	GW	8	8	O	RI Data	Perfluorobutanoic acid (PFBA)	2.6	V	ng/l	1	Y	Y	0.66	DL	1.6	LOD	2.222222	LOQ	E537
MG	SS051P-MW06S	-74.60380651	40.02318701	463055.0001	433378.0001	C4G4913	SS051P-MW06S-00-053124	ZIF214	05/31/2024 11:05:	GW	9	9	O	RI Data	Perfluorohexanesulfonic acid (PFHxS)	4.6	V	ng/l	1	Y	Y	0.28	DL	1	LOD	2	LOQ	E537
MG	SS051P-MW06S	-74.60380651	40.02318701	463055.0001	433378.0001	C4G4913	SS051P-MW06S-00-053124	ZIF214	05/31/2024 11:05:	GW	9	9	O	RI Data	Perfluorooctanesulfonic acid (PFOS)	2.7	V	ng/l	1	Y	Y	0.47	DL	1	LOD	2	LOQ	E537
MG	SS051P-MW10	-74.59738521	40.02012053	464852	432258.9997	C441193	SS051P-MW10-00-020624	YIQ367	02/06/2024 11:00:	GW	7	7	O	RI Data	Perfluorohexanesulfonic acid (PFHxS)	5.4	V	ng/l	1	Y	Y	0.28	DL	1	LOD	2	LOQ	E537
MG	SS051P-MW10	-74.59738521	40.02012053	464852	432258.9997	C4G3893	SS051P-MW10-00-052824	ZIA040	05/28/2024 14:00:	GW	8	8	O	RI Data	Perfluorooctanesulfonic acid (PFOS)	2.2	V	ng/l	1	Y	Y	0.52	DL	1.1	LOD	2.222222	LOQ	E537
MG	SS051P-MW10	-74.59738521	40.02012053	464852	432258.9997	C4G3893	SS051P-MW10-00-052824	ZIA040	05/28/2024 14:00:	GW	8	8	O	RI Data	Perfluorohexanesulfonic acid (PFHxS)	6.4	V	ng/l	1	Y	Y	0.31	DL	1.1	LOD	2.222222	LOQ	E537
MG	SS051P-SW11	-74.60031169	40.01829632	464031.6829	431595.4397	C4B8125	SS051P-SD11-041824-00	YYL634	04/18/2024 10:30:	SD	0	0.5	O	RI Data	Moisture	27	V	%	1	Y	Y	0.5	DL		LOD	1	LOQ	% MOISTURE
MG	SS051P-SW11	-74.60031169	40.01829632	464031.6829	431595.4397	C4D2651	SS051P-SD11-050224-00	ZBN910	05/02/2024 11:05:	SD	0	0.5	O	RI Data	Moisture	20	V	%	1	Y	Y	0.5	DL		LOD	1	LOQ	% MOISTURE
MG	SS051P-SW11	-74.60031169	40.01829632	464031.6829	431595.4397	C4D2651	SS051P-SW11-050224-00	ZBN921	05/02/2024 11:00:	SW	0	0	O	RI Data	Perfluorohexanesulfonic acid (PFHxS)	58	V	ng/l	1	Y	Y	0.3	DL	1.1	LOD	2.173912	LOQ	E537
MG	SS051P-SW11	-74.60031169	40.01829632	464031.6829	431595.4397	C4D2651	SS051P-SW11-050224-00	ZBN921	05/02/2024 11:00:	SW	0	0	O	RI Data	Perfluoropentanoic acid (PFPeA)	18	V	ng/l	1	Y	Y	0.24	DL	0.76	LOD	2.173912	LOQ	E537
MG	SS051P-SW11	-74.60031169	40.01829632	464031.6829	431595.4397	C4D2651	SS051P-SW11-050224-00	ZBN921	05/02/2024 11:00:	SW	0	0	O	RI Data	Perfluoroheptanesulfonic acid (PFHpS)	2.4	V	ng/l	1	Y	Y	0.47	DL	1.1	LOD	2.173912	LOQ	E537
MG	SS051P-SW11	-74.60031169	40.01829632	464031.6829	431595.4397	C4D2651	SS051P-SW11-050224-00	ZBN921	05/02/2024 11:00:	SW	0	0	O	RI Data	Perfluorobutanoic acid (PFBA)	8.1	V	ng/l	1	Y	Y	0.64	DL	1.5	LOD	2.173912	LOQ	E537
MG	SS051P-SW11	-74.60031169	40.01829632	464031.6829	431595.4397	C4D2651	SS051P-SW11-050224-00	ZBN921	05/02/2024 11:00:	SW	0	0	O	RI Data	Perfluoroheptanoic acid (PFHpA)	8.6	V	ng/l	1	Y	Y	0.3	DL	1.1	LOD	2.173912	LOQ	E537
MG	SS051P-SW11	-74.60031169	40.01829632	464031.6829	431595.4397	C4D2651	SS051P-SW11-050224-00	ZBN921	05/02/2024 11:00:	SW	0	0	O	RI Data	Perfluorooctanoic acid (PFOA)	24	V	ng/l	1	Y	Y	0.45	DL	1.1	LOD	2.173912	LOQ	E537
MG	SS051P-SW11	-74.60031169	40.01829632	464031.6829	431595.4397	C4D2651	SS051P-SW11-050224-00	ZBN921	05/02/2024 11:00:	SW	0	0	O	RI Data	6:2 Fluorotelomer sulfonic (6:2 FTS)	66	V	ng/l	1	Y	Y	0.68	DL	1.5	LOD	4.347824	LOQ	E537
MG	SS051P-SW11	-74.60031169	40.01829632	464031.6829	431595.4397	C4D2651	SS051P-SW11-050224-00	ZBN921	05/02/2024 11:00:	SW	0	0	O	RI Data	Perfluorobutanesulfonic acid (PFBS)	11	V	ng/l	1	Y	Y	0.29	DL	1.1	LOD	2.173912	LOQ	E537
MG	SS051P-SW11	-74.60031169	40.01829632	464031.6829	431595.4397	C4D2651	SS051P-SW11-050224-00	ZBN921	05/02/2024 11:00:	SW	0	0	O	RI Data	Perfluorononanoic acid (PFNA)	3.1	V	ng/l	1	Y	Y	0.38	DL	1.1	LOD	2.173912	LOQ	E537
MG	SS051P-SW11	-74.60031169	40.01829632	464031.6829	431595.4397	C4D2651	SS051P-SW11-050224-00	ZBN921	05/02/2024 11:00:	SW	0	0	O	RI Data	Perfluorohexanoic acid (PFHxA)	26	V	ng/l	1	Y	Y	0.22	DL	0.76	LOD	2.173912	LOQ	E537
MG	SS051P-SW11	-74.60031169	40.01829632	464031.6829	431595.4397	C4D2651	SS051P-SW11-050224-00	ZBN921	05/02/2024 11:00:	SW	0	0	O	RI Data	Perfluorooctanesulfonic acid (PFOS)	48	V	ng/l	1	Y	Y	0.51	DL	1.1	LOD	2.173912	LOQ	E537
MG	SS051P-SW11	-74.60031169	40.01829632	464031.6829	431595.4397	C4D2651	SS051P-SW11-050224-00	ZBN921	05/02/2024 11:00:	SW	0	0	O	RI Data	Perfluoropentanesulfonic acid (PFPeS)	11	V	ng/l	1	Y	Y	0.37	DL	1.1	LOD	2.173912	LOQ	E537
MG	SS051P-SW12	-74.59944266	40.0186825	464275.2223	431735.8323	C4B8125	SS051P-SD12-041824-00	YYL633	04/18/2024 10:15:	SD	0	0.5	O	RI Data	Moisture	20	V	%	1	Y	Y	0.5	DL		LOD	1	LOQ	% MOISTURE
MG	SS051P-SW12	-74.59944266	40.0186825	464275.2223	431735.8323	C4D2651	SS051P-SD12-050224-00	ZBN909	05/02/2024 10:55:	SD	0	0.5	O	RI Data	Moisture	18	V	%	1	Y	Y	0.5	DL		LOD	1	LOQ	% MOISTURE
s	SS051P-SW12	-74.59944266	40.0186825	464275.2223	431735.8323	C4D2651	SS051P-SW12-050224-00	ZBN920	05/02/2024 10:50:	SW	0	0	O	RI Data	6:2 Fluorotelomer sulfonic (6:2 FTS)	56	V	ng/l	1	Y	Y	0.68	DL	1.5	LOD	4.347824	LOQ	E537
MG	SS051P-SW12	-74.59944266	40.0186825	464275.2223	431735.8323	C4D2651	SS051P-SW12-050224-00	ZBN920	05/02/2024 10:50:	SW	0	0	O	RI Data	Perfluorohexanoic acid (PFHxA)	23	V	ng/l	1	Y	Y	0.22	DL	0.76	LOD	2.173912	LOQ	E537
MG	SS051P-SW12	-74.59944266	40.0186825	464275.2223	431735.8323	C4D2651	SS051P-SW12-050224-00	ZBN920	05/02/2024 10:50:	SW	0	0	O	RI Data	Perfluoroheptanesulfonic acid (PFHpS)	2.2	V	ng/l	1	Y	Y	0.47	DL	1.1	LOD	2.173912	LOQ	E537
MG	SS051P-SW12	-74.59944266	40.0186825	464275.2223	431735.8323	C4D2651	SS051P-SW12-050224-00	ZBN920	05/02/2024 10:50:	SW	0	0	O	RI Data	Perfluorooctanoic acid (PFOA)	23	V	ng/l	1	Y	Y	0.45	DL	1.1	LOD	2.173912	LOQ	E537
MG	SS051P-SW12	-74.59944266	40.0186825	464275.2223	431735.8323	C4D2651	SS051P-SW12-050224-00	ZBN920	05/02/2024 10:50:	SW	0	0	O	RI Data	Perfluorobutanesulfonic acid (PFBS)	10	V	ng/l	1	Y	Y	0.29	DL	1.1	LOD	2.173912	LOQ	E537
MG	SS051P-SW12	-74.59944266	40.0186825	464275.2223	431735.8323	C4D2651	SS051P-SW12-050224-00	ZBN920	05/02/2024 10:50:	SW	0	0	O	RI Data	Perfluorobutanoic acid (PFBA)	7.6	V	ng/l	1	Y	Y	0.64	DL	1.5	LOD	2.173912	LOQ	E537
MG	SS051P-SW12	-74.59944266	40.0186825	464275.2223	431735.8323	C4D2651	SS051P-SW12-050224-00	ZBN920	05/02/2024 10:50:	SW	0	0	O	RI Data	Perfluorooctanesulfonic acid (PFOS)	55	V	ng/l	1	Y	Y	0.51	DL	1.1	LOD	2.173912	LOQ	E537
MG	SS051P-SW12	-74.59944266	40.0186825	464275.2223	431735.8323	C4D2651	SS051P-SW12-050224-00	ZBN920	05/02/2024 10:50:	SW	0	0	O	RI Data	Perfluoroheptanoic acid (PFHpA)	8.1	V	ng/l	1	Y	Y	0.3	DL	1.1	LOD	2.173912	LOQ	E537
MG	SS051P-SW12	-74.59944266	40.0186825	464275.2223	431735.8323	C4D2651	SS051P-SW12-050224-00	ZBN920	05/02/2024 10:50:	SW	0	0	O	RI Data	Perfluorononanoic acid (PFNA)	3.1	V	ng/l	1	Y	Y	0.38	DL	1.1	LOD	2.173912	LOQ	E537
MG	SS051P-SW12	-74.59944266	40.0186825	464275.2223	431735.8323	C4D2651	SS051P-SW12-050224-00	ZBN920	05/02/2024 10:50:	SW	0	0	O	RI Data	Perfluoropentanesulfonic acid (PFPeS)	9.8	V	ng/l	1	Y	Y	0.37	DL	1.1	LOD	2.173912	LOQ	E537
MG	SS051P-SW12	-74.59944266	40.0186825	464275.2223	431735.8323	C4D2651	SS051P-SW12-050224-00	ZBN920	05/02/2024 10:50:	SW	0	0	O	RI Data	Perfluorohexanesulfonic acid (PFHxS)	55	V	ng/l	1	Y	Y	0.3	DL	1.1	LOD	2.173912	LOQ	E537
MG	SS051P-SW12	-74.59944266	40.0186825	464275.2223	431735.8323	C4D2651	SS051P-SW12-050224-00	ZBN920	05/02/2024 10:50:	SW	0	0	O	RI Data	Perfluoropentanoic acid (PFPeA)	17	V	ng/l	1	Y	Y	0.24	DL	0.76	LOD	2.173912	LOQ	E537

SECTION 03 30 53

MISCELLANEOUS CAST-IN-PLACE CONCRETE
05/14

PART 1 GENERAL

1.1 SUMMARY

Perform all work in accordance withACI 318.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 117	(2010; Errata 2011) Specifications for Tolerances for Concrete Construction and Materials and Commentary
ACI 301	(2016) Specifications for Structural Concrete
ACI 304R	(2000; R 2009) Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 305R	(2010) Guide to Hot Weather Concreting
ACI 306R	(2016) Guide to Cold Weather Concreting
ACI 318	(2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)
ACI 347	(2014) Guide to Formwork for Concrete
ACI SP-66	(2004) ACI Detailing Manual

ASTM INTERNATIONAL (ASTM)

ASTM A1064/A1064M	(2017) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
ASTM A615/A615M	(2020) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM C1064/C1064M	(2017) Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete

ASTM C1157/C1157M	(2017) Standard Performance Specification for Hydraulic Cement
ASTM C1260	(2014) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C143/C143M	(2020) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2020) Standard Specification for Portland Cement
ASTM C1567	(2013) Standard Test Method for Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
ASTM C1602/C1602M	(2018) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete
ASTM C172/C172M	(2017) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C173/C173M	(2016) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C231/C231M	(2017a) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2010a; R 2016) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C309	(2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C31/C31M	(2019a) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2018) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2020) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C494/C494M	(2019) Standard Specification for Chemical Admixtures for Concrete
ASTM C595/C595M	(2017) Standard Specification for Blended Hydraulic Cements
ASTM C618	(2019) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete

ASTM C685/C685M	(2017) Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C94/C94M	(2020) Standard Specification for Ready-Mixed Concrete
ASTM C989/C989M	(2018a) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM D1752	(2018) Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D412	(2016) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D471	(2016a) Standard Test Method for Rubber Property - Effect of Liquids
ASTM D75/D75M	(2019) Standard Practice for Sampling Aggregates
ASTM D98	(2015) Calcium Chloride

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 513	(1974) Corps of Engineers Specifications for Rubber Waterstops
COE CRD-C 572	(1974) Corps of Engineers Specifications for Polyvinylchloride Waterstops

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 247	Comprehensive Procurement Guideline for Products Containing Recovered Materials

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Installation Drawings; G, RO

SD-03 Product Data

Air-Entraining Admixture; G, RO

Accelerating Admixture; G, RO

Water-Reducing or Retarding Admixture; G, RO

Curing Materials; G, RO

Expansion Joint Filler Strips, Premolded; G, RO

Joint Sealants - Field Molded Sealants; G, RO

Waterstops; G, RO

Batching and Mixing Equipment

Conveying and Placing Concrete

Formwork

Mix Design Data; G, RO

Ready-Mix Concrete

Curing Compound

Mechanical Reinforcing Bar Connectors; G, RO

SD-06 Test Reports

Aggregates

Concrete Mixture Proportions; G, RO

Compressive Strength Testing; G, RO

Slump; G, RO

Air Content; G, RO

Water

SD-07 Certificates

Cementitious Materials

Aggregates

Delivery Tickets

SD-08 Manufacturer's Instructions

Curing Compound

1.4 QUALITY ASSURANCE

Indicate specific locations of Concrete Placement, Steel Reinforcement, and Accessories on installation drawings.

1.4.1 Flatness and Levelness of Equipment Pads

Equipment pads shall be flat and level within 1/8-inch when tested witha 10-foot straight edge. Conduct floor flatness and levelness measurements within 24 hours after completion of final troweling operation.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

The Government retains the option to sample and test waterstop, aggregates and concrete to determine compliance with the specifications. Provide facilities and labor as may be necessary to assist the Government in procurement of representative test samples. Obtain samples of aggregates at the point of batching in accordance with ASTM D75/D75M. Sample concrete in accordance with ASTM C172/C172M. Determine slump and air content in accordance with ASTM C143/C143M and ASTM C231/C231M, respectively, when cylinders are molded. Prepare, cure, and transport compression test specimens in accordance with ASTM C31/C31M. Test compression test specimens in accordance with ASTM C39/C39M. Take samples for strength tests not less than once each shift in which concrete is produced . Provide a minimum of five specimens from each sample; two to be tested at 28 days (90 days if pozzolan is used) for acceptance, two will be tested at 7 days for information and one held in reserve.

2.1.1 Strength

Acceptance test results are the average strengths of two specimens tested at 28 days (90 days if pozzolan is used). The strength of the concrete is considered satisfactory so long as the average of three consecutive acceptance test results equal or exceed the specified compressive strength, f'c, but not more than 20 percent, and no individual acceptance test result falls below f'c by more than 500 psi.

2.1.2 Construction Tolerances

Apply a Class "C" finish to all surfaces except those specified to receive a Class "D" finish. Apply a Class "D" finish to all post-construction surfaces which will be permanently concealed. Surface requirements for the classes of finish required are as specified in ACI 117.

2.1.3 Concrete Mixture Proportions

Concrete mixture proportions are the responsibility of the Contractor. Mixture proportions must include the dry weights of cementitious material(s); the nominal maximum size of the coarse aggregate; the specific gravities, absorptions, and saturated surface-dry weights of fine and coarse aggregates; the quantities, types, and names of admixtures; and quantity of water per yard of concrete. Provide materials included in the mixture proportions of the same type and from the same source as will be used on the project. The specified compressive strength f'c is 4500 psi at 28 days (90 days if pozzolan is used). The maximum nominal size coarse aggregate is 3/4 inch, in accordance with ACI 304R. The air content must be between 4.5 and 7.5 percent with a slump between 2 and 5 inches. The maximum water-cementitious material ratio is 0.45. Submit the applicable test reports and mixture proportions that will produce concrete of the quality required, ten days prior to placement of concrete.

2.2 MATERIALS

Submit manufacturer's literature from suppliers which demonstrates compliance with applicable specifications for the specified materials.

2.2.1 Cementitious Materials

Submit Manufacturer's certificates of compliance, accompanied by mill test reports, attesting that the concrete materials meet the requirements of the specifications in accordance with the Special Clause "CERTIFICATES OF COMPLIANCE". Also, certificates for all material conforming to EPA's Comprehensive Procurement Guidelines (CPG), in accordance with 40 CFR 247. Provide cementitious materials that conform to the appropriate specifications listed:

2.2.1.1 Portland Cement

ASTM C150/C150M, Type II or V, low alkali with tri-calcium aluminates (C3A) content less than 10 percent.

2.2.1.2 Blended Hydraulic Cement

Provide blended cement conforming to ASTM C595/C595M and ASTM C1157/C1157M, Type IP or IS, including the optional requirement for mortar expansion and sulfate soundness and consist of a mixture of ASTM C150/C150M Type II cement and a complementary cementing material. The slag added to the Type IS blend must be ASTM C989/C989M ground granulated blast-furnace slag. The pozzolan added to the Type IP blend must be ASTM C618 Class F, interground with the cement clinker. Provide the manufacturer's written statement that the amount of pozzolan in the finished cement will not vary more than plus or minus 5 mass percent of the finished cement from lot-to-lot or within a lot. Do not change the percentage and type of mineral admixture used in the blend from that submitted for the aggregate evaluation and mixture proportioning.

2.2.1.3 Pozzolan

Provide pozzolan that conforms to ASTM C618, Class F.

2.2.2 Aggregates

Coarse and fine aggregate materials shall meet the deleterious requirements in specification section 32 13 14.13. Fine and coarse aggregates shall also meet the quality and grading requirements of ASTM C33/C33M and both testeded and evaluated for alkali-aggregate reactivity in accordance with ASTM C1260. Perform evaluation of fine and coarse aggregates separately and in combination, matching the proposed mix design proportioning. All results of the separate and combination testing must have a measured expansion less than 0.08 percent at 28 days after casting. If the test data indicates an expansion of 0.08 percent or greater, reject the aggregate(s) or perform additional testing using ASTM C1260 and ASTM C1567. Perform the additional testing using ASTM C1260 and ASTM C1567 using the low alkali portland cement in combination with ground granulated blast furnace (GGBF) slag, or Class F fly ash. Use GGBF slag in the range of 40 to 50 percent of the total cementitious material by mass. Use Class F fly ash in the range of 25 to 40 percent of the total cementitious material by mass. Submit certificates of compliance and test reports for aggregates showing the material(s) meets the quality and grading requirements of the specifications under which it is

furnished. Coarse aggregates shall meet the grading requirement of ASTM C33/C33M size number 67.

2.2.3 Admixtures

Provide admixtures, when required or approved, in compliance with the appropriate specification listed. Retest chemical admixtures that have been in storage at the project site, for longer than 6 months or that have been subjected to freezing, at the expense of the Contractor at the request of the Contracting Officer and will be rejected if test results are not satisfactory.

2.2.3.1 Air-Entraining Admixture

Provide air-entraining admixture that meets the requirements of ASTM C260/C260M.

2.2.3.2 Accelerating Admixture

Provide calcium chloride meeting the requirements of ASTM D98. Other accelerators must meet the requirements of ASTM C494/C494M, Type C or E.

2.2.3.3 Water-Reducing or Retarding Admixture

Provide water-reducing or retarding admixture meeting the requirements of ASTM C494/C494M, Type A, B, or D.

2.2.4 Water

Mixing and curing water in compliance with the requirements of ASTM C1602/C1602M; potable, and free of injurious amounts of oil, acid, salt, or alkali. Submit test report showing water complies with ASTM C1602/C1602M.

2.2.5 Reinforcing Steel

Provide reinforcing bars conforming to the requirements of ASTM A615/A615M, Grade 60, deformed. Provide welded steel wire reinforcement conforming to the requirements of ASTM A1064/A1064M. Detail reinforcement not indicated in accordance with ACI 301 and ACI SP-66. Provide mechanical reinforcing bar connectors in accordance with ACI 301 and provide 125 percent minimum yield strength of the reinforcement bar.

2.2.6 Expansion Joint Filler Strips, Premolded

Expansion joint filler strips, premolded of sponge rubber conforming to ASTM D1752, Type I.

2.2.7 Joint Sealants - Field Molded Sealants

Conform to ASTM C920, Type M, Grade NS, Class 25, use NT for vertical joints and Type M, Grade P, Class 25, use T for horizontal joints. Provide polyethylene tape, coated paper, metal foil, or similar type bond breaker materials. The backup material needs to be compressible, nonshrink, nonreactive with the sealant, and a nonabsorptive material such as extruded butyl or polychloroprene foam rubber. Immediately prior to installation of field-molded sealants, clean the joint of all debris and further cleaned using water, chemical solvents, or other means as recommended by the sealant manufacturer or directed.

2.2.8 Formwork

Design and engineer the formwork as well as its construction in accordance with ACI 301 Section 2 and 5 and ACI 347. Fabricate of wood, steel, or other approved material. Submit formwork design prior to the first concrete placement.

2.2.9 Form Coatings

Provide form coating in accordance with ACI 301.

2.2.10 Curing Materials

Provide curing materials in accordance with ACI 301, Section 5.

2.3 READY-MIX CONCRETE

Provide ready-mix concrete with mix design data conforming to ACI 301 Part 2. Submit delivery tickets in accordance with ASTM C94/C94M for each ready-mix concrete delivery, include the following additional information: .

a. Type and brand cement

b. Cement content in 94-pound bags per cubic yard of concrete

c. Maximum size of aggregate

d. Amount and brand name of admixture

e. Total water content expressed by water cementitious material ratio

2.4 ACCESSORIES

2.4.1 Waterstops

2.4.1.1 PVC Waterstop

Polyvinylchloride waterstops conforming to COE CRD-C 572.

2.4.1.2 Rubber Waterstop

Rubber waterstops conforming to COE CRD-C 513.

2.4.1.3 Thermoplastic Elastomeric Rubber Waterstop

Thermoplastic elastomeric rubber waterstops conforming to ASTM D471.

2.4.1.4 Hydrophilic Waterstop

Swellable strip type compound of polymer modified chloroprene rubber that swells upon contact with water conforming to ASTM D412 as follows: Tensile strength 420 psi minimum; ultimate elongation 600 percent minimum. Minimum hardness of 50 on the type A durometer and the volumetric expansion ratio in distilled water at 70 degrees F; 3 to 1 minimum.

2.4.2 Curing Compound

Provide curing compound conforming to ASTM C309. Submit manufactures instructions for placing curing compound.

PART 3 EXECUTION

3.1 PREPARATION

Prepare construction joints to expose coarse aggregate. The surface must be clean, damp, and free of laitance. Construct ramps and walkways, as necessary, to allow safe and expeditious access for concrete and workmen. Remove snow, ice, standing or flowing water, loose particles, debris, and foreign matter. Satisfactorily compact earth foundations. Make spare vibrators available. Placement cannot begin until the entire preparation has been accepted by the Government.

3.1.1 Embedded Items

Secure reinforcement in place after joints, anchors, and other embedded items have been positioned. Arrange internal ties so that when the forms are removed the metal part of the tie is not less than 2 inches from concrete surfaces permanently exposed to view or exposed to water on the finished structures. Prepare embedded items so they are be free of oil and other foreign matters such as loose coatings or rust, paint, and scale. The embedding of wood in concrete is permitted only when specifically authorized or directed. Provide all equipment needed to place, consolidate, protect, and cure the concrete at the placement site and in good operating condition.

3.1.2 Formwork Installation

Forms must be properly aligned, adequately supported, and mortar-tight. Provide smooth form surfaces, free from irregularities, dents, sags, or holes when used for permanently exposed faces. Chamfer all exposed joints and edges , unless otherwise indicated.

3.1.3 Production of Concrete

3.1.3.1 Ready-Mixed Concrete

Provide ready-mixed concrete conforming to ASTM C94/C94M except as otherwise specified.

3.1.3.2 Concrete Made by Volumetric Batching and Continuous Mixing

Conform to ASTM C685/C685M.

3.1.3.3 Batching and Mixing Equipment

The option of using an on-site batching and mixing facility is available. The facility must provide sufficient batching and mixing equipment capacity to prevent cold joints. Submit the method of measuring materials, batching operation, and mixer for review, and manufacturer's data for batching and mixing equipment demonstrating compliance with the applicable specifications. Provide an Onsite Plant conforming to the requirements of either ASTM C94/C94M or ASTM C685/C685M.

3.1.4 Waterstops

Install and splice waterstops as directed by the manufacturer.

3.2 CONVEYING AND PLACING CONCRETE

Convey and place concrete in accordance with ACI 301, Section 5.

3.2.1 Cold-Weather Requirements

Place concrete in cold weather in accordance with ACI 306R

3.2.2 Hot-Weather Requirements

Place concrete in hot weather in accordance with ACI 305R

3.3 FINISHING

3.3.1 Temperature Requirement

Do not finish or repair concrete when either the concrete or the ambient temperature is below 50 degrees F.

3.3.2 Finishing Formed Surfaces

Remove all fins and loose materials , and surface defects including filling of tie holes. Repair all honeycomb areas and other defects. Remove all unsound concrete from areas to be repaired. Ream or chip surface defects greater than 1/2 inch in diameter and holes left by removal of tie rods in all surfaces not to receive additional concrete and fill with dry-pack mortar. Brush-coat the prepared area with an approved epoxy resin or latex bonding compound or with a neat cement grout after dampening and filling with mortar or concrete.

3.3.3 Finishing Unformed Surfaces

All unformed surfaces that are not to be covered by additional concrete or backfill shall be float finished to elevations shown, unless otherwise specified. Surfaces to receive additional concrete or backfill shall be brought to the elevations shown and left as a true and regular surface. Exterior surfaces shall be sloped for drainage unless otherwise shown. Joints shall be carefully made with a jointing tool. Unformed surfaces shall be finished to a tolerance of 3/8 inch for a float finish as determined by a 10 foot straightedge placed on surfaces shown on the plans to be level or having a constant slope. Finishing shall not be performed while there is excess moisture or bleeding water on the surface. No water or cement shall be added to the surface during finishing.

3.3.3.1 Expansion Joints

Expansion joints shall be made in accordance with the details shown or as otherwise specified.

3.4 CURING AND PROTECTION

Cure and protect in accordance with ACI 301, Section 5.

3.5 FORM WORK

Provide form work in accordance with ACI 301, Section 2 and Section 5.

3.5.1 Removal of Forms

Remove forms in accordance with ACI 301, Section 2.

3.6 STEEL REINFORCING

Reinforcement must be free from loose, flaky rust and scale, and free from oil, grease, or other coating which might destroy or reduce the reinforcement's bond with the concrete.

3.6.1 Fabrication

Shop fabricate steel reinforcement in accordance with ACI 318 and ACI SP-66. Provide shop details and bending in accordance with ACI 318 and ACI SP-66.

3.6.2 Splicing

Perform splices in accordance with ACI 318 and ACI SP-66.

3.6.3 Supports

Secure reinforcement in place by the use of metal or concrete supports, spacers, or ties.

3.7 EMBEDDED ITEMS

Before placing concrete, take care to determine that all embedded items are firmly and securely fastened in place. Provide embedded items free of oil and other foreign matter, such as loose coatings of rust, paint and scale. Embedding of wood in concrete is permitted only when specifically authorized or directed.

3.8 TESTING AND INSPECTING

Report the results of all tests and inspections conducted at the project site informally at the end of each shift. Submit written reports weekly. Deliver within three days after the end of each weekly reporting period. See Section 01 45 00 QUALITY CONTROL.

3.8.1 Field Testing Technicians

The individuals who sample and test concrete must have demonstrated a knowledge and ability to perform the necessary test procedures equivalent to the ACI minimum guidelines for certification of Concrete Field Testing Technicians, Grade I.

3.8.2 Preparations for Placing

Inspect foundation or construction joints, forms, and embedded items in sufficient time prior to each concrete placement to certify that it is ready to receive concrete.

3.8.3 Sampling and Testing

a. Obtain samples and test concrete for quality control during

placement. Sample fresh concrete for testing in accordance with ASTM C172/C172M. Make six test cylinders.

b. Test concrete for compressive strength at 7 and 28 days for each design mix and for every 100 cubic yards of concrete. Test two cylinders at 7 days; two cylinders at 28 days; and hold two cylinders in reserve. Conform test specimens to ASTM C31/C31M. Perform compressive strength testing conforming to ASTM C39/C39M.

c. Test slump at the site of discharge for each design mix in accordance with ASTM C143/C143M. Check slump once during each shift that concrete is produced for each strength of concrete required.

d. Test air content for air-entrained concrete in accordance with ASTM C231/C231M. Test concrete using lightweight or extremely porous aggregates in accordance with ASTM C173/C173M. Check air content at least once during each shift that concrete is placed for each strength of concrete required.

e. Determine temperature of concrete at time of placement in accordance with ASTM C1064/C1064M. Check concrete temperature at least once during each shift that concrete is placed for each strength of concrete required.

3.8.4 Action Required

3.8.4.1 Placing

Do not begin placement until the availability of an adequate number of acceptable vibrators, which are in working order and have competent operators, has been verified. Discontinue placing if any lift is inadequately consolidated.

3.8.4.2 Air Content

Whenever an air content test result is outside the specification limits, adjust the dosage of the air-entrainment admixture prior to delivery of concrete to forms.

3.8.4.3 Slump

Whenever a slump test result is outside the specification limits, adjust the batch weights of water and fine aggregate prior to delivery of concrete to the forms. Make the adjustments so that the water-cementitious material ratio does not exceed that specified in the submitted concrete mixture proportion and the required concrete strength is still met.

-- End of Section --

SECTION 03 42 13.00 10

PLANT-PRECAST CONCRETE PRODUCTS FOR BELOW GRADE CONSTRUCTION
05/16

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 211.1	(1991; R 2009) Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete
ACI 211.2	(1998; R 2004) Standard Practice for Selecting Proportions for Structural Lightweight Concrete
ACI 305R	(2020) Guide to Hot Weather Concreting
ACI 306.1	(1990; R 2002) Standard Specification for Cold Weather Concreting
ACI 318	(2014; Errata 1-2 2014; Errata 3-5 2015; Errata 6 2016; Errata 7-9 2017) Building Code Requirements for Structural Concrete (ACI 318-14) and Commentary (ACI 318R-14)

AMERICAN CONCRETE PIPE ASSOCIATION (ACPA)

ACPA 01-102	(2000) Concrete Pipe Handbook
ACPA 01-110	(1984) Design Manual for Sulfide and Corrosion Prediction and Control
ACPA QPC	(202016) QCast Plant Certification Manual

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2020; Errata 1 2021) Structural Welding Code - Steel
AWS D1.4/D1.4M	(2011) Structural Welding Code - Reinforcing Steel

ASTM INTERNATIONAL (ASTM)

ASTM A1064/A1064M	(2022) Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete

ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A36/A36M	(2019) Standard Specification for Carbon Structural Steel
ASTM A615/A615M	(2022) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A706/A706M	(2022) Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement
ASTM A767/A767M	(2016) Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
ASTM A775/A775M	(2022) Standard Specification for Epoxy-Coated Steel Reinforcing Bars
ASTM A884/A884M	(2019) Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement
ASTM C1064/C1064M	(2017) Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C1107/C1107M	(2020) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM C1244	(2020) Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill
ASTM C138/C138M	(2017a) Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C143/C143M	(2020) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C1478	(2019) Standard Specification for Storm Drain Resilient Connectors Between Reinforced Concrete Storm Sewer Structures, Pipes and Laterals
ASTM C171	(2020) Standard Specification for Sheet Materials for Curing Concrete
ASTM C173/C173M	(2016) Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
ASTM C192/C192M	(2019) Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory

ASTM C231/C231M	(2022) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C309	(2019) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C31/C31M	(2022) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C39/C39M	(2021) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C443	(2021) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C857	(2016) Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
ASTM C858	(2010; E 2012) Standard Specification for Underground Precast Concrete Utility Structures
ASTM C877	(2021) Standard Specification for External Sealing Bands for Concrete Pipe, Manholes, and Precast Box Sections
ASTM C891	(2020) Standard Practice for Installation of Underground Precast Concrete Utility Structures
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C923	(2008; R 2013; E 2016) Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals
ASTM C990	(2009; R 2019) Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

CSA GROUP (CSA)

CSA A23.4	(2016; R 2021) Precast Concrete - Materials and Construction

NATIONAL PRECAST CONCRETE ASSOCIATION (NPCA)

NPCA QC Manual	(2017) Quality Control Manual for Precast and Prestressed Concrete Plants

1.2 SUBMITTALS

All submittals are the responsibility of the precast concrete producer. Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Quality Control Procedures

SD-02 Shop Drawings

Standard Precast Units; G, DO

SD-03 Product Data

Standard Precast Units

Embedded Items
Accessories

SD-05 Design Data

Design Calculations; G, DO
Concrete Mix Proportions; G, DO

SD-06 Test Reports

Test Reports

SD-07 Certificates

Quality Control Procedures

1.3 QUALITY ASSURANCE

Demonstrate adherence to the standards set forth in NPCA QC Manual or ACPA QPC. Meet requirements written in the subparagraphs below.

1.3.1 NPCA and ACPA Plant Certification

The precast concrete producer must be certified by the National Precast Concrete Association's or the American Concrete Pipe Association's Plant Certification Program prior to and during production of the products for this project.

1.3.2 Qualifications, Quality Control and Inspection

1.3.2.1 Qualifications

Select a precast concrete producer that has been in the business of producing precast concrete units similar to those specified for a minimum of 3 years. The precast concrete producer must maintain a permanent quality control department or retain an independent testing agency on a continuing basis.

1.3.2.2 Quality Control Procedures

Submit quality control procedures established by the precast manufacturer in accordance with NPCA QC Manual and ACPA QPC. Show that the following QC tests are performed as required and in accordance with the ASTM standards indicated.

1.3.2.2.1 Slump

Perform a slump test for each 150 cu yd of concrete produced, or once a day, whichever comes first. Perform slump tests in accordance with ASTM C143/C143M.

1.3.2.2.2 Temperature

Measure the temperature of fresh concrete when slump or air content tests are made and when compressive test specimens are made in accordance with ASTM C1064/C1064M.

1.3.2.2.3 Compressive Strength

Make at least four compressive strength specimens for each 150 cubic yards of concrete of each mix in accordance with the following Standards: ASTM C31/C31M, ASTM C192/C192M, ASTM C39/C39M.

1.3.2.2.4 Air Content

Perform tests for air content on air-entrained, wet-cast concrete for each 150 cu yd of concrete, but not less often than once each day when air-entrained concrete is used. Determine the air content in accordance with either ASTM C231/C231M or ASTM C173/C173M for normal weight aggregates and ASTM C173/C173M for lightweight aggregates.

1.3.2.2.5 Unit Weight

Perform tests for unit weight a minimum of once per week to verify the yield of batch mixes. Perform unit weight tests for each 100 cu yd of lightweight concrete in accordance with ASTM C138/C138M.

1.3.2.3 Inspection

The Contracting Officer may place an inspector in the plant when the units covered by this specification are being manufactured. The burden of payment for plant inspection will be clearly detailed in the specification. The precast concrete producer must give notice 14 days prior to the time the units will be available for plant inspection. Neither the exercise nor waiver of inspection at the plant will affect the Government's right to enforce contractual provisions after units are transported or erected.

1.3.2.4 Test Reports

Submit the following:

1.3.2.4.1 Material Certifications or Laboratory Test Reports

Include mill tests and all other test data, for portland cement, blended cement, pozzolans, ground granulated blast furnace slag, silica fume, aggregate, admixtures, and curing compound proposed for use on this

project.

1.3.2.4.2 Mix Test

Submit reports showing that the mix has been successfully tested to produce concrete with the properties specified and will be suitable for the job conditions. Such tests may include compressive strength, flexural strength, plastic or hardened air content, freeze thaw durability, abrasion and absorption. Clearly detail in the specifications special tests for precast concrete or cast-in items.

1.3.2.4.3 Self-Consolidating Concrete

Submit sufficient documentation, when the use of self-consolidating concrete (SCC) is proposed, showing a minimum of 30-days production track records demonstrating that SCC is appropriate for casting of the product.

1.3.2.4.4 In-Plant QA/QC Inspection Reports

Submit inspection reports upon the request of the Contracting Officer.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Delivery

Deliver precast units to the site in accordance with the delivery schedule to avoid excessive build-up of units in storage at the site. Upon delivery to the jobsite, all precast concrete units will be inspected by the Contracting Officer for quality and final acceptance.

1.4.2 Storage

Store units off the ground or in a manner that minimizes potential damage.

1.4.3 Handling

Handle, transport, and store products in a manner to minimize damage. Lifting devices or holes must be consistent with industry standards. Perform lifting with methods or devices intended for this purpose as indicated on shop drawings.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Furnish precast concrete units designed and fabricated by an experienced and acceptable precast concrete manufacturer who has been, for at least three years, regularly and continuously engaged in the manufacture of precast concrete work similar to that indicated on the drawings. Coordinate precast work with the work of other trades. Below grade structures must comply with ASTM C858.

2.1.1 Standard Precast Units

Design standard precast concrete units to withstand indicated design load conditions in accordance with applicable industry design standards ACI 318, ASTM C857. Design must also consider stresses induced during handling, shipping and installation as to avoid product cracking or other handling damage. Indicate design loads for precast concrete units on the shop

drawings. Submit drawings for standard precast concrete units furnished by the precast concrete producer for approval by the Contracting Officer. These drawings must demonstrate that the applicable industry design standards have been met. Include installation and construction information on shop drawings. Include details of steel reinforcement size and placement as well as supporting design calculations, if appropriate. Produce precast concrete units in accordance with the approved drawings. Submit cut sheets, for standard precast concrete units, showing conformance to project drawings and requirements, and to applicable industry design standards listed in this specification.

2.1.2 Joints and Sealants

Provide joints and sealants between adjacent units of the type and configuration indicated on shop drawings meeting specified design and performance requirements.

2.1.3 Concrete Mix Design

2.1.3.1 Concrete Mix Proportions

Base selection of proportions for concrete on the methodology presented in ACI 211.1 for normal weight concrete and ACI 211.2 for lightweight concrete. Develop the concrete proportions using the same type and brand of cement, the same type and brand of pozzolan, the same type and gradation of aggregates, and the same type and brand of admixture that will be used in the manufacture of precast concrete units for the project. Do not use calcium chloride in precast concrete containing reinforcing steel or other embedded metal items. At a minimum of thirty days prior to precast concrete unit manufacturing, the precast concrete producer will submit a mix design and proportions for each strength and type of concrete that will be used. Furnish a complete list of materials, including quantity, type, brand and applicable data sheets for all mix design constituents as well as applicable reference specifications. The use of self-consolidating concrete is permitted, provided that mix design proportions and constituents meet the requirements of this specification.

2.1.3.2 Concrete Strength

Provide precast concrete units with a 28-day compressive strength (f'c) of 4,500 psi.

2.1.3.3 Water-to-Cement Ratio

Where exposed to freezing and thawing, furnish concrete containing entrained air and with a water-cementitious ratio of 0.45 or less. Where exposed to deicer salts, brackish water, or seawater, furnish concrete with a water-cementitious ratio of 0.40 or less, for corrosion protection.

2.1.3.4 Air Content

The air content of concrete that will be exposed to freezing conditions must be within the limits given below.

	AIR CONTENT PERCENT	
NOMINAL MAXIMUM AGGREGATE SIZE	EXPOSURE CLASS F1	EXPOSURE CLASSES F2 and F3
3/8 inch	6.0	7.5
1/2 inch	5.5	7.0
3/4 inch	5.0	6.0
1.0 inch	4.5	6.0
1.5 inch	4.5	5.5
Note: For specified compressive strengths greater than 5000 psi, air content may be reduced 1 percent		

2.1.3.5 Corrosion Control for Sanitary Sewer Systems

Follow design recommendations outlined in Chapter 7 of ACPA 01-102 or the ACPA 01-110 when hydrogen sulfide is indicated as a potential problem.

2.2 MATERIALS

Except as otherwise specified in the following paragraphs, conform materials to Section 03 30 53 MISCELLANEOUS CAST-IN-PLACE CONCRETE.

2.2.1 Pigments

Non-fading and lime-resistant

2.2.2 Reinforcement

2.2.2.1 Reinforcing Bars

a. Deformed Billet-steel: ASTM A615/A615M

b. Deformed Low-alloy steel: ASTM A706/A706M

2.2.2.2 Reinforcing Wire

a. Plain Wire: ASTM A1064/A1064M

b. Deformed Wire: ASTM A1064/A1064M

2.2.2.3 Welded Wire Reinforcement

a. Plain Wire: ASTM A1064/A1064M

b. Deformed Wire: ASTM A1064/A1064M

2.2.2.4 Epoxy Coated Reinforcement

a. Reinforcing Bars: ASTM A775/A775M

b. Wires and Welded Wire: ASTM A884/A884M

2.2.2.5 Galvanized Reinforcement

Provide galvanized reinforcement conforming to ASTM A767/A767M.

2.2.3 Inserts and Embedded Metal

All items embedded in concrete must be of the type required for the intended task, and meet the following standards.

a. Structural Steel Plates, Angles, etc.: ASTM A36/A36M

b. Hot-dipped Galvanized: ASTM A153/A153M

c. Proprietary Items: In accordance with manufacturers published literature

2.2.4 Accessories

Submit proper installation instructions and relevant product data for items including, but not limited to, sealants, gaskets, connectors, steps, cable racks and other items installed before or after delivery.

a. Rubber Gaskets for Circular Concrete Sewer Pipe and Culvert Pipe: ASTM C443.

b. External Sealing Bands for Noncircular Sewer, Storm Drain and Culvert Pipe: ASTM C877.

c. Preformed Flexible Joint Sealants for Concrete Pipe, Manholes, and Manufactured Box Sections: ASTM C990.

d. Elastomeric Joint Sealants: ASTM C920

2.2.5 Pipe Entry Connectors

Pipe entry connectors must conform to ASTM C923 or ASTM C1478.

2.2.6 Grout

Nonshrink Grout must conform to ASTM C1107/C1107M. Cementitious grout must be a mixture of portland cement, sand, and water. Proportion one part cement to approximately 2.5 parts sand, with the amount of water based on placement method. Provide air entrainment for grout exposed to the weather.

PART 3 EXECUTION

3.1 FABRICATION AND PLACEMENT

Perform fabrication in accordance with NPCA QC Manual or ACPA QPC unless specified otherwise.

3.1.1 Forms

Use forms, for manufacturing precast concrete products, of the type and design consistent with industry standards and practices. They should be capable of consistently providing uniform products and dimensions. Construct forms so that the forces and vibrations to which the forms will

be subjected can cause no product damage. Clean forms of concrete build-up after each use. Apply form release agents according to the manufacturers recommendations and do not allow to build up on the form casting surfaces.

3.1.2 Reinforcement

Follow applicable ASTM Standard or ACI 318 for placement and splicing. Fabricate cages of reinforcement either by tying the bars, wires or welded wire reinforcement into rigid assemblies or by welding, where permissible, in accordance with AWS D1.4/D1.4M. Position reinforcing as specified by the design and so that the concrete cover conforms to requirements. The tolerance on concrete cover must be one-third of that specified but not more than 1/2 inch. Provide concrete cover not less than 1/2 inch. Take positive means to assure that the reinforcement does not move significantly during the casting operations.

3.1.3 Embedded Items

Position embedded items at locations specified in the design documents. Perform welding in accordance with AWS D1.1/D1.1M when necessary. Hold rigidly in place inserts, plates, weldments, lifting devices and other items to be imbedded in precast concrete products so that they do not move significantly during casting operations. Submit product data sheets and proper installation instruction for anchors, lifting inserts and other devices. Clearly indicate the products dimensions and safe working load.

3.2 CONCRETE

3.2.1 Concrete Mixing

Mixing operations must produce batch-to-batch uniformity of strength, consistency, and appearance.

3.2.2 Concrete Placing

Deposit concrete into forms as near to its final location as practical. Keep the free fall of the concrete to a minimum. Consolidate concrete in such a manner that segregation of the concrete is minimized and honeycombed areas are kept to a minimum. Use vibrators to consolidate concrete with frequencies and amplitudes sufficient to produce well consolidated concrete.

3.2.2.1 Cold Weather Concreting

Perform cold weather concreting in accordance with ACI 306.1.

a. Provide adequate equipment for heating concrete materials and protecting concrete during freezing or near-freezing weather.

b. All concrete materials, reinforcement, forms, fillers, and ground with which concrete is to come in contact must be free from frost.

c. Do not use frozen materials or materials containing ice.

d. In cold weather the temperature of concrete at the time of placing must not be below 45 degrees F. Discard concrete that freezes before its compressive strength reaches 500 psi.

3.2.2.2 Hot Weather Concreting

Follow recommendations for hot weather concreting in ACI 305R. During hot weather, give proper attention to constituents, production methods, handling, placing, protection, and curing to prevent excessive concrete temperatures or water evaporation that could impair required strength or serviceability of the member or structure. The temperature of concrete at the time of placing must not exceed 90 degrees F.

3.2.3 Concrete Curing

Commence curing immediately following the initial set and completion of surface finishing.

3.2.3.1 Curing by Moisture Retention

Prevent moisture evaporation from exposed surfaces until adequate strength for stripping is reached by one of the following methods:

a. Cover with polyethylene sheets a minimum of 6 mils thick in accordance with ASTM C171.

b. Cover with burlap or other absorptive material and keep continually moist.

c. Use a membrane-curing compound, conforming to ASTM C309 and applied at a rate not less than 200 square ft/gallon, or in accordance with manufacturers' recommendations.

3.2.3.2 Curing with Heat and Moisture

Do not subject concrete to steam or hot air until after the concrete has attained its initial set. Apply steam, if used, within a suitable enclosure, which permits free circulation of the steam in accordance with CSA A23.4. If hot air is used for curing, take precautions to prevent moisture loss from the concrete. The temperature of the concrete must not be permitted to exceed 150 degrees F. These requirements do not apply to products cured with steam under pressure in an autoclave.

3.2.4 Surface Finish

Finish unformed surfaces of wet-cast precast concrete products as specified. If no finishing procedure is specified, finish such surfaces using a strike-off to level the concrete with the top of the form.

3.2.4.1 Formed Non-Architectural Surfaces

Cast surfaces against approved forms following industry practices in cleaning forms, designing concrete mixes, placing and curing concrete. Normal color variations, form joint marks, small surface holes caused by air bubbles, and minor chips and spalls will be accepted but no major imperfections, honeycombs or other major defects will be permitted.

3.2.4.2 Unformed Surfaces

Finish unformed surfaces with a vibrating screed, or by hand with a float. Normal color variations, minor indentations, minor chips and spalls will be accepted. Major imperfections, honeycombs, or other major defects are not permitted.

3.2.5 Stripping Products from Forms

Do not remove products from the forms until the concrete reaches the compressive strength for stripping required by the design. If no such requirement exists, products may be removed from the forms after the final set of concrete provided that stripping damage is minimal.

3.2.6 Patching and Repair

No repair is required to formed surfaces that are relatively free of air voids and honeycombed areas, unless the surfaces are required by the design to be finished.

3.2.6.1 Repairing Minor Defects

Defects that will not impair the functional use or expected life of a precast concrete product may be repaired by any method that does not impair the product.

3.2.6.2 Repairing Honeycombed Areas

When honeycombed areas are to be repaired, remove all loose material and cut back the areas into essentially horizontal or vertical planes to a depth at which coarse aggregate particles break under chipping rather than being dislodged. Use proprietary repair materials in accordance with the manufacturer's instructions. If a proprietary repair material is not used, saturate the area with water. Immediately prior to repair, the area should be damp, but free of excess water. Apply a cement-sand grout or an approved bonding agent to the chipped surfaces, followed immediately by consolidating an appropriate repair material into the cavity.

3.2.6.3 Repairing Major Defects

Evaluate, by qualified personnel, defects in precast concrete products which impair the functional use or the expected life of products to determine if repairs are feasible and, if so, to establish the repair procedure.

3.2.7 Shipping Products

Do not ship products until they are at least five days old, unless it can be shown that the concrete strength has reached at least 75 percent of the specified 28-day strength, or that damage will not result, impairing the performance of the product.

3.3 INSTALLATION

3.3.1 Site Access

It is the Contractor's responsibility to provide adequate access to the site to facilitate hauling, storage and proper handling of the precast concrete products.

3.3.2 General Requirements

a. Install precast concrete products to the lines and grades shown in the contract documents or otherwise specified.

b. Lift products by suitable lifting devices at points provided by the precast concrete producer.

c. Install products in accordance with the precast concrete producer's instructions. In the absence of such instructions, install underground utility structures in accordance with ASTM C891. Install pipe and manhole sections in accordance with the procedures outlined by the American Concrete Pipe Association.

d. Field modifications to the product will relieve the precast producer of liability even if such modifications result in the failure of the product.

3.3.3 Water Tightness

Where water tightness is a necessary performance characteristic of the precast concrete product's end use, watertight joints, connectors and inserts should be used to ensure the integrity of the entire system.

3.4 FIELD QUALITY CONTROL

3.4.1 Site Tests

When water tightness testing is required for an underground product, use one of the following methods:

3.4.2 Vacuum Testing

Prior to backfill vacuum test system according to ASTM C1244.

3.4.3 Water Testing

Perform water testing according to the contract documents and precast concrete producer's recommendations.

-- End of Section --

SECTION 13 48 00

SEISMIC BRACING FOR MISCELLANEOUS EQUIPMENT
05/18

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 355.2	(2007) Qualification of Post-Installed Mechanical Anchors in Concrete and Commentary
ACI 355.4	(2011) Qualification of Post-Installed Adhesive Anchors in Concrete (ACI 355.4) and Commentary

AMERICAN INSTITUTE OF STEEL CONSTRUCTION (AISC)

AISC 325	(2017) Steel Construction Manual

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7	(2017) Minimum Design Loads for Buildings and Other Structures

ASTM INTERNATIONAL (ASTM)

ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A325	(2014) Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
ASTM A490	(2014a) Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength
ASTM A563	(2015) Standard Specification for Carbon and Alloy Steel Nuts
ASTM E488/E488M	(2015) Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements
ASTM F1554	(2018) Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength

ICC EVALUATION SERVICE, INC. (ICC-ES)

ICC-ES AC23	(2012; R 2016) Acceptance Criteria for Sprayed Fire-resistant Materials (SFRMs), Intumescent Fire-resistant Coatings and Mastic Fire-resistant Coatings Used to Protect Structural Steel Members

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-301-01	(2019) Structural Engineering
UFC 4-010-01	(2018) DoD Minimum Antiterrorism Standards for Buildings

1.2 SYSTEM DESCRIPTION

1.2.1 General Requirements

Apply the requirements for seismic protection measures, described in this section and on the drawings, of the miscellaneous equipment and systems listed below, in accordance with UFC 3-301-01 and additional data furnished by the Contracting Officer. Provide seismic protection measures in addition to any other requirements called for in other sections of these specifications. Where there is a conflict between the specifications and the drawings, the specifications will take precedence. Accomplish resistance to lateral forces induced by earthquakes without consideration of friction resulting from gravity loads
.

1.2.2 Miscellaneous Equipment and Systems

Provide bracing and attachment for the following miscellaneous equipment and components developed by the Contractor in accordance with the requirements of this specification:

Equipment/Components with Ip = 1.0
Electrical Distribution Equipment (Panels, Generator, Automatic Transfer Switch)
High Mast Light Pole & Framed support equipment

1.2.3 Contractor Designed Bracing

Submit copies of the design calculations with the drawings. Calculations must be approved, certified, stamped and signed by a registered Professional Structural Engineer. Calculations must verify the capability of structural members to which bracing is attached for carrying the load from the brace. Design the bracing in accordance with UFC 3-301-01, UFC 4-010-01 and additional data furnished by the Contracting Officer. Resistance to lateral forces induced by earthquakes must be accomplished without consideration of friction resulting from gravity loads. UFC 3-301-01 uses parameters for the building, not for the equipment in the building; therefore, corresponding adjustments to the formulas must be required. Loadings determined using UFC 3-301-01 are based on strength design; therefore, AISC 325 Specifications must be used for the design. The bracing for the equipment designated in paragraph 1.2.2 must be developed by the Contractor.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. When shown in this specification, detailed shop drawings for all required equipment, piping and ductwork with calculations certified by a registered structural engineer will be provided. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Resilient Vibration Isolation Devices; G, DO

Equipment Requirements; G, RO

SD-03 Product Data

Equipment Requirements; G, RO

Anchor Bolts; G, RO

Vibration Isolators; G, RO

SD-05 Design Data

Design Calculations; G,DO

SD-06 Test Reports

Anchor Bolts; G, RO

SD-07 Certificates

PART 2 PRODUCTS

2.1 EQUIPMENT REQUIREMENTS

Submit detail drawings of bracing along with calculations, catalog cuts, templates, and erection and installation details, as appropriate, for the items listed in Paragraph 1.2.2. Indicate thickness, type, grade, class of metal, and dimensions; and show construction details, reinforcement, anchorage, and installation with relation to the building construction. Provide calculations and drawings that are stamped by a registered structural engineer, and that verify the capability of structural members to which bracing is attached for carrying the load from the brace. Design must be based on actual equipment and system layout. Design must include calculated dead loads, static seismic loads and capacity of materials utilized for the connection of the equipment or system to the structure. Analysis must detail anchoring methods.

Include drawing for Designated Seismic System Equipment indicating the equipment location in the facility sufficient to be used for the installation. Equipment must be rigidly or flexibly mounted as indicated in the specifications and/or drawings depending on vibration isolation requirements as follows below.

2.1.1 Rigidly Mounted Equipment

Equipment furnished under this contract must be rigidly mounted using cast-in-place anchor bolts to anchor them or post-installed anchors that are qualified for earthquake loading in accordance with ACI 355.2 and ACI 355.4. Anchor bolts must conform to ASTM F1554-07ae1. For any rigid equipment which is rigidly anchored, provide flexible joints for piping, electrical conduit, etc., that are capable of accommodating displacements equal to the full width of the joint in both orthogonal directions. Suspended equipment bracing attachments should be located just above the center of gravity to minimize swinging.

2.1.2 Nonrigid or Flexibly-Mounted Equipment

Select vibration isolation devices so that the maximum movement of equipment from the static deflection point is 1/4 inch. Equipment flexibly mounted on vibration isolators must have a bumper restraint or snubber in each horizontal direction and vertical restraints must be provided where require to resist overturning. Isolator housing and restraints must be constructed of ductile materials. A viscoelastic pad or similar material of appropriate thickness must be used between the bumper and components to limit the impact load. Restraints must be designed to resist the calculated horizontal lateral and vertical forces.

Spring vibration isolators must be seismically rated, restrained isolators for equipment subject to load variations and large external forces. The seismically rated housing must be sized to meet or exceed the force requirements applicable to the project and meet the required isolation criteria. Spring vibration isolator manufacturer's will be a member of VISCMA. Design force, Fp, must be doubled for vibration isolators with an air gap greater than 0.25 inches as specified in ASCE 7, Chapter 13.

2.2 BOLTS AND NUTS

Hex head bolts, and heavy hexagon nuts must be ASTM A325 or ASTM A490 bolts and ASTM A563 nuts. Provide bolts and nuts galvanized in accordance with ASTM A153/A153M when used underground or exposed to weather.

PART 3 EXECUTION

3.1 ANCHOR BOLTS

3.1.1 General

Submit copies of test results to verify the adequacy of the specific anchor and application, as specified.

Ensure housekeeping pads have adequate space to mount equipment and seismic restraint devices allowing adequate edge distance and embedment depth for restraint anchor bolts. If drilled anchors are used, identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not drill holes in concrete until concrete has

achieved full design strength. Install neoprene grommet washers or till the gap with epoxy on equipment anchor bolts where clearance between anchor and equipment support hole exceeds 0.125 inches.

3.1.2 Cast-In-Place

Use templates to locate cast-in-place bolts accurately and securely in formwork. Provide anchor bolts with an embedded straight length equal to at least 12 times nominal diameter of the bolt. Anchor bolts that exceed the normal depth of equipment foundation piers or pads must either extend into concrete floor or the foundation or be increased in depth to accommodate bolt lengths. Use templates to locate cast-in-place bolts accurately and securely in formwork.

3.1.3 Drilled-In Anchor Bolts

Drill holes with rotary impact hammer drills. Drill bits must be of diameters as specified by the anchor manufacturer. Unless otherwise shown on the drawings, all holes must be drilled perpendicular to the concrete surface. Where anchors are permitted to be installed in cored holes, use core bits with matched tolerances as specified by the manufacturer. Properly clean cored hole per manufacturer's instructions. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Exercise care in coring or drilling to avoid damaging existing reinforcing or embedded items. Notify the COR if reinforcing steel or other embedded items are encountered during drilling. Take precautions as necessary to avoid damaging electrical conduit. Unless otherwise specified, do not drill holes in concrete until concretehas achieved full design strength. Perform anchor installation in accordance with manufacturer instructions. For Wedge Anchors, Heavy-Duty Sleeve Anchors, and Undercut Anchors, protect threads from damage during anchor installation. Heavy-duty sleeve anchors must be installed with sleeve fully engaged in part to be fastened. Set anchors to manufacturer's recommended torque, using a torque wrench. Following attainment of 10 percent of the specified torque, 100 percent of the specified torque must be reached within 7 or fewer complete turns of the nut. If the specified torque is not achieved within the required number of turns, the anchor must be removed and replaced unless otherwise directed by the Engineer.

For Cartridge Injection Adhesive Anchors where approved for seismic application, clean all holes per manufacturer instructions to remove loose material and drilling dust prior to installation of adhesive. Inject adhesive into holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive. Follow manufacturer recommendations to ensure proper mixing of adhesive components. Sufficient adhesive must be injected in the hole to ensure that the annular gap is filled to the surface. Remove excess adhesive from the surface. Shim anchors with suitable device to center the anchor in the hole. Do not disturb or load anchors before manufacturer specified cure time has elapsed. For Capsule Anchors where approved for seismic application, perform drilling and setting operations in accordance with manufacturer instructions. Clean all holes to remove loose material and drilling dust prior to installation of adhesive. Remove water from drilled holes in such a manner as to achieve a surface dry condition. Capsule anchors must be installed with equipment conforming to manufacturer recommendations. Do not disturb or load anchors before manufacturer specified cure time has elapsed. Observe manufacturer recommendations with respect to installation temperatures for cartridge injection adhesive anchors and capsule anchors.

3.1.4 Anchor Bolt Testing

Test in place expansion and chemically bonded anchors not more than 24 hours after installation of the anchor, conducted by an independent testing agency; testing must be performed on random anchor bolts as described below.

3.1.4.1 Torque Wrench Testing

Perform torque wrench testing on not less than 50 percent of the total installed expansion anchors and at least one anchor for every piece of equipment containing more than two anchors. The test torque must equal the minimum required installation torque as required by the bolt manufacturer. Calibrate torque wrenches at the beginning of each day the torque tests are performed. Recalibrate torque wrenches for each bolt diameter whenever tests are run on bolts of various diameters. Apply torque between 20 and 100 percent of wrench capacity. Reach the test torque within one half turn of the nut, except for 3/8 inch sleeve anchors which must reach their torque by one quarter turn of the nut. If any anchor fails the test, test similar anchors not previously tested until 20 consecutive anchors pass. Failed anchors must be retightened and retested to the specified torque; if the anchor still fails the test it must be replaced.

3.1.4.2 Pullout Testing

Test expansion and chemically bonded anchors by applying a pullout load using a hydraulic ram attached to the anchor bolt. Testing must be done in accordance with ASTM E488/E488M or ICC-ES AC23. At least 5 percent of the anchors, but not less than 3 per day must be tested. Apply the load to the anchor without removing the nut; when that is not possible, the nut must be removed and a threaded coupler must be installed of the same tightness as the original nut. Check the test setup to verify that the anchor is not restrained from withdrawing by the baseplate, the test fixture, or any other fixtures. The support for the testing apparatus must be at least 1.5 times the embedment length away from the bolt being tested. Load each tested anchor to 1 times the design tension value for the anchor. The anchor must have no observable movement at the test load. If any anchor fails the test, similar anchors not previously tested must be tested until 10 consecutive anchors pass. Failed anchors must be retightened and retested to the specified load; if the anchor still fails the test it must be replaced.

3.2 RESILIENT VIBRATION ISOLATION DEVICES

Where the need for these devices is determined, based on the magnitude of the design seismic forces, select anchor bolts for vibration isolation devices and/or snubbers for equipment base and foundations that follow the same procedure as in paragraph ANCHOR BOLTS, except use an equipment weight equal to five times the actual equipment weight.

3.2.1 Spring-Type Vibration Devices

Select vibration isolation devices so that the maximum movement of equipment from the static deflection point is 1/2 inch. Equipment flexibly mounted on vibration isolators must have a bumper restraint or snubber in each horizontal direction and vertical restraints must be provided where required to resist overturning. Isolator housing and

restraints must be constructed of ductile materials. A viscoelastic pad or similar material of appropriate thickness must be used between the bumper and components to limit the impact load. Restraints must be designed to resist the calculated horizontal lateral and vertical forces.

Spring vibration isolators must be seismically rated, restrained isolators for equipment subject to load variations and large external forces. The seismically rated housing must be sized to meet or exceed the force requirements applicable to the project and meet the required isolation criteria. Spring vibration isolator manufacturers will be a member of VISCMA.

3.3 EQUIPMENT SWAY BRACING

3.3.1 Floor or Pad Mounted Equipment

3.3.1.1 Shear Resistance

Bolt to the floor, floor mounted equipment. Provide the number and installation of bolts to resist shear forces in accordance with paragraph ANCHOR BOLTS.

3.3.1.2 Overturning Resistance

Use the ratio of the overturning moment from seismic forces to the resisting moment due to gravity loads to determine if overturning forces need to be considered in the sizing of anchor bolts. Provide calculations to verify the adequacy of the anchor bolts for combined shear and overturning.

-- End of Section --

SECTION 26 08 00

APPARATUS INSPECTION AND TESTING
11/22

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2025) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

1.2 RELATED REQUIREMENTS

Section 26 20 00 ELECTRICAL DISTRIBUTION SYSTEM applies to this section with additions and modifications specified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Acceptance Tests and Inspections; G, RO

SD-07 Certificates

Qualifications of Organization, and Lead Engineering Technician; G, RO

Acceptance Test and Inspections Procedure; G, RO

1.4 QUALITY ASSURANCE

1.4.1 Qualifications

Engage the services of a qualified testing organization to provide inspection, testing, calibration, and adjustment of the electrical distribution system and generation equipment listed in paragraph ACCEPTANCE TESTS AND INSPECTIONS herein. Organization must be independent of the supplier, manufacturer, and installer of the equipment. The organization must be a first tier subcontractor. No work required by this section of the specification may be performed by a second tier subcontractor.

a. Submit name and qualifications of organization. Organization must have been regularly engaged in the testing of electrical materials, devices, installations, and systems for a minimum of 5 years. The

organization must have a calibration program, and test instruments used must be calibrated in accordance with NETA ATS.

b. Submit name and qualifications of the lead engineering technician performing the required testing services. Include a list of three comparable jobs performed by the technician with specific names and telephone numbers for reference. Testing, inspection, calibration, and adjustments must be performed by an engineering technician, certified by NETA (Level III) or the National Institute for Certification in Engineering Technologies (NICET) with a minimum of 5 years' experience inspecting, testing, and calibrating electrical distribution and generation equipment, systems, and devices.

1.4.2 Acceptance Tests and Inspections Reports

Submit certified copies of inspection reports and test reports. Include certification of compliance with specified requirements, identify deficiencies, and recommend corrective action when appropriate. Type and neatly bind test reports to form a part of the final record. Submit test reports documenting the results of each test not more than 10 days after test is completed.

1.4.3 Acceptance Test and Inspections Procedure

Submit test procedure reports for each item of equipment to be field tested at least 45 days prior to planned testing date. Do not perform testing until after test procedure has been approved.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 ACCEPTANCE TESTS AND INSPECTIONS

Testing organization will perform acceptance tests and inspections. Test methods, procedures, and test values must be performed and evaluated in accordance with NETA ATS, the manufacturer's recommendations, and paragraph FIELD QUALITY CONTROL of each applicable specification section. Tests identified as optional in NETA ATS are not required unless otherwise specified. Place equipment in service only after completion of required tests and evaluation of the test results have been completed. Supply to the testing organization complete sets of shop drawings, settings of adjustable devices, and other information necessary for an accurate test and inspection of the system prior to the performance of any final testing. Notify Contracting Officer at least 14 days in advance of when tests will be conducted by the testing organization. Perform acceptance tests and inspections on applicable equipment and systems specified in the following sections:

a. Section 26 32 15 ENGINE-GENERATOR SET STATIONARY 15-2500 KW, WITH AUXILIARIES. Functional engine shutdown tests, vibration base-line test, and load bank test will not be performed by the testing organization, but by the start-up engineer.

b. Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Medium voltage cables (Airfield Lighting) and grounding systems only.

c. Section 26 36 23 AUTOMATIC TRANSFER SWITCHES AND BY-PASS/ISOLATION SWITCH

3.2 SYSTEM ACCEPTANCE

Final acceptance of the system is contingent upon satisfactory completion of acceptance tests and inspections.

3.3 PLACING EQUIPMENT IN SERVICE

A representative of the approved testing organization must be present when equipment tested by the organization is initially energized and placed in service.

-- End of Section --

SECTION 26 20 00

ELECTRICAL DISTRIBUTION SYSTEM
05/25, CHG 2: 02/26

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B1	(2013) Standard Specification for Hard-Drawn Copper Wire
ASTM B8	(2023) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM D709	(2017) Standard Specification for Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 81	(2025) IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth
IEEE C2	(2023) National Electrical Safety Code
IEEE Stds Dictionary	(2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2025) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION (NECA)

NECA NEIS 1	(2015) Standard for Good Workmanship in Electrical Construction

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C80.1	(2020) American National Standard for Electrical Rigid Steel Conduit (ERSC)
ANSI C80.5	(2020) American National Standard for Electrical Rigid Aluminum Conduit
NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA FU 1	(2012) Low Voltage Cartridge Fuses

NEMA ICS 1	(2022) Standard for Industrial Control and Systems: General Requirements
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures
NEMA KS 1	(2013) Enclosed and Miscellaneous Distribution Equipment Switches (600 V Maximum)
NEMA RN 1	(2018) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 2	(2020) Standard for Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TC 3	(2021) Polyvinyl Chloride (PVC) Fittings for Use With Rigid PVC Conduit and Tubing
NEMA WD 1	(1999; R 2020) Standard for General Color Requirements for Wiring Devices
NEMA WD 6	(2021) Wiring Devices Dimensions Specifications
NEMA Z535.4	(2023) Product Safety Signs and Labels

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2026; TIA 26-1; ERTA 26-1; TIA 26-2; TIA 26-3; TIA 26-4; TIA 26-5; TIA 26-6; TIA 26-7; ERTA 26-2; ERTA 26-3) National Electrical Code
NFPA 70E	(2024) Standard for Electrical Safety in the Workplace
NFPA 780	(2026) Standard for the Installation of Lightning Protection Systems

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910.147	The Control of Hazardous Energy (Lock Out/Tag Out)
29 CFR 1910.303	Electrical, General

UL SOLUTIONS (UL)

UL 1	(2005; Reprint Jan 2022) UL Standard for Safety Flexible Metal Conduit
UL 6	(2022) UL Standard for Safety Electrical Rigid Metal Conduit-Steel
UL 6A	(2008; Reprint Nov 2024) UL Standard for Safety Electrical Rigid Metal Conduit -

	Aluminum, Red Brass, and Stainless Steel
UL 44	(2018; Reprint Oct 2025) UL Standard for Safety Thermoset-Insulated Wires and Cables
UL 50	(2024) UL Standard for Safety Enclosures for Electrical Equipment, Non-Environmental Considerations
UL 67	(2018; Reprint Aug 2025) UL Standard for Safety Panelboards
UL 83	(2017; Reprint Oct 2025) UL Standard for Safety Thermoplastic-Insulated Wires and Cables
UL 248-4	(2010; Reprint Apr 2019) Low-Voltage Fuses - Part 4: Class CC Fuses
UL 248-8	(2011; Reprint Aug 2020) Low-Voltage Fuses - Part 8: Class J Fuses
UL 248-10	(2011; Reprint Aug 2020) Low-Voltage Fuses - Part 10: Class L Fuses
UL 248-12	(2011; Reprint Aug 2020) Low Voltage Fuses - Part 12: Class R Fuses
UL 248-15	(2018) Low-Voltage Fuses - Part 15: Class T Fuses
UL 360	(2025) UL Standard for Safety Liquid-Tight Flexible Metal Conduit
UL 467	(2022) UL Standard for Safety Grounding and Bonding Equipment
UL 486A-486B	(2025) UL Standard for Safety Wire Connectors
UL 486C	(2023; Reprint Feb 2025) UL Standard for Safety Splicing Wire Connectors
UL 489	(2025) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 498	(2017; Reprint Jun 2024) UL Standard for Safety Attachment Plugs and Receptacles
UL 510	(2020; Dec 2022) UL Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 514B	(2012; Reprint Mar 2024) UL Standard for Safety Conduit, Tubing and Cable Fittings
UL 651	(2011; Reprint Jan 2026) UL Standard for Safety Schedule 40, 80, Type EB and A

	Rigid PVC Conduit and Fittings
UL 719	(2025) UL Standard for Safety Nonmetallic-Sheathed Cables
UL 854	(2020; Reprint Jul 2024) Standard for Service-Entrance Cables
UL 869A	(2006; Reprint Jun 2020) Reference Standard for Service Equipment
UL 943	(2016; Reprint Aug 2025) UL Standard for Safety Ground-Fault Circuit-Interrupters
UL 1242	(2025) UL Standard for Safety for Electrical Intermediate Metal Conduit – Steel
UL 1283	(2025) UL Standard for Safety Electromagnetic Interference Filters
UL 1449	(2021; Reprint Oct 2025) UL Standard for Safety Surge Protective Devices
UL 1569	(2018; Reprint Apr 2024) UL Standard for Safety Metal-Clad Cables
UL 1699	(2025) UL Standard for Safety Arc-Fault Circuit-Interrupters
UL 4248-1	(2022; Reprint Jun 2025) UL Standard for Safety Fuseholders - Part 1: General Requirements
UL 4248-12	(2025) UL Standard for Safety Fuseholders - Part 12: Class R

1.2 DEFINITIONS

Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined in IEEE Stds Dictionary.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Panelboards; G, DO

Marking Strips Drawings; G, DO

SD-03 Product Data

Switches; G, RO

Receptacles; G, RO

Circuit Breakers; G, RO

Surge Protective Devices; G, RO

SD-06 Test Reports

600-volt Wiring Test; G, RO

Grounding System Test; G, RO

Ground-fault Receptacle Test; G, RO

SD-07 Certificates

Fuses; G, RO

SD-10 Operation and Maintenance Data

Metering, Data Package 5; G, RO

1.4 QUALITY ASSURANCE

1.4.1 Electrician Qualifications

Electrical work must be performed by qualified persons with verifiable credentials who are familiar with applicable code requirements. Verifiable credentials consist of State, National and Local Certifications or Licenses that a Master or Journeyman Electrician may hold, depending on work being performed.

1.4.2 Fuses

Submit coordination data as specified in paragraph, FUSES of this section.

1.4.3 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Provide equipment, materials, installation, and workmanship in accordance with NFPA 70 unless more stringent requirements are specified or indicated. NECA NEIS 1 is the minimum standard for workmanship.

1.4.4 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship and:

a. Have been in satisfactory commercial or industrial use for 2 years prior to bid opening including applications of equipment and materials under similar circumstances and of similar size.

b. Have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.

c. Where two or more items of the same class of equipment are required, provide products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.4.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 consecutive hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site are not acceptable.

1.5 WARRANTY

Provide equipment items supported by service organizations that are located within 250 miles of the equipment installation in order to render service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.6 SEISMIC REQUIREMENTS

Provide seismic work conforming to Section 13 48 00 SEISMIC CONTROL FOR MISCELLANEOUS EQUIPMENT.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

As a minimum, meet requirements of UL, where UL standards are established for those items, and requirements of NFPA 70 for all materials, equipment, and devices.

2.2 CONDUIT AND FITTINGS

Conform to the following:

2.2.1 Rigid Metallic Conduit

2.2.1.1 Rigid, Threaded Zinc-Coated Steel Conduit

ANSI C80.1, UL 6.

2.2.1.2 Rigid Aluminum Conduit

ANSI C80.5, UL 6A.

2.2.2 Rigid Nonmetallic Conduit

PVC Type EPC-40, and EPC-80 in accordance with NEMA TC 2,UL 651.

2.2.3 Intermediate Metal Conduit (IMC)

UL 1242, zinc-coated steel only.

2.2.4 Plastic-Coated Rigid Steel and IMC Conduit

NEMA RN 1, Type 40 (40 mils thick).

2.2.5 Flexible Metal Conduit

UL 1, limited to 6 feet in areas where not accessible or below a raised floor installation.

2.2.5.1 Liquid-Tight Flexible Metal Conduit, Steel

UL 360, limited to 6 feet in areas where not accessible or below a raised floor installation. The use of flexible metal conduit for bends or transitions in RMC, IMC, or EMT is prohibited.

2.2.6 Fittings for Metal Conduit, EMT, and Flexible Metal Conduit

UL 514B. Ferrous fittings: cadmium- or zinc-coated in accordance with UL 514B.

2.2.6.1 Fittings for Rigid Metal Conduit and IMC

Threaded-type. Split couplings unacceptable.

2.2.7 Fittings for Rigid Nonmetallic Conduit

NEMA TC 3 for PVC, and UL 514B.

2.3 CABINETS, JUNCTION BOXES, AND PULL BOXES

UL 50; volume greater than 100 cubic inches, NEMA Type 1 enclosure; sheet steel, hot-dip, zinc-coated. Where exposed to wet, damp, or corrosive environments, NEMA Type as indicated on drawings.

2.4 WIRES AND CABLES

Provide wires and cables in accordance with applicable requirements of NFPA 70 and UL for type of insulation, jacket, and conductor specified or indicated. Do not use wires and cables manufactured more than 24 months prior to date of delivery to site.

2.4.1 Conductors

Provide the following:

a. Conductor sizes and capacities shown are based on copper, unless indicated otherwise.

b. Conductors No. 8 AWG and larger diameter: stranded.

c. Conductors No. 10 AWG and smaller diameter: solid.

d. Conductors for remote control, alarm, and signal circuits, classes 1, 2, and 3: stranded unless specifically indicated otherwise.

e. All conductors: copper.

2.4.1.1 Minimum Conductor Sizes

Provide minimum conductor size in accordance with the following:

a. Branch circuits: No. 12 AWG.

b. Class 1 remote-control and signal circuits: No. 14 AWG.

c. Class 2 low-energy, remote-control and signal circuits: No. 16 AWG.

d. Class 3 low-energy, remote-control, alarm and signal circuits: No. 22 AWG.

2.4.2 Color Coding

Provide color coding for service, feeder, branch, control, and signaling circuit conductors.

2.4.2.1 Ground and Neutral Conductors

Provide color coding of ground and neutral conductors as follows:

a. Grounding conductors: Green.

b. Neutral conductors: White.

c. Exception, where neutrals of more than one system are installed in same raceway or box, other neutrals color coding: white with a different colored (not green) stripe for each.

2.4.2.2 Ungrounded Conductors

Provide color coding of ungrounded conductors in different voltage systems as follows:

a. 120/240 volt, single phase: Black and red

2.4.3 Insulation

Unless specified or indicated otherwise or required by NFPA 70, provide power and lighting wires rated for 600-volts, Type THWN/THHN conforming to UL 83 or Type XHHW or RHW conforming to UL 44, except that grounding wire may be type TW conforming to UL 83; remote-control and signal circuits: Type TW or TF, conforming to UL 83. Where equipment or devices require 90-degree Centigrade (C) conductors, provide only conductors with 90-degree C insulation or better for all lighting circuits and any 100% circuit breakered circuits.

2.4.4 Bonding Conductors

ASTM B1, solid bare copper wire for sizes No. 8 AWG and smaller diameter; ASTM B8, Class B, stranded bare copper wire for sizes No. 6 AWG and larger diameter.

2.4.5 Service Entrance Cables

Service Entrance (SE) and Underground Service Entrance (USE) Cables, UL 854.

2.4.6 Nonmetallic Sheathed Cable

UL 719, Type NM or NMC.

2.4.7 Metal-Clad Cable

UL 1569; NFPA 70, Type MC cable.

2.4.8 Mineral-Insulated, Metal-Sheathed Cable

UL listed; NFPA 70, Type MI cable. Do not use sheathing containing asbestos fibers.

2.5 SPLICES AND TERMINATION COMPONENTS

UL 486A-486B for wire connectors and UL 510 for insulating tapes. Connectors for No. 10 AWG and smaller diameter wires: insulated, pressure-type in accordance with UL 486A-486B or UL 486C (twist-on splicing connector). Provide solderless terminal lugs on stranded conductors.

The conductor sizes of many circuits have been increased to mitigate voltage drop. Where such size increases exceed the maximium permitted by a given device termination, the conductor size may be reduced to terminate properly in accordance with manufacturer requirements. Where such conductorsize reduction is required, the aggregate length of conductor over the course of the entire circuit that is reduced below the minimum size stated in the contract documents (or as adjusted by actual contractor-furnished equipment) shall not exceed 10'-0". Splice kits, junctions, etc., shall be selected to accomodate the full wire size and a conductor size reduction for such and similar devices shall not be permitted.

2.6 DEVICE PLATES

Provide the following:

a. UL listed, one-piece device plates for outlets to suit the devices installed.

b. For metal outlet boxes, plates on unfinished walls: zinc-coated sheet steel or cast metal having round or beveled edges.

c. For nonmetallic boxes and fittings, other suitable plates may be provided.

d. Screws: machine-type with countersunk heads in color to match finish of plate.

e. Sectional type device plates are not be permitted.

f. Plates installed in wet locations: gasketed and UL listed for "wet locations."

2.7 SWITCHES

2.7.1 Breakers Used as Switches

For 120-, 240 and 277-Volt LED fixtures, mark breakers "SWD" in accordance

with UL 489.

2.7.2 Disconnect Switches

NEMA KS 1. Provide heavy duty-type switches where indicated, where switches are rated higher than 240 volts, and for double-throw switches. Utilize Class R fuseholders and fuses for fused switches, unless indicated otherwise. Provide horsepower rated for switches serving as the motor-disconnect means. Provide switches in NEMA 3R, enclosure or as indicated in accordance with NEMA ICS 6.

2.8 FUSES

NEMA FU 1. Provide complete set of fuses for each fusible switch. Coordinate time-current characteristics curves of fuses serving motors or connected in series with circuit breakers or other circuit protective devices for proper operation. Submit coordination data for approval. Provide fuses with a voltage rating not less than circuit voltage.

2.8.1 Fuseholders

Provide in accordance with UL 4248-1.

2.8.2 Cartridge Fuses, Current Limiting Type (Class R)

UL 248-12, Class time-delay type. Provide only Class R associated fuseholders in accordance with UL 4248-12.

2.8.3 Cartridge Fuses, High-Interrupting Capacity, Current Limiting Type (Classes J, L, and CC)

UL 248-8, UL 248-10, UL 248-4, Class J for zero to 600 amperes, Class L for 601 to 6,000 amperes, and Class CC for zero to 30 amperes.

2.8.4 Cartridge Fuses, Current Limiting Type (Class T)

UL 248-15, Class T for zero to 1,200 amperes, 300 volts; and zero to 800 amperes, 600 volts.

2.9 RECEPTACLES

Provide the following:

a. UL 498, general purpose specification grade, grounding-type. Residential grade receptacles are not acceptable.

b. Ratings and configurations: as indicated.

c. Bodies: brown in accordance with NEMA WD 1.

d. Face and body: thermoplastic supported on a metal mounting strap.

e. Dimensional requirements: in accordance with NEMA WD 6.

f. Screw-type, side-wired wiring terminals. Do not use back-stabbed conductor terminals.

g. Grounding pole connected to mounting strap.

h. The receptacle: containing triple-wipe power contacts and double or triple-wipe ground contacts.

2.9.1 Split Duplex Receptacles

Provide separate terminals for each ungrounded pole. One receptacle must be controlled separately.

2.9.2 Weather Resistant Receptacles

Provide receptacles, UL listed for use in "wet locations" with integral GFCI protection. Include cast metal box with gasketed, hinged, lockable and weather resistant while-in-use, die-cast metal/aluminum extra-duty rated hood.

2.9.3 Ground-Fault Circuit Interrupter Receptacles

UL 943, duplex type for mounting in standard outlet box. Provide device capable of detecting current leak when the current to ground is 6 milliamperes or higher, and tripping in accordance with requirements of UL 943 for Class A ground-fault circuit interrupter devices. Provide screw-type, side-wired wiring terminals or pre-wired (pigtail) leads.

2.9.4 Tamper-Resistant Receptacles

Provide duplex receptacle with mechanical sliding shutters that prevent the insertion of small objects into its contact slots.

2.10 PANELBOARDS

Provide panelboards in accordance with the following:

a. UL 67 and UL 50 having a short-circuit current rating as indicated on the drawings.

b. Panelboards for use as service disconnecting means: additionally conform to UL 869A.

c. Panelboards: circuit breaker-equipped.

d. Designed such that individual breakers can be removed without disturbing adjacent units or without loosening or removing supplemental insulation supplied as means of obtaining clearances as required by UL.

e. "Specific breaker placement" is required in panelboards to match the breaker placement indicated in the panelboard schedule on the design drawings. If it is not possible to match "specific breaker placement" during construction, obtain Government approval prior to device installation.

f. Use of "Subfeed Breakers" is not acceptable.

g. Main breaker: "separately" mounted "above" branch breakers.

h. Where "space only" is indicated, make provisions for future installation of breakers.

i. Directories: indicate load served by each circuit in panelboard.

j. Directories: indicate source of service to panelboard (e.g., Panel PA served from Panel MDP).

k. Provide new directories for existing panels modified by this project as indicated.

l. Type directories and mount in holder behind transparent protective covering.

m. Panelboards: listed and labeled for their intended use.

n. Panelboard nameplates: provided in accordance with paragraph FIELD FABRICATED NAMEPLATES.

2.10.1 Enclosure

Provide panelboard enclosure in accordance with the following:

a. UL 50.

b. Cabinets mounted outdoors or flush-mounted: hot-dipped galvanized after fabrication.

c. Cabinets: painted in accordance with paragraph FIELD APPLIED PAINTING.

d. Outdoor cabinets: NEMA 3R raintight with conduit hubs welded to the cabinet and a removable steel plate 1/4 inch thick in the bottom for field drilling for conduit connections.

e. Front edges of cabinets: form-flanged or fitted with structural shapes welded or riveted to the sheet steel, for supporting the panelboard front.

f. All cabinets: fabricated such that no part of any surface on the finished cabinet deviates from a true plane by more than 1/8 inch.

g. Holes: provided in the back of indoor surface-mounted cabinets, with outside spacers and inside stiffeners, for mounting the cabinets with a 1/2 inch clear space between the back of the cabinet and the wall surface.

h. Flush doors: mounted on hinges that expose only the hinge roll to view when the door is closed.

i. Each door: fitted with a combined catch and lock latch.

j. Keys: two provided with each lock, with all locks keyed alike.

k. Finished-head cap screws: provided for mounting the panelboard fronts on the cabinets.

2.10.2 Panelboard Buses

Support bus bars on bases independent of circuit breakers. Design main buses and back pans so that breakers may be changed without machining, drilling, or tapping. Provide isolated neutral bus in each panel for connection of circuit neutral conductors. Provide separate ground bus identified as equipment grounding bus in accordance with UL 67 for

connecting grounding conductors; bond to steel cabinet. In addition to equipment grounding bus, provide second "isolated" ground bus, where indicated.

2.10.3 Circuit Breakers

UL 489, thermal magnetic-type having a minimum short-circuit current rating equal to the short-circuit current rating of the panelboard in which the circuit breaker will be mounted. Breaker terminals: UL listed as suitable for type of conductor provided. Where indicated on the drawings, provide circuit breakers with shunt trip devices. Series rated circuit breakers and plug-in circuit breakers that do not use a retaining bolt are unacceptable.

2.10.3.1 Multipole Breakers

Provide common trip-type with single operating handle. Design breaker such that overload in one pole automatically causes all poles to open. Maintain phase sequence throughout each panel so that any three adjacent breaker poles are connected to Phases A, B, and C, respectively.

2.10.3.2 Circuit Breaker With Ground-Fault Circuit Interrupter

UL 943 and NFPA 70. Provide with auto-monitoring (self-test) and lockout features, "push-to-test" button, visible indication of tripped condition, and ability to detect and trip when current imbalance is 6 milliamperes or higher in accordance with requirements of UL 943 for Class A ground-fault circuit interrupter devices.

2.10.3.3 Arc-Fault Circuit Interrupters

UL 489, UL 1699 and NFPA 70. Molded case circuit breakers: rated as indicated. Two pole arc-fault circuit-interrupters: rated 120/240 volts. The provision of (two) one pole circuit breakers for shared neutral circuits in lieu of (one) two pole circuit breaker is unacceptable. Provide with "push-to-test" button.

2.11 LOCKOUT REQUIREMENTS

Provide circuit breakers, disconnecting means, and other devices that are electrical energy-isolating capable of being locked out for machines and other equipment to prevent unexpected startup or release of stored energy in accordance with 29 CFR 1910.147, NFPA 70E and 29 CFR 1910.303.

2.12 GROUNDING AND BONDING EQUIPMENT

2.12.1 Ground Rods

UL 467. Ground rods: cone pointed copper-clad steel, with minimum diameter of 3/4 inch and minimum length 10 feet. Sectional type rods may be used for rods 20 feet or longer.

2.12.2 Ground Bus

Copper ground bus: provided in the electrical equipment rooms as indicated.

2.13 NAMEPLATES AND SIGNS

2.13.1 Manufacturer's Nameplate

Provide on each item of equipment a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.13.2 Field Fabricated Nameplates

Provide field fabricated nameplates in accordance with the following:

a. ASTM D709.

b. Provide laminated plastic nameplates for each equipment enclosure, relay, switch, and device; as specified or as indicated on the drawings.

c. Each nameplate inscription: identify the function and, when applicable, the position.

d. Nameplates: melamine plastic, 0.125 inch thick, white with black center core.

e. Provide red laminated plastic label with white center core where indicated.

f. Surface: matte finish. Corners: square. Accurately align lettering and engrave into the core.

g. Minimum size of nameplates: one by 2.5 inches.

h. Lettering size and style: a minimum of 0.25 inch high normal block style.

2.13.3 Warning Signs

Provide warning signs for flash protection in accordance with NFPA 70E and NEMA Z535.4 for switchboards, panelboards, industrial control panels, and motor control centers that are in other than dwelling occupancies and are likely to require examination, adjustment, servicing, or maintenance while energized. Provide field installed signs to warn qualified persons of potential electric arc flash hazards when warning signs are not provided by the manufacturer. Provide marking that is clearly visible to qualified persons before examination, adjustment, servicing, or maintenance of the equipment.

2.14 METERING

Provide a new meter as per attachment 26 20 00 Attachment 1 - AMRS Meter Specification. Provide and install two (2) single RJ45 port, media converters, one at each end of the fiber communication line from the new meter to the location shown on the drawings. Media converters cannot be selectable or dual mode.

2.15 SURGE PROTECTIVE DEVICES

Provide parallel type surge protective devices (SPD) which comply with

UL 1449 at the service entrance and panelboards. Provide surge protectors in a NEMA 4 enclosure in accordance with NEMA ICS 6. Do not install SPD inside a panelboard or switchboard enclosure. Use Type 1 or Type 2 SPD and connect on the load side of a dedicated circuit breaker. Submit performance and characteristic curves.

Provide the following modes of protection:

FOR SINGLE PHASE AND THREE PHASE WYE CONNECTED SYSTEMS-

Phase to phase (L-L)

Each phase to neutral (L-N)

SPDs at the service entrance: provide with a minimum surge current rating of 80,000 amperes for L-L mode minimum and 40,000 amperes for other modes (L-N, L-G, and N-G) and downstream SPDs rated 40,000 amperes for L-L mode minimum and 20,000 amperes for other modes (L-N, L-G, and N-G).

Provide SPDs in accordance with NFPA 780 for the lightning protection system.

Maximum L-N, L-G, and N-G Voltage Protection Rating:

1,000V for 120/240V, single phase system

Maximum L-L Voltage Protection Rating:

1,200V for 120/240V, three phase system

The minimum MCOV (Maximum Continuous Operating Voltage) rating for L-N and L-G modes of operation: 120 percent of nominal voltage for 240 volts and below; 115 percent of nominal voltage above 240 volts to 480 volts.

Provide EMI/RFI filtering in accordance with UL 1283 for each mode with the capability to attenuate high frequency noise. Minimum attenuation: 20db.

2.15.1 Warranty

Provide not less than a 5-year warranty and include unlimited free replacements of the unit if destroyed by lightning or other transients during the warranty period.

2.16 FACTORY APPLIED FINISH

Provide factory-applied finish on electrical equipment in accordance with the following:

a. NEMA 250 corrosion-resistance test and the additional requirements as specified herein.

b. Interior and exterior steel surfaces of equipment enclosures: thoroughly cleaned followed by a rust-inhibitive phosphatizing or equivalent treatment prior to painting.

c. Exterior surfaces: free from holes, seams, dents, weld marks, loose scale or other imperfections.

d. Interior surfaces: receive not less than one coat of corrosion-resisting paint in accordance with the manufacturer's standard practice.

e. Exterior surfaces: primed, filled where necessary, and given not less than two coats baked enamel with semigloss finish.

f. Equipment located indoors: ANSI Light Gray, and equipment located outdoors: ANSI Dark Gray.

g. Provide manufacturer's coatings for touch-up work and as specified in paragraph FIELD APPLIED PAINTING.

PART 3 EXECUTION

3.1 INSTALLATION

Electrical installations, including weatherproof and hazardous locations and ducts, plenums and other air-handling spaces: conform to requirements of NFPA 70 and IEEE C2 and to requirements specified herein.

3.1.1 Underground Service

Underground service conductors and associated conduit: continuous from service entrance equipment to outdoor power system connection.

3.1.2 Service Entrance Identification

Service entrance disconnect devices, switches, and enclosures: labeled and identified as such.

3.1.2.1 Labels

Wherever work results in service entrance disconnect devices in more than one enclosure, as permitted by NFPA 70, label each enclosure, new and existing, as one of several enclosures containing service entrance disconnect devices. Label, at minimum: indicate number of service disconnect devices housed by enclosure and indicate total number of enclosures that contain service disconnect devices. Provide laminated plastic labels conforming to paragraph FIELD FABRICATED NAMEPLATES. Use lettering of at least 0.25 inch in height, and engrave on black-on-white matte finish. Service entrance disconnect devices in more than one enclosure: provided only as permitted by NFPA 70.

3.1.3 Wiring Methods

Provide insulated conductors installed in rigid steel conduit, IMC, rigid nonmetallic conduit, or EMT, except where specifically indicated or specified otherwise or required by NFPA 70 to be installed otherwise. Grounding conductor: separate from electrical system neutral conductor. Provide insulated green equipment grounding conductor for circuit(s) installed in conduit and raceways. Shared neutral, or multi-wire branch circuits, are not permitted with arc-fault circuit interrupters. Minimum conduit size: 1/2 inch in diameter for low voltage lighting and power circuits. Vertical distribution in multiple story buildings: made with metal conduit in fire-rated shafts, with metal conduit extending through shafts for minimum distance of 6 inches.

3.1.3.1 Pull Wire

Install pull wires in empty conduits. Pull wire: plastic having minimum 200-pound force tensile strength. Leave minimum 36 inches of slack at each end of pull wire.

3.1.3.2 Metal-Clad Cable

Install in accordance with NFPA 70, Type MC cable.

3.1.4 Conduit Installation

Unless indicated otherwise, conceal conduit under floor slabs and within finished walls, ceilings, and floors. Keep conduit minimum 6 inches away from parallel runs of flues and steam or hot water pipes. Install conduit parallel with or at right angles to ceilings, walls, and structural members where located above accessible ceilings and where conduit will be visible after completion of project.

3.1.4.1 Restrictions Applicable to Aluminum Conduit

a. Do not install underground or encase in concrete or masonry.

b. Do not use brass or bronze fittings.

c. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.4.2 Restrictions Applicable to Nonmetallic Conduit

a. PVC Schedule 40.

(1) Do not use where subject to physical damage, including but not limited to, mechanical equipment rooms, electrical equipment rooms, fire pump rooms, and where restrictions are applying to both PVC Schedule 40 and PVC Schedule 80.

(2) Do not use above grade, except where allowed in this section for rising through floor slab or indicated otherwise.

b. PVC Schedule 80.

(1) Do not use where subject to physical damage, including but not limited to, hospitals, power plant, missile magazines, and other such areas.

(2) Do not use in hazardous (classified) areas.

(3) Do not use in penetrating fire-rated walls or partitions, or fire-rated floors.

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3.1.4.3 Restrictions Applicable to Flexible Conduit

Use only as specified in paragraph FLEXIBLE CONNECTIONS. Do not use when the enclosed conductors must be shielded from the effects of High-altitude Electromagnetic Pulse (HEMP).

3.1.4.4 Underground Conduit

Plastic-coated rigid steel; plastic-coated steel IMC; PVC, Type EPC-40 Plastic coating: extend minimum 6 inches above floor.

3.1.4.5 Stub-Ups

Provide conduits stubbed up through grade/pavement for connection to free-standing equipment with adjustable top or coupling threaded inside for plugs, set flush with finished grade/pavement. Extend conductors to equipment in rigid steel conduit, except that flexible metal conduit may be used 6 inches above floor. Where no equipment connections are made, install screwdriver-operated threaded flush plugs in conduit end.

3.1.4.6 Conduit Support

Support conduit by pipe straps, wall brackets, threaded rod conduit hangers, or ceiling trapeze. Plastic cable ties are not acceptable. Fasten by wood screws to wood; by toggle bolts on hollow masonry units; by concrete inserts or expansion bolts on concrete or brick; and by machine screws, welded threaded studs, or spring-tension clamps on steel work. Threaded C-clamps may be used on rigid steel conduit only. Do not weld conduits or pipe straps to steel structures. Do not exceed one-fourth proof test load for load applied to fasteners. Provide vibration resistant and shock-resistant fasteners attached to concrete ceiling. Do not cut main reinforcing bars for any holes cut to depth of more than 1 1/2 inches in reinforced concrete beams or to depth of more than 3/4 inch in concrete joints. Fill unused holes. In partitions of light steel construction, use sheet metal screws. In suspended-ceiling construction, run conduit above ceiling. Do not support conduit by ceiling support system. Conduit and box systems: supported independently of both (a) tie wires supporting ceiling grid system, and (b) ceiling grid system into which ceiling panels are placed. Do not share supporting means between electrical raceways and mechanical piping or ducts. Identify independent conduit support in both fire and non-fire rated assemblies in accordance with NFPA 70. Coordinate installation with above-ceiling mechanical systems to assure maximum accessibility to all systems. Spring-steel fasteners may be used for lighting branch circuit conduit supports in suspended ceilings in dry locations. Where conduit crosses building expansion joints, provide suitable watertight expansion fitting that maintains conduit electrical continuity by bonding jumpers or other means. For conduits greater than 2 1/2 inches inside diameter, provide supports to resist forces of 0.5 times the equipment weight in any direction and 1.5 times the equipment weight in the downward direction.

3.1.4.7 Directional Changes in Conduit Runs

Make changes in direction of runs with symmetrical bends or cast-metal fittings. Make field-made bends and offsets with hickey or conduit-bending machine. Do not install crushed or deformed conduits. Avoid trapped conduits. Prevent plaster, dirt, or trash from lodging in conduits, boxes, fittings, and equipment during construction. Free clogged conduits of obstructions.

3.1.4.8 Locknuts and Bushings

Fasten conduits to sheet metal boxes and cabinets with two locknuts where required by NFPA 70, where insulated bushings are used, and where bushings cannot be brought into firm contact with the box; otherwise, use at least

minimum single locknut and bushing. Provide locknuts with sharp edges for digging into wall of metal enclosures. Install bushings on ends of conduits, and provide insulating type where required by NFPA 70.

3.1.4.9 Flexible Connections

Provide flexible steel conduit between 3 and 6 feet in length for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement. Install flexible conduit to allow 20 percent slack. Minimum flexible steel conduit size: 1/2 inch diameter. Provide liquid tight flexible conduit in wet and damp locations for equipment subject to vibration, noise transmission, movement or motors. Provide separate ground conductor across flexible connections. Plastic cable ties are not acceptable as a support method.

3.1.5 Boxes, Outlets, and Supports

Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures. Boxes for metallic raceways: cast-metal, hub-type when located in wet locations, when surface mounted on outside of exterior surfaces, and when specifically indicated. Boxes in other locations: sheet steel, except that aluminum boxes may be used with aluminum conduit, and nonmetallic boxes may be used with nonmetallic conduit system. Provide each box with volume required by NFPA 70 for number of conductors enclosed in box. Boxes for mounting lighting fixtures: minimum 4 inches square, or octagonal, except that smaller boxes may be installed as required by fixture configurations, as approved. Boxes for use in masonry-block or tile walls: square-cornered, tile-type, or standard boxes having square-cornered, tile-type covers. Provide gaskets for cast-metal boxes installed in wet locations and boxes installed flush with outside of exterior surfaces. Provide separate boxes for flush or recessed fixtures when required by fixture terminal operating temperature; provide readily removable fixtures for access to boxes unless ceiling access panels are provided. Support boxes and pendants for surface-mounted fixtures on suspended ceilings independently of ceiling supports. Fasten boxes and supports with wood screws on wood, with bolts and expansion shields on concrete or brick, with toggle bolts on hollow masonry units, and with machine screws or welded studs on steel. In open overhead spaces, cast boxes threaded to raceways need not be separately supported except where used for fixture support; support sheet metal boxes directly from building structure or by bar hangers. Where bar hangers are used, attach bar to raceways on opposite sides of box, and support raceway with approved-type fastener maximum 24 inches from box. When penetrating reinforced concrete members, avoid cutting reinforcing steel.

3.1.5.1 Boxes

Boxes for use with raceway systems: minimum 1 1/2 inches deep, except where shallower boxes required by structural conditions are approved. Boxes for other than lighting fixture outlets: minimum 4 inches square, except that 4 by 2 inch boxes may be used where only one raceway enters outlet.

3.1.5.2 Pull Boxes

Construct of at least minimum size required by NFPA 70 of code-gauge aluminum or galvanized sheet steel,and compatible with nonmetallic raceway systems, except where cast-metal boxes are required in locations specified

herein. Provide boxes with screw-fastened covers. Where several feeders pass through common pull box, tag feeders to indicate clearly electrical characteristics, circuit number, and panel designation.

3.1.6 Mounting Heights

Mount panelboards, circuit breakers, and disconnecting switches so height of center of grip of the operating handle of the switch or circuit breaker at its highest position is maximum 79 inches above grade/pavement. Mount lighting switches 48 inches above finished grade/pavement. Mount receptacles 18 inches above finished grade/pavement.

3.1.7 Conductor Identification

Provide conductor identification within each enclosure where tap, splice, or termination is made. For conductors No. 6 AWG and smaller diameter, provide color coding by factory-applied, color-impregnated insulation. For conductors No. 4 AWG and larger diameter, provide color coding by plastic-coated, self-sticking markers; colored nylon cable ties and plates; or heat shrink-type sleeves. Identify control circuit terminations in accordance with manufacturer's recommendations.

3.1.7.1 Marking Strips

Provide marking strips for identification of power distribution, control, data, and communications cables in accordance with the following:

a. Provide white or other light-colored plastic marking strips, fastened by screws to each terminal block, for wire designations.

b. Use permanent ink for the wire numbers

c. Provide reversible marking strips to permit marking both sides, or provide two marking strips with each block.

d. Size marking strips to accommodate the two sets of wire numbers.

e. Assign a device designation in accordance with NEMA ICS 1 to each device to which a connection is made. Mark each device terminal to which a connection is made with a distinct terminal marking corresponding to the wire designation used on the Contractor's schematic and connection diagrams.

f. The wire (terminal point) designations used on the Contractor's wiring diagrams and printed on terminal block marking strips may be according to the Contractor's standard practice; however, provide additional wire and cable designations for identification of remote (external) circuits for the Government's wire designations.

g. Prints of the marking strips drawings submitted for approval will be so marked and returned to the Contractor for addition of the designations to the terminal strips and tracings, along with any rearrangement of points required.

3.1.8 Splices

Make splices in accessible locations. Make splices in conductors No. 10 AWG and smaller diameter with insulated, pressure-type connector. Make splices in conductors No. 8 AWG and larger diameter with solderless

connector, and cover with insulation material equivalent to conductor insulation.

3.1.9 Grounding and Bonding

Provide in accordance with NFPA 70 and NFPA 780. Ground exposed, non-current-carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductor in metallic and nonmetallic raceways, telecommunications system grounds, grounding conductor of nonmetallic sheathed cables, and neutral conductor of wiring systems. Make ground connection at main service equipment, and extend grounding conductor to point of entrance of metallic water service. Make connection to water pipe by suitable ground clamp or lug connection to plugged tee. If flanged pipes are encountered, make connection with lug bolted to street side of flanged connection. Supplement metallic water service grounding system with additional made electrode in compliance with NFPA 70. Make ground connection to driven ground rods as indicated on drawings. Bond additional driven rods together with a minimum of 4 AWG soft bare copper wire buried to a depth of at least 12 inches. Where ground fault protection is employed, ensure that connection of ground and neutral does not interfere with correct operation of fault protection.

3.1.9.1 Ground Rods

Provide ground rods and measure the resistance to ground using the fall-of-potential method described in IEEE 81. Do not exceed 25 ohms under normally dry conditions for the maximum resistance of a driven ground. If this resistance cannot be obtained, provide additional rods, spaced on center. Spacing for additional rods must be a minimum of 10 feet. In high-ground-resistance, UL listed chemically charged ground rods may be used. If the resultant resistance exceeds 25 ohms measured not less than 48 hours after rainfall, notify the Contracting Officer who will decide on the number of ground rods to add.

3.1.9.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, excepting specifically those connections for which access for periodic testing is required, by exothermic weld or high compression connector.

a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.

b. Make high compression connections using a hydraulic or electric compression tool to provide the correct circumferential pressure. Provide tools and dies as recommended by the manufacturer. Use an embossing die code or other standard method to provide visible indication that a connector has been adequately compressed on the ground wire.

3.1.9.3 Ground Bus

Provide a copper ground bus in the electrical equipment rooms as indicated. Noncurrent-carrying metal parts of electrical equipment: effectively grounded by bonding to the ground bus. Bond the ground bus to

both the entrance ground, and to a ground rod or rods as specified above having the upper ends terminating approximately 4 inches above the floor. Make connections and splices of the brazed, welded, bolted, or pressure-connector type, except use pressure connectors or bolted connections for connections to removable equipment.

3.1.9.4 Resistance

Maximum resistance-to-ground of grounding system: do not exceed 5 ohms under dry conditions. Where resistance obtained exceeds 5 ohms, contact Contracting Officer for further instructions.

3.1.10 Repair of Existing Work

Perform repair of existing work, demolition, and modification of existing electrical distribution systems as follows:

3.1.10.1 Workmanship

Lay out work in advance. Exercise care where cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, or other surfaces is necessary for proper installation, support, or anchorage of conduit, raceways, or other electrical work. Repair damage to buildings, piping, and equipment using skilled craftsmen of trades involved.

3.1.10.2 Removal of Existing Electrical Distribution System

Removal of existing electrical distribution system equipment includes equipment's associated wiring, including conductors, cables, exposed conduit, surface metal raceways, boxes, and fittings, back to equipment's power source as indicated.

3.1.10.3 Continuation of Service

Maintain continuity of existing circuits of equipment to remain. Maintain existing circuits of equipment energized. Restore circuits wiring and power which are to remain but were disturbed during demolition back to original condition.

3.1.11 Watthour Meters

Watthour meters shall be installed and tested as per 26 20 00 Attachment 1 - AMRS Meter Specification and 26 20 00 Attachment 2 - AMRS Meter Pre-Functional Checklist.

3.1.12 Surge Protective Devices

Connect the surge protective devices in parallel to the power source, keeping the conductors as short and straight as practically possible. Maximum allowed lead length is 3 feet avoiding 90 degree bends. Do not locate surge protective devices inside a panelboard or switchboard enclosure.

3.2 FIELD FABRICATED NAMEPLATE MOUNTING

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets. Provide nameplate on all equipment in access controlled spaces and areas.

3.3 WARNING SIGN MOUNTING

Provide the number of signs required to be readable from each accessible side. Space the signs in accordance with NFPA 70E.

3.4 FIELD APPLIED PAINTING

Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Where field painting of enclosures for panelboards, load centers or the like is specified to match adjacent surfaces, to correct damage to the manufacturer's factory applied coatings, or to meet the indicated or specified safety criteria, provide manufacturer's recommended coatings and apply in accordance to manufacturer's instructions.

3.5 FIELD QUALITY CONTROL

Furnish test equipment and personnel and submit written copies of test results. Give Contracting Officer 5 working days notice prior to each test. Where applicable, test electrical equipment in accordance with NETA ATS.

3.5.1 Devices Subject to Manual Operation

Operate each device subject to manual operation at least five times, demonstrating satisfactory operation each time.

3.5.2 600-Volt Wiring Test

Test wiring rated 600 volt and less to verify that no short circuits or accidental grounds exist. Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of 1,000 volts DC for 600 volt rated wiring and 500 volts DC for 300 volt rated wiring in accordance with NETA ATS to provide direct reading of resistance. All existing wiring to be reused must also be tested.

3.5.3 Ground-Fault Receptacle Test

Test ground-fault receptacles with a "load" (such as a plug in light) to verify that the "line" and "load" leads are not reversed. Press the TEST button and then the RESET button to verify by LED status that the device is a self-test model as specified in UL 943.

3.5.4 Grounding System Test

Test grounding system to ensure continuity, and that resistance to ground is not excessive. Test each ground rod for resistance to ground before making connections to rod; tie grounding system together and test for resistance to ground. Make resistance measurements in dry weather, not earlier than 48 hours after rainfall. Submit written results of each test to Contracting Officer, and indicate location of rods as well as resistance and soil conditions at time measurements were made.

3.5.5 Watthour Meter

a. Visual and mechanical inspection

(1) Examine for broken parts, shipping damage, and tightness of

connections.

(2) Verify that meter type, scales, and connections are in accordance with approved shop drawings.

b. Electrical tests

(1) Determine accuracy of meter.

(2) Calibrate watthour meters to one-half percent.

(3) Verify that correct multiplier has been placed on face of meter, where applicable.

-- End of Section --

Figure 3 – AMRS Meter Specifications

AMRS Electric Meter Specifications

The AMRS Compliant Electric Meter shall meet Department of Defense cybersecurity standards as well as the following requirements:

- Electric meters shall meet or exceed the ANSI C12.1-2022, 0.2 accuracy class standard
- Current transformers (CTs) shall meet or exceed the accuracy class of their associated electrical meter
- Onboard memory
- Onboard Ethernet communications, 10/100 base with RJ45 connector or receptacle
- Modbus/TCP communication protocol
- Front display with ability to display all measured values
- Minimum of one (1) external RS485 serial communications port
- Minimum of two inputs that shall count pulses from other devices
- Electric meter enclosure shall be designed and constructed in accordance with UL508A to ensure safety and reduce the risk of electrical hazard
- The assembler of the electric meter enclosure must be ISO 9000 certified
- Electric meter enclosure shall include a UL-label on interior door
- Electric meter and enclosure when combined shall contain:
  - Stand-alone step-down transformer compatible with the system voltage that is being monitored, with a secondary voltage of 95-120v
  - 24V – 30W DC stand-alone DC power supply for external devices
  - Input/output terminal blocks

AMRS Compliant Meter List

The following list of meters were evaluated, meet the AMRS meter specification and function within the AMRS platform. All networked devices, their integrated firmware and software will be approved by the PMO for use in the AMRS. PMO approval is contingent upon the device, in its fielded configuration, passing USAF cyber and AMRS compatibility testing.

- Schneider Electric PM8000
- Schneider Electric ION 8650
- Schneider Electric ION 9000
- Schneider Electric ION 9000T
- Siemens 9410
- Siemens 9810
- Schneider Electric PM5560 (no new AMRS funded installs; host bases may fund new installs if they deem appropriate)
- Schneider Electric ION 8600 (currently connected to AMRS only, no new installs)
- Electro Industries Nexus 1272 (currently connected to AMRS only, no new installs)
- Electro Industries Nexus 1262 (currently connected to AMRS only, no new installs)
- Schneider Electric PM800 (currently connected to AMRS only, no new installs)
- Veris Hawkeye 8100 series (currently connected to AMRS only, no new installs)

Meter Installation Guidelines

- Contractor shall assume all existing equipment is working properly. If, during the post award survey portion of the SOW, an existing piece of equipment is found to be malfunctioning, then the contractor shall bring it to the government's attention via the submittal of an RFI to determine how to proceed. This may require a contract change to delete this meter from the scope or to add a new meter.
- All due diligence to survey the existing site conditions is the responsibility of the contractor.
- New electric meter enclosures shall be installed in interior locations, located 5 feet above finished floor level, and as close to the main distribution panel as possible.
- All metering device labels shall be white on black phenolic no smaller than 1" x 3"
- New meter installations shall include the installation of new, properly sized, split or solid core CTs as deemed to physically fit upon inspection by the contractor. It is part of due diligence of the contractor to design and install appropriately sized CTs into the space offered within the system. Rope-style or Rogowski CTs are not authorized.
- Existing nonfunctional CTs are to be removed if possible. If removal is not possible, existing nonfunctional CTs must be shorted out.
- If CT or voltage tap installation method includes disturbing the bonds of existing cables or wiring within the gear, before and after IR scans shall be performed before removing and after torquing the connections to ensure the integrity of the conductor bonds.
- CTs shall be insulated. It is the responsibility of the contractor to design and install CTs of the appropriate amperage and size to accommodate the full load of existing gear. If the contractor intends to size the CTs from the breaker size, rather than the gear size, a RFI must be submitted requesting review and approval of said deviation.
- Meter enclosures shall include fused, finger safe voltage disconnects and CT shorting blocks. Instructions explaining how to operate the CT shorting blocks must be visible inside each meter enclosure.
- The meter must not require utility outages for servicing.
- The CT shorting block ground wires must be installed on the load side.
- Meters shall have control power regardless of breaker position.
- All meter enclosures shall be fed by a load break 3-pole fusible disconnect switch that is external of the meter assembly. This safety disconnect switch shall be marked as follows "Meter Disconnect NOT Service Equipment" and any additional NEC labeling requirements.
- New electric meter supply voltages shall be acquired by means of voltage taps from the bus or system breakers for the voltage system that the AMRS meter is monitoring.
- Insulation piercing connectors are not an approved method and energized electrical work will not be permitted.
- Electric meters with connected gas or water meter inputs shall have two internal registers configured - one for a raw pulse count and one for a weighted pulse count based on the scaling of the connected gas or water meter. It is the responsibility of the contractor to ensure that scaling ratios configured into the electric meter/device are accurate.

- All new communications equipment and metering devices are required to be enclosed in a lockable NEMA 4 or NEMA 4X enclosure. No other enclosure types are approvable for this project regardless of installation location.
- Communications equipment must be installed in a separate enclosure than the meter enclosure.
- Communication equipment and metering equipment should never be installed in an exterior location. In the event the contractor would like the government to consider communications equipment and/or a metering device to be located in an exterior location, a RFI must be submitted for review. If approved, the exterior meter enclosure must be a lockable NEMA 4X, stainless steel enclosure with panel that can completely cover the face of the meter and protect it from all environmental elements.

Cabling Installation Guidelines

- New meter installations shall be connected via CAT6 cable from the meter to a wall outlet in the electrical room, to a patch panel in the communications room, and then to the AFnet switch in the communications room (base communication squadron will make the last connection to the AFnet switch).
- All CAT6 cable runs must be continuous from the wall outlet to the patch panel with no intermediate patches or cross connects and are not to exceed 328 linear feet including patch cords.
- The contractor shall verify the CAT6 cable termination standard, T568A or T568B, with the base comm squadron prior to cable installation.
- Required technical approach to network communication cabling more than 328 feet is: fiber optic cable and fiber media converters with lockable enclosures and dedicated power outlets.
- When fiber is required, a minimum of two (2) strands are required per device connection.
- TIAA compliant fiber media converter shall be installed in the communications room as close as possible to the network switch and as close as possible to the electric meter enclosure.
- All cabling not installed above ceilings or behind walls shall be protected by conduit
- Communication receptacles accessible to the general public must be installed in lockable enclosures.
- Cable labels shall be permanent, wrap-around and self-laminating with text generated by a mechanical device. Labels shall be applied at both ends of the cable, visible during normal maintenance of the infrastructure and resistant to environmental conditions.
- All data cable test results (including fiber) shall be completed only after the cable has been terminated in its permanent location, temporary cable test results will not be accepted.
- Surge protection is required on all communication cabling extending from the exterior to the interior of a facility. This includes gas and water meter communication cables from the exterior to the interior of the building.
- Surge suppression devices shall be installed w/in 3 feet of the building entrance inside the facility. Devices shall be easily accessible and labeled to aide in location during future troubleshooting efforts.

- Surge protection devices shall be Power over Ethernet (PoE) compatible and housed within a lockable enclosure that allows space for a proper cable bend radius.
- Fiber optic cable strands shall be terminated on patch panel bulkheads or within a fiber optic wall outlet assembly; unsecured connectors are not acceptable.
- Fiber optic cable runs must use continuous fiber with no intermediate patches or cross connects and must not use mechanical splices or end terminations; all splices and terminations shall be fusion spliced.

Wireless Communication

- As a general rule, wired communication utilizing the base network is preferred due to life cycle costs and ability to move data. Only by exception should wireless be considered for connecting of devices to the base network.
- Any wireless communication protocol is considered sub-optimal. Wireless systems have proven to be cost prohibitive when trying to secure accreditation as well as long term sustainment. Any wireless communication for metering must meet all criteria in the AF Guidance Memo on CE Controls and be part of the AMRS ATO. In addition, any wireless communication must be approved by that installation's frequency manager.
- Wireless systems will need to comply with requirement for controls and be able to operate in an islanded installation. Collapse of systems or disconnecting wireless communication protocols shall also be part of an incident response plan for the specific devices on each base.

AMRS Compatible Gas Meter Specifications

AMRS compatible gas metering solutions rely on accurately scaled output pulses, properly sized components according to peak demand, and peak pulse rates to eliminate the risk of saturating the receiving device ensuring the loss-less delivery of accurate gas pulse data into the AMRS system. The due diligence of the contractor shall be to coordinate with the appropriate base personnel to obtain all necessary information to effectively design and build a system that satisfies these requirements and conforms to the following specifications:

- Pulse kit must be able to produce a two-wire (Form A) pulse output via exterior rated RS485 cable in conduit
- Gas meter or attached pulse kit must include a visual register or dial
- All new gas meter assemblies shall include upstream gasket strainers
- All meter labels shall be white on black phenolic
- All cabling not installed above ceilings or behind walls shall be protected by conduit

AMRS Compatible Water Meter Specifications

AMRS compatible water metering solutions rely on accurately scaled output pulses, properly sized components according to peak demand, and peak pulse rates to eliminate the risk of saturating the receiving device ensuring the loss-less delivery of accurate water pulse data into the AMRS system. The due diligence of the contractor shall be to coordinate with the appropriate base personnel to obtain all necessary information to effectively design and build a system that satisfies these requirements and conforms to the following specifications:

- Pulse kit must be able to produce a two-wire (Form A) pulse output via RS485 cable
- Water meter or attached pulse kit must include a visual register or dial
- All new water meter assemblies shall include upstream bronze wye strainers
- All meter labels shall be white on black phenolic
- All cabling not installed above ceilings or behind walls shall be protected by conduit

AMRS Compatible Translation Devices and Accumulators

The following devices are compatible with the AMRS platform, have been tested and passed cybersecurity requirements. Please note that they will only be approved for use on a case-by-case basis when dictated by unique existing site conditions. Translation devices and accumulators require lockable enclosures and dedicated power outlets.

- Schneider Electric PAS600L EcoStruxure Panel Server
- Schneider Electric Link 150 Ethernet Gateway (End-of-Life item; no new installs)
- Schneider Electric ComX 210 Data Logger (End-of-Life item; no new installs)
- Perle SDS1P Device Server (currently connected to AMRS only, no new installs)
- Perle IOLAN DS1 (currently connected to AMRS only, no new installs)
- Advantec ADAM-6060 I/O Module (currently connected to AMRS only, no new installs)
- Advantec ADAM-6051 CE Version (currently connected to AMRS only, no new installs)

Pre-Functional Checklist for New, Replaced & Repaired AMRS Meters

1. Confirm IP address and Gateway are correctly programmed in the electric meter.
2. Record MAC address of the electric meter (to be provided to Comm Squadron)
3. Verify consumption is displayed in kWh.
4. Monitor meter kWh reading. Make sure it is going up.
5. View kWh# of digits displayed (should be 9 to the left of the decimal).
6. View display screen sequence, time delay and screens shown.
7. CT location. Physically view the CTs and where they are located and what wires they are on.
    a. Verify where building is electrically fed from.
    b. Verify that no building electrical connections are ahead of the CTs.
    c. Verify CTs are oriented correctly (Arrow correctly pointing "To Load" or "From Supply")
8. View CT ratio printed on CTs.
9. Confirm CT ratio is correctly programmed into electric meter.
10. Confirm all other settings in the meter are correct (voltage, frequency,# of phases, etc.)
11. Confirm CAT6 cable is connected to meter.
12. Verify CAT6 cable has been run to the communications closet or switch.
    a. If an AFnet switch is present, the CAT6 cable should be plugged into an open port.
13. Verify CAT6 cable is good on all pairs and terminated properly.
    a. If an AFnet switch is present, verify meter can communicate with switch.
14. Verify CAT6 cable is labeled as "AMRS Meter" on the end at the communications closet or switch.
15. Verify Meter Circuit Breaker is labeled as "AMRS Meter".
16. Verify meter is programmed with the proper name.
17. Verify gas meter connection to electric meter.
18. Verify gas meter pulse ratio in electric meter.
19. View gas meter readout/display and units.
20. Verify water meter connection to electric meter.
21. Verify water meter pulse ratio in electric meter.
22. View water meter readout/display and units.

SECTION 26 32 15

ENGINE-GENERATOR SET STATIONARY 15-2500 KW, WITH AUXILIARIES
02/26

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B16.3	(2021) Malleable Iron Threaded Fittings, Classes 150 and 300
ASME B16.5	(2020) Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.11	(2021) Forged Fittings, Socket-Welding and Threaded
ASME B16.21	(2021) Nonmetallic Flat Gaskets for Pipe Flanges
ASME B31.1	(2024) Power Piping
ASME B31.3	(2024) Process Piping
ASME BPVC SEC IX	(2017; Errata 2018) BPVC Section IX-Welding, Brazing and Fusing Qualifications
ASME BPVC SEC VIII D1	(2023) BPVC Section VIII-Rules for Construction of Pressure Vessels Division 1

ASTM INTERNATIONAL (ASTM)

ASTM A53/A53M	(2024) Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
ASTM A106/A106M	(2019a) Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service
ASTM A181/A181M	(2023) Standard Specification for Carbon Steel Forgings, for General-Purpose Piping
ASTM A193/A193M	(2025) Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service and Other Special Purpose Applications
ASTM A194/A194M	(2024) Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel

	Nuts for Bolts for High-Pressure or High-Temperature Service, or Both
ASTM A234/A234M	(2025) Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service
ASTM D975	(2020) Standard Specification for Diesel Fuel Oils

ELECTRICAL GENERATING SYSTEMS ASSOCIATION (EGSA)

EGSA 101P	(1995) Performance Standard for Engine Driven Generator Sets

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 1	(2000; R 2011) General Principles for Temperature Limits in the Rating of Electric Equipment and for the Evaluation of Electrical Insulation
IEEE 43	(2013) Recommended Practice for Testing Insulation Resistance of Rotating Machinery
IEEE 81	(2025) IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth
IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE 115	(2019) Guide for Test Procedures for Synchronous Machines: Part I Acceptance and Performance Testing; Part II Test Procedures and Parameter Determination for Dynamic Analysis
IEEE 120	(2023) Master Test Guide for Electrical Measurements in Power Circuits
IEEE 519	(2022) Standard for Harmonic Control in Electrical Power Systems
IEEE C2	(2023) National Electrical Safety Code
IEEE C50.12	(2025) 50 Hz and 60 Hz Synchronous Generators and Generator/Motors Coupled to Hydraulic Turbines and Rated 5 MVA and Above
IEEE C57.13	(2016) Standard Requirements for Instrument Transformers
IEEE C57.13.1	(2006; R 2012) Guide for Field Testing of Relaying Current Transformers

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2024) International Building Code

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2025) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

INTERNATIONAL ELECTROTECHNICAL COMMISSION (IEC)

IEC 60034-2A	(1974; ED 1.0) Rotating Electrical Machines Part 2: Methods for Determining Losses and Efficiency of Rotating Electrical Machinery from Tests (Excluding Machines for Traction Vehicles) Measurement of Losses by the Calorimetric Method

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 3046	(2002, 2006, 2009, 2001) Reciprocating Internal Combustion Engines - Performance--Part 1, 3, 4, 5, 6
ISO 8528	(1993; R 2018) Reciprocating Internal Combustion Engine Driven Alternating Current Generator Sets--Part 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 13

MANUFACTURERS STANDARDIZATION SOCIETY OF THE VALVE AND FITTINGS INDUSTRY (MSS)

MSS SP-58	(2025) Pipe Hangers and Supports - Materials, Design and Manufacture, Selection, Application, and Installation
MSS SP-80	(2019) Bronze Gate, Globe, Angle, and Check Valves

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA ICS 2	(2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures
NEMA MG 00001	(2024) Motors and Generators
NEMA PB 1	(2011) Panelboards
NEMA PB 2	(2011) Deadfront Distribution Switchboards
NEMA/ANSI C12.11	(2024) Instrument Transformers for Revenue Metering, 10 kV BIL through 350 kV BIL (0.6 kV NSV through 69 kV NSV)

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 30	(2024; ERTA 1 2025) Flammable and Combustible Liquids Code
NFPA 37	(2024; TIA 24-1) Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines
NFPA 54	(2024) National Fuel Gas Code
NFPA 58	(2024; TIA 24-2) Liquefied Petroleum Gas Code
NFPA 70	(2026; TIA 26-1; ERTA 26-1; TIA 26-2; TIA 26-3; TIA 26-4; TIA 26-5; TIA 26-6; TIA 26-7; ERTA 26-2; ERTA 26-3) National Electrical Code
NFPA 110	(2025) Standard for Emergency and Standby Power Systems

SOCIETY OF AUTOMOTIVE ENGINEERS INTERNATIONAL (SAE)

SAE ARP892	(1965; R 1994) DC Starter-Generator, Engine
SAE J537	(2023) Storage Batteries

U.S. DEPARTMENT OF DEFENSE (DOD)

MIL-DTL-5624	(2024; Rev X) Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-DTL-16884	(2017; Rev P) Fuel, Naval Distillate
MIL-STD-461	(2015; Rev G) Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment
UFC 3-301-01	(2023; with Change 6, 2026) Structural Engineering

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

40 CFR 60	Standards of Performance for New Stationary Sources

UL SOLUTIONS (UL)

UL 467	(2022) UL Standard for Safety Grounding and Bonding Equipment
UL 489	(2025) UL Standard for Safety Molded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures
UL 1236	(2015; Reprint Feb 2021) UL Standard for Battery Chargers and Charging

	Engine-Starter Batteries
UL 1437	(2025) Electrical Analog Instruments - Panel Board Types

1.2 RELATED MATERIALS

Section 26 20 00 ELECTRICAL DISTRIBUTION SYSTEM, and Section 26 08 00 APPARATUS INSPECTION AND TESTING apply to this section, except as modified herein.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Engine-Generator Set and Auxiliary Equipment; G, DO

Auxiliary Systems; G, DO

Detailed Drawings; G, DO

Acceptance; G, RO

SD-03 Product Data

Harmonic Requirements; G, RO

Engine-Generator Set Efficiencies; G, RO

Emissions; G, RO

filters; G, RO

special tools; G, RO

Engine-Generator Parameter Schedule

Heat Exchanger

Generator

Manufacturer's Catalog

Site Welding

Spare Parts

Onsite Training

Vibration-Isolation

Posted Data and Instructions; G, RO

Instructions; G, RO

Experience

Field Engineer

General Installation

Exciter

SD-05 Design Data

Performance Criteria

Sound Limitations; G, RO

Integral Main Fuel Storage Tank

Day Tank

Power Factor

Heat Exchanger

Time-Delay on Alarms

Cooling System

Vibration Isolation

Battery Charger

Capacity Calculations for Engine-Generator Set; G, DO

Brake Mean Effective Pressure (BMEP) Calculations; G, RO

Torsional Vibration Stress Analysis Computations; G, RO

Capacity Calculations for Batteries; G, DO

Turbocharger Load Calculations; G, DO

SD-06 Test Reports

Performance Tests

Factory Inspection and Tests

Factory Tests

Onsite Inspection and Tests; G, RO

Acceptance Checks and Tests; G, RO

Functional Acceptance Tests; G, RO

Maintenance Procedures; G, RO

Operation and Maintenance Manuals; G, RO

Inspections; G, RO

Functional Acceptance Test Procedure; G, RO

SD-07 Certificates

Cooling System

Vibration Isolation

Prototype Test

Reliability and Durability

Start-Up Engineer; G, RO

Instructor's Qualification Resume; G, RO

Engine Emission Limits; G, RO

Sound Limitations

Site Visit

Materials and Equipment

Factory Inspection and Tests

SD-09 Manufacturer's Field Reports

Engine Tests; G, RO

Generator Tests; G, RO

Assembled Engine-Generator Set Tests; G, RO

SD-10 Operation and Maintenance Data

Preliminary Assembled Operation and Maintenance Manuals; G, RO

SD-11 Closeout Submittals

Posted Data and Instructions; G, RO

Training Plan; G, RO

1.4 QUALITY ASSURANCE

1.4.1 Conformance to Codes and Standards

Where equipment is specified to conform to requirements of any code or standard such as UL, NEMA, etc., the design, fabrication and installation must also conform to the code.

1.4.2 Site Welding

Qualify procedures and welders in accordance with ASME BPVC SEC IX.

a. Welding procedures qualified by others, and welders and welding operators qualified by a previously qualified employer may be accepted as permitted by ASME B31.1.

b. Submit a copy of qualifying procedures and a list of names and identification symbols of qualified welders and welding operators.

c. Submit a letter listing the welder qualifying procedures for each welder, complete with supporting data such as test procedures used, what was tested to, and a list of the names of all welders and their identification symbols.

d. Perform welder qualification tests for each welder whose qualifications are not in compliance with the referenced standards. Notify the Contracting Officer 24 hours in advance of qualification tests which must be performed at the work site, if practical.

e. The welder or welding operator must apply the personally assigned symbol near each weld made as a permanent record.

1.4.3 Vibration Limitation

Limit the maximum engine-generator set vibration in the horizontal, vertical, and axial directions to 6 mils (peak-peak RMS), with an overall velocity limit of 0.95 inches/second RMS, at rated speed for all loads through 110 percent of rated speed. The engine-generator set must be provided with vibration isolation in accordance with the manufacturer's standard recommendation. Where the vibration isolation system does not secure the base to the structure floor or unit foundation, provide seismic restraints in accordance with the seismic parameters specified.

1.4.4 Torsional Analysis

Submit torsional analysis including prototype testing or calculations which certify and demonstrate that no damaging or dangerous torsional vibrations will occur when the prime mover is connected to the generator, at synchronous speeds, plus/minus 10 percent.

1.4.5 Performance Data

Submit vibration isolation system performance data for the range of frequencies generated by the engine-generator set during operation from no load to full load and the maximum vibration transmitted to the floor. Also submit a description of seismic qualification of the engine-generator mounting, base, and vibration isolation.

1.4.6 Seismic Requirements

Seismic requirements must be in accordance with UFC 3-301-01 and Section 13 48 00 SEISMIC BRACING FOR MISCELLANEOUS EQUIPMENT.

1.4.7 Experience

Each component manufacturer must have a minimum of 3 years' experience in the manufacture, assembly and sale of components used with stationary

engine-generator sets for commercial and industrial use. The engine-generator set manufacturer/assembler must have a minimum of 3 years' experience in the manufacture, assembly and sale of stationary engine-generator sets for commercial and industrial use. Submit a statement showing and verifying these requirements.

1.4.8 Field Engineer

The engine-generator set manufacturer or assembler must furnish a qualified field engineer to supervise the complete installation of the engine-generator set, assist in the performance of the onsite tests, and instruct personnel as to the operational and maintenance features of the equipment. The field engineer must have attended the engine generator manufacturer's training courses on installation and operation and maintenance of engine generator sets. Submit a letter listing the Instructor's Qualification Resume, schools, formal training, and experience of the field engineer.

1.4.9 Detailed Drawings

Submit detailed drawings showing the following:

a. Base-mounted equipment, complete with base and attachments, including anchor bolt template and recommended clearances for maintenance and operation.

b. Starting system.

c. Fuel system.

d. Cooling system.

e. Exhaust system.

f. Electric wiring of relays, breakers, programmable controllers, and switches including single line and wiring diagrams.

g. Lubrication system, including piping, pumps, strainers, filters, controls and wiring.

h. Location, type, and description of vibration isolation devices for all applications.

i. The safety system, including wiring schematics.

j. One-line schematic and wiring diagrams of the generator, exciter, regulator, governor, and instrumentation.

k. Panel layouts.

l. Mounting and support for each panel and major piece of electrical equipment.

m. Engine-generator set rigging points and lifting instructions.

1.4.10 Auxiliary Systems Engine-Generator Set and Auxiliary Equipment Drawing Requirements

Submit drawings pertaining to the engine-generator set and auxiliary

equipment, including but not limited to the following:

a. Certified outline, general arrangement (setting plan), and anchor bolt details. Show total weight and center of gravity of assembled equipment on the steel sub-base.

b. Detailed elementary, schematic wiring, and interconnection diagrams of the engine starting system, jacket coolant heating system, engine protective devices, engine alarm devices, engine speed governor system, generator and excitation system, and other integral devices.

c. Detailed elementary, schematic wiring; and interconnection diagrams of the fuel system, starting battery system, engine-generator control panel, and generator circuit breaker.

d. Dimensional drawings or catalog cuts of exhaust silencers, radiator, fuel day tanks, fuel oil cooler, valves and pumps, intake filters, vibration isolators, and other auxiliary equipment not integral with the engine-generator set.

1.4.11 Vibration Isolation System Certification

Submit certification from the manufacturer that the vibration isolation system will reduce the vibration to the limits specified in the paragraph VIBRATION ISOLATION.

1.5 DELIVERY, STORAGE, AND HANDLING

Properly protect materials and equipment, in accordance with the manufacturers recommended storage procedures,before, during, and after installation. Protect stored items from the weather and contamination. During installation, cap piping and similar openings to keep out dirt and other foreign matter.

Deliver equipment on pallets or blocking wrapped in heavy-duty plastic, sealed to protect parts and assemblies from moisture and dirt. Protect and prepare batteries for shipment as recommended by the battery manufacturer. Store auxiliary equipment at the site in covered enclosures, protected from atmospheric moisture, dirt, and ground water.

1.6 EXTRA MATERIALS

Provide two sets of special tools and two sets of filters required for maintenance. Special tools are those that only the manufacturer provides, for special purposes, or to reach otherwise inaccessible parts. One handset must be provided for each electronic governor when required to indicate and/or change governor response settings. Furnish 4 liters one gallon of identical paint used on engine-generator set in manufacturer's sealed container with each engine-generator set.

Wrenches and tools specifically designed and required to work on the new equipment, which are not commercially available as standard mechanic's tools, must be furnished to the Contracting Officer.

Provide proposed operating instructions for the engine-generator set and auxiliary equipment laminated between matte-surface thermoplastic sheets and suitable for placement adjacent to corresponding equipment. After approval, install operating instructions where directed.

1.7 MAINTENANCE SERVICES

Submit the operation and maintenance manuals and have them approved prior to commencing onsite tests.

1.7.1 Operation Manual

Provide three copies of the operation manual in 8-1/2 by 11 inch three-ring binders. Sections must be separated by heavy plastic dividers with tabs which identify the material in the section. Fold drawings with the title block visible, and placed in 8-1/2 by 11 inch plastic pockets with reinforced holes. The manual must include:

a. Step-by-step procedures for system startup, operation, and shutdown;

b. Drawings, diagrams, and single-line schematics to illustrate and define the electrical, mechanical, and hydraulic systems with their controls, alarms, and safety systems;

c. Procedures for interface and interaction with related systems to include automatic transfer switches .

1.7.2 Maintenance Manual

Provide three copies of the maintenance manual containing the information described below in 8-1/2 x 11 inch three-ring binders. Separate each section by a heavy plastic divider with tabs. Fold drawings with the title block visible, and placed in plastic pockets with reinforced holes. The manual must include:

a. Procedures for each routine maintenance item. Procedures for troubleshooting. Factory-service, take-down overhaul, and repair service manuals, with parts lists.

b. The manufacturer's recommended maintenance schedule.

c. A component list which includes the manufacturer's name, address, type or style, model or serial number, rating, and catalog number for the major components.

d. A list of spare parts for each piece of equipment and a complete list of materials and supplies needed for operation.

1.7.3 Assembled Operation and Maintenance Manuals

The contents of the assembled operation and maintenance manuals must include the manufacturer's O&M information required by the paragraph SD-10, OPERATION AND MAINTENANCE DATA and the manufacturer's O&M information specified in Section 26 36 23 AUTOMATIC TRANSFER SWITCHES AND BY-PASS/ISOLATION SWITCH.

a. Manuals must be in separate books or volumes, assembled and bound securely in durable, hard covered, water resistant binder, and indexed by major assembly and components in sequential order.

b. A table of contents (index) must be made part of the assembled O&M. The manual must be assembled in the order noted in table of contents.

c. The cover sheet or binder on each volume of the manuals must be

identified and marked with the words, "Operation and Maintenance Manual."

1.8 SITE CONDITIONS

Protect the components of the engine-generator set, including cooling system components, pumps, fans, and similar auxiliaries when not operating and provide components capable of the specified outputs in the following environment:

a. Site Location: JBMDL - Joint Base McGuire-Dix-Lakehurst (McGuire Air Force Base)

b. Site Elevation: 140 feet above mean sea level.

c. Ambient Temperatures:

(1) Maximum 97 degrees F dry bulb, 81 degrees F wet bulb.

(2) Minimum 5 degrees F dry bulb.

d. Design Wind Velocity: 10.1 mph.

e. Prevailing Wind Direction: West

f. Seismic Zone: Zone B as defined by ICC IBC.

PART 2 PRODUCTS

2.1 SYSTEM REQUIREMENTS

a. Provide and install each engine-generator set complete and totally functional, with all necessary ancillary equipment to include: air filtration; starting system; generator controls, protection, and isolation; instrumentation; lubrication; fuel system; cooling system; and engine exhaust system. Each engine-generator set must satisfy the requirements specified in the Engine-Generator Parameter Schedule. Submit certification that the engine-generator set and cooling system function properly in the ambient temperatures specified.

b. Provide each engine-generator set consisting of one engine, one generator, and one exciter mounted, assembled, and aligned on one base; and all other necessary ancillary equipment which may be mounted separately. Assemble sets having a capacity of 750 kW or smaller and attach to the base prior to shipping. Sets over 750 kW capacity may be shipped in sections. Provide set components that are environmentally suitable for the locations shown and that are the manufacturer's standard product offered in catalogs for commercial or industrial use. Provide a generator strip heater for moisture control when the generator is not operating. Identify any nonstandard products or components and the reason for their use.

2.1.1 Engine-Generator Parameter Schedule

Engine-Generator Set and Auxiliary Equipment
Capacity Calculations for Engine-Generator Set

ENGINE-GENERATOR PARAMETER SCHEDULE	
Identification	Make/Model
Electrical Characteristics	
Power Rating	Emergency Standby Gross bhp rating / Net brake power rating 125 kW at 0.8 power factor
Governor Type	Type Make / Model Isochronous
Overload Capacity (Prime applications only)	110 percent of Service Load for 1 hour in 12 consecutive hours
Service Load	156 kVA (maximum) 156 kVA (continuous)
Motor Starting kVA (Max.)	156 kVA
Power Factor	0.8 lagging
Engine-Generator Applications	stand-alone
Voltage Regulation (No Load to Full Load)(Stand-alone applications)	plus or minus 2 percent (maximum)
Voltage Bandwidth (steady state)	plus or minus 0.5 percent
Frequency	60 Hz
Voltage	120/240 volts
Phases	1 Phase
Minimum Generator Sub-transient Reactance	12 percent Sub-transient
Nonlinear Loads	0 kVA
Max Step Load Increase	100 percent of Service Load at 0.95 PF
Transient Recovery Time with Step Load Increase (Voltage)	12 seconds
Transient Recovery	12 seconds
Time with Step Load Increase (Frequency)	
Maximum Voltage Deviation with Step Load Increase	15 percent of rated voltage
Maximum Frequency Deviation with Step Load Increase	2.5 percent of rated frequency

ENGINE-GENERATOR PARAMETER SCHEDULE	
Max Step Load Decrease (without shutdown)	100 percent of Service Load at 0.8 PF
Frequency Bandwidth (steady state)	plus or minus 0.25 percent
Frequency Regulation (droop) (No Load to Full Load)	3 percent (maximum)
Frequency Bandwidth (steady state)	plus or minus 0.25 percent
Reactances	Synchronous reactance, Xd Transient reactance, X'd Sub-transient reactance, X"d Negative sequence reactance, X2 Zero sequence reactance, Xo
Capacity Calculations	
Calculations must verify that the engine-generator set power rating is adequate for the following load conditions:	
Lighting	62 kW
Capacity Calculations for Batteries	
Calculation must verify that the engine starting battery capacity exceeds dc power requirements.	
Mechanical Characteristics	
Engine Description	Strokes/cycle Number of cylinders Bore and Stroke, inches
Engine Speed	1800 rpm
Engine Cooling Type	water/ethylene glycol
Intercooler Type	Air-to-Air / Jacket Water
Induction Method	Naturally Aspirated / Turbocharged
Turbocharger	Make / Model
Max Time to Start and be Ready to Assume Load	10 seconds
Max Summer Outdoor Temp (Ambient)	122 degrees F
Min Winter Outdoor Temp (Ambient)	-40 degrees F
Installation Elevation	140 above sea level
Engine-Generator Set Efficiencies	

ENGINE-GENERATOR PARAMETER SCHEDULE	
Fuel Consumption	At 0.8 power factor, Gallons / hour for: 1 / 2 load 3 / 4 load Full Load
Generator Efficiency	At 0.8 power factor,(per cent) in accordance with IEC 60034-2A for: 1 / 2 load 3 / 4 load Full Load
Radiator Capacity	Coolant Type gpm coolant cfm air through radiator Btu per hr of heat exchange based on optimum coolant temperature to and from engine
Engine-Generator Set Emissions Data	
Exhaust Temperature	Degrees F at full load
Weight of Exhaust Gas	lb per hr at full load
Weight of Intake Air	lb per hr at full load
Total Heat Rejected	Btu per hr, at full load to: Jacket Coolant System Fuel Oil Cooling System
Emissions	lb per hr, at full load Total Suspended Particulate Particulate Matter with an average aerodynamic diameter of 10 microns Sulfur Dioxides Nitrogen Oxides (as NO2) Carbon Monoxide Volatile Organic Compounds
Visible Emissions	Percent opacity at full load
Brake Mean Effective Pressure (BMEP) Calculations	

ENGINE-GENERATOR PARAMETER SCHEDULE

Calculation must verify that the engine meets the specified maximum BMEP, as follows:

$$BMEP \ psi = \frac{(120{,}000 \times bkW) \times (792{,}000 \times bhp)}{(rpm \times cu.\ in.)}$$

Where:

bkW bhp = bkW' + bkW" bhp' + bhp"
bkW" bhp" is the Brake kW horsepower required by engine driven fan for cooling radiator or motor driven fan for cooling radiator.
bkW' bhp' = kW/GEN.EFF. kW/(GEN.EFF. times 0.746)
GEN.EFF. = Generator efficiency
cu. in. = Total engine piston displacement in cubic inches
rpm = Engine revolutions per minute
kW = Minimum power rating

Torsional Vibration Stress Analysis Computations

Torsional vibrational stresses in the crankshaft and generator shaft of assembled engine and driven generator must not exceed 5000 psi when engine is driving generator at rated speed while assembled unit is loaded to rated engine-generator set power. Computations must be based on a mathematical model of the assembled generator set provided or based on calculations using measured values from tests on a unit identical to the one provided. Calculations based on models of, or measured data from, the unassembled engine and generator will not be acceptable. Calculations must include:

a. A description of the system relating information pertinent to analysis such as operating speed range and identification plate data.

b. A mass elastic assembly drawing, showing the arrangement of the units in the generator set and dimensions of shafting, including minimum diameters (or section moduli) of shafting in the system.

c. A labeled line diagram of the mass elastic system indicating values of masses, stiffness, equivalent lengths, and equivalent diameters including basic assumptions and definition of terms.

d. Sample computations showing procedures used to obtain resulting stress values.

e. Computations indicating assembled engine-generator speed of 1800 rpm with assembly loaded to rated generator power and the resulting computed critical torsional stress values in the assembled engine crankshaft and generator shaft.

Turbocharger Load Calculations

ENGINE-GENERATOR PARAMETER SCHEDULE
NOTE: When the engine-generator set installation includes field installed exhaust system (i.e., the engine-generator set is installed internal to a building in lieu of in a self-contained outdoor enclosure), include the following paragraph. When the proposed exhaust system layout is different from that shown on the contract drawings, submit calculations showing that the external loads from the exhaust system such as weight and thermal expansion do not exceed the engine manufacturer's maximum allowed forces and moments on the turbocharger.

2.1.2 Rated Output Capacity

Provide each engine-generator-set with power equal to the sum of service load plus the machine's efficiency loss and associated ancillary equipment loads. Rated output capacity must also consider engine and/or generator oversizing required to meet requirements in paragraph Engine-Generator Parameter Schedule.

The engine must meet the specified maximum BMEP requirements at rated speed as calculated in accordance with the calculations in the engine-generator parameter schedule. The engine capacity must be based on the following:

a. Engine burning diesel fuel conforming to MIL-DTL-16884 or MIL-DTL-5624, Grade JP-5 at an ambient temperature of 85 degrees F. For stationary engines operated in the United States, diesel fuel requirements are found in 40 CFR 60 Subpart IIII.

b. Engine cooled by a radiator fan mechanically driven by the engine or remote with a motor driven fan.

c. Engine cooled by coolant mixture of water and ethylene glycol, 50 percent by volume of each.

2.1.2.1 Engine Emission Limits

Engine must be certified by the manufacturer to meet applicable EPA

emission standards found in 40 CFR 60 Subpart IIII. In addition, engine must meet any applicable state or local emission requirements (ex: California SCAQMD).

2.1.2.2 Performance Class

The voltage and frequency behavior of the generator set must be in accordance with ISO 8528 operating limit values for performance Class G2.

2.1.3 Power Ratings

Power ratings must be in accordance with EGSA 101P.

2.1.4 Transient Response

The engine-generator set governor and voltage regulator must cause the engine-generator set to respond to the maximum step load changes such that output voltage and frequency recover to and stabilize within the operational bandwidth within the transient recovery time. The engine-generator set must respond to maximum step load changes such that the maximum voltage and frequency deviations from bandwidth are not exceeded.

2.1.5 Reliability and Durability

Each standby engine-generator set must have both an engine and a generator capable of delivering the specified power on a standby basis with an anticipated mean time between overhauls of no less than 5,000 hours operating with a load factor of 70 percent. Cite two like engines and two like generators that have performed satisfactorily in a stationary power plant, independent and separate from the physical location of the manufacturer's and assembler's facilities, for standby without any failure to start, including all periodic exercise. Provide like engines and generators that have had no failures resulting in downtime for repairs in excess of 72 hours during two consecutive years of service. Provide engines that are the same model, speed, bore, stroke, number and configuration of cylinders, and rated output capacity. Provide generators that are the same model, speed, pitch, cooling, exciter, voltage regulator and rated output capacity.

Submit a reliability and durability certification letter from the manufacturer and assembler to prove that existing facilities are and have been successfully utilizing the same components proposed to meet this specification, in similar service. Certification may be based on components, i.e. engines used with different models of generators and generators used with different engines, and does not exclude annual technological improvements made by a manufacturer in the basic standard-model component on which experience was obtained, provided parts interchangeability has not been substantially affected and the current standard model meets the performance requirements specified. Provide a list with the name of the installations, completion dates, and name and telephone number of a point of contact.

2.1.6 Engine-Generator Set Enclosure

Provide engine-generator set enclosures that are corrosion resistant and fully weather resistant. The enclosure must contain all set components and provide ventilation to permit operation at Service Load under secured conditions. Provide access doors to controls and equipment requiring

periodic maintenance or adjustment. Provide removable panels for access to components requiring periodic replacement. The enclosure must be capable of being removed without disassembly of the engine-generator set or removal of components other than the exhaust system. The enclosure must reduce the noise of the generator set to within the limits specified in the paragraph SOUND LIMITATIONS.

2.1.7 Vibration Isolation

Provide an engine-generator set with a vibration isolation system in accordance with the manufacturer's standard recommendation. Submit vibration isolation system performance data for the range of frequencies generated by the engine-generator set during operation from no load to full load and the maximum vibration transmitted to the floor plus description of seismic qualification of the engine-generator mounting, base, and vibration isolation. Submit torsional analysis including prototype testing or and calculations which certify and demonstrate that no damaging or dangerous torsional vibrations will occur when the prime mover is connected to the generator, at synchronous speeds, plus 10 percent. Design and qualify vibration isolation systems as an integral part of the base and mounting system in accordance with the seismic parameters specified. Where the vibration isolation system does not secure the base to the structure floor or unit foundation, provide seismic restraints in accordance with the seismic parameters specified.

2.1.8 Harmonic Requirements

Non-linear loads to be served by each engine-generator set are as indicated. The maximum linear load demand (kVA at PF) when non-linear loads will also be in use is as indicated.

2.1.9 Starting Time Requirements

Upon receipt of a signal to start, each engine generator set will start, reach rated frequency and voltage and be ready to assume load within the time specified. For standby sets used in emergency power applications, each engine generator set will start, reach rated frequency and voltage, and power will be supplied to the load terminals of the automatic transfer switch within the starting time specified.

2.2 NAMEPLATES

Provide the manufacturer's name, type or style, model or serial number and rating on a plate secured to the equipment for each major component of this specification. Provide plates and tags sized so that inscription is readily legible to operating or maintenance personnel and securely mounted to or attached in proximity of their identified controls or equipment. Lettering must be normal block lettering, a minimum of 0.25 inch high. As a minimum, provide nameplates for:

Engines	Relays
Generators	Transformers (CT & PT)
Regulators	Day tanks

Pumps and pump motors	Governors
Generator Breaker	Air Starting System
Economizers	Heat exchangers (other than base mounted)

Where the following equipment is not provided as a standard component by the engine generator set manufacturer, the nameplate information may be provided in the maintenance manual in lieu of nameplates.

Battery charger	Heaters
Switchboards	Exhaust mufflers
Switchgear	Silencers
Battery	Exciters

2.2.1 Materials

Construct ID plates and tags of 16 gage minimum thickness bronze or stainless steel sheet metal engraved or stamped with inscription. Construct plates and tags not exposed to the weather or high operational temperature of the engine of laminated plastic, 0.125 inch thick, matte white finish with black center core, with lettering accurately aligned and engraved into the core.

2.2.2 Control Devices and Operation Indicators

Provide ID plates or tags for control devices and operation indicators, including valves, off-on switches, visual alarm annunciators, gages and thermometers, that are required for operation and maintenance of provided mechanical systems. Plates or tags must be minimum of 0.5 inch high and 2 inches long and must indicate component system and component function.

2.2.3 Equipment

Provide ID plates of a minimum size of high and 5 inches long on provided equipment indicating the following information:

a. Manufacturer's name, address, type and model number, serial number, and certificate of compliance with applicable EPA mission standards;

b. Contract number and accepted date;

c. Capacity or size;

d. System in which installed; and

e. System which it controls.

2.3 SAFETY DEVICES

Exposed moving parts, parts that produce high operating temperatures, parts which may be electrically energized, and parts that may be a hazard to operating personnel must be insulated, fully enclosed, guarded, or

fitted with other types of safety devices. Install safety devices such that proper operation of the equipment is not impaired.

2.4 MATERIALS AND EQUIPMENT

Submit certification stating that where materials or equipment are specified to comply with requirements of UL, written proof of such compliance has been obtained. The label or listing of the specified agency, or a written certificate from an approved, nationally recognized testing organization equipped to perform such services, stating that the items have been tested and conform to the requirements and testing methods of the specified agency are acceptable as proof.

2.4.1 Circuit Breakers, Low Voltage

UL 489.

2.4.2 Filter Elements

Provide the manufacturer's standard fuel-oil, lubricating-oil, and combustion-air filter elements.

2.4.3 Instrument Transformers

NEMA/ANSI C12.11.

2.4.4 Revenue Metering

IEEE C57.13.

2.4.5 Pipe (Fuel/Lube-Oil, Compressed Air, Coolant, and Exhaust)

ASTM A53/A53M, or ASTM A106/A106M steel pipe. Pipe smaller than 2 inches must be Schedule 80. Pipe 2 inches and larger must be Schedule 40.

2.4.5.1 Flanges and Flanged Fittings

ASTM A181/A181M, Class 60, or ASME B16.5, Grade 1, Class 150.

2.4.5.2 Pipe Welding Fittings

ASTM A234/A234M, Grade WPB or WPC, Class 150 or ASME B16.11, 3000 lb.

2.4.5.3 Threaded Fittings

ASME B16.3, Class 150.

2.4.5.4 Valves

MSS SP-80, Class 150.

2.4.5.5 Gaskets

Manufacturer's standard.

2.4.6 Pipe Hangers

MSS SP-58.

2.4.7 Electrical Enclosures

NEMA ICS 6.

2.4.7.1 Switchboards

NEMA PB 2.

2.4.7.2 Panelboards

NEMA PB 1.

2.4.8 Electric Motors

Provide electric motors that conform to the requirements of NEMA MG 00001. Motors must have sealed ball bearings and a maximum speed of 1800 rpm. Motors used indoors must have drip-proof frames; enclose those that are used outside. Alternating current motors larger than 1/2 Hp must be of the squirrel-cage induction type for operation on 240 volts or higher, 60 Hz. Alternating current motors 1/2 Hp or smaller, must be suitable for operation on 120 volts, 60 Hz, and single-phase power. Direct current motors must be suitable for operation on 120 volts.

2.4.9 Motor Controllers

Provide motor controllers and starters that conform to the requirements of NFPA 70 and NEMA ICS 2.

2.5 ENGINE

Each engine must operate on No. 2-D diesel fuel conforming to ASTM D975, must be designed for stationary applications and must be complete with ancillaries. The engine must be a standard production model shown in the manufacturer's catalog describing and depicting each engine-generator set and all ancillary equipment in sufficient detail to demonstrate complete specification compliance. The engine must be naturally aspirated, supercharged, or turbocharged. The engine must be 2- or 4-stroke-cycle and compression-ignition type. The engine must be vertical in-line, V- or opposed-piston type, with a solid cast block or individually cast cylinders. The engine must have a minimum of two cylinders. Opposed-piston type engines must have more than four cylinders. Each block must have a coolant drain port. Equip each engine with an over-speed sensor.

ISO 3046. Diesel engines must be four-cycle naturally aspirated, or turbocharged, or turbocharged and intercooled; vertical in-line or vertical Vee type; designed for stationary service. Engines must be capable of immediate acceleration from rest to normal speed without intermediate idle/warm up period or pre-lubrication to provide essential electrical power. Two-cycle engines are not acceptable.

2.5.1 Sub-base Mounting

Mount each engine-generator set on a structural steel sub-base sized to support the engine, generator, and necessary accessories, auxiliaries and control equipment to produce a complete self-contained unit as standard with the manufacturer. Design the structural sub-base to properly support the equipment and maintain proper alignment of the engine-generator set in the specified seismic zone. In addition, provide sub-base with both

lifting rings and jacking pads properly located to facilitate shipping and installation of the unit. Factory align engine and generator on the sub-base and securely bolt into place in accordance with the manufacturer's standard practice. Crankshaft must have rigid coupling for connection to the generator.

2.5.2 Assembly

Completely shop assemble each engine-generator set on its structural steel sub-base. Paint entire unit with manufacturer's standard paints and colors. After factory tests and before shipping, thoroughly clean and retouch painting as necessary to provide complete protection.

2.5.3 Turbocharger

If required by the manufacturer to meet the engine-generator set rating, provide turbine type driven by exhaust gas from engine cylinders, and direct connected to the blower supplying air to the engine intake manifold.

2.5.4 Intercooler

Provide manufacturer's standard intercooler for engine size specified.

2.5.5 Crankcase Protection

2.5.6 Miscellaneous Engine Accessories

Provide the following engine accessories where the manufacturer's standard design permits:

a. Piping on engine to inlet and outlet connections, including nonstandard companion flanges.

b. Structural steel sub-base and vibration isolators, foundation bolts, nuts, and pipe sleeves.

c. Level jack screws or shims, as required.

d. Rails, chocks, and shims for installation of sub-base on the foundation.

e. Removable guard, around fan. Support guard, on engine sub-base, to suit manufacturer's standard.

2.5.7 Intercooler

Provide manufacturer's standard intercooler for engine size specified.

2.6 FUEL SYSTEM

Provide fuel system conforming to the requirements of NFPA 30 and NFPA 37 and containing the following elements.

2.6.1 Pumps

Fuel transfer pumps may be mounted on the day tank. Pump must be horizontal, positive displacement. Direct-connect pump to motor through a flexible coupling. Equip each pump with a bypass relief valve, if not provided with an internal relief valve. Provide motor and controller in

accordance with the paragraphs ELECTRIC MOTORS and MOTOR CONTROLLERS, respectively.

2.6.1.1 Main Pump

Provide engines with an engine driven pump. The pump must supply fuel at a minimum rate sufficient to provide the amount of fuel required to meet the performance indicated within the parameter schedule. Base the fuel flow rate on meeting the load requirements and all necessary recirculation.

2.6.2 Fuel Filter

Provide a minimum of one full-flow fuel filter for each engine. The filter must be readily accessible and capable of being changed without disconnecting the piping or disturbing other components. Mark the inlet and outlet connections of the filter.

Provide intake filter assemblies for each engine of the oil bath or dry type, as standard with the manufacturer. Filters must be capable of removing a minimum of 92 percent of dirt and abrasive 3 microns and larger from intake air. Size filters to suit engine requirements at 100 percent of rated full load. Design unit for field access for maintenance purposes.

2.6.3 Relief/Bypass Valve

Provide a relief/bypass valve to regulate pressure in the fuel supply line, return excess fuel to a return line and prevent the build-up of excessive pressure in the fuel system.

2.6.4 Integral Main Fuel Storage Tank

Each engine shall be provided with a sub-base tank. Submit calculations for the capacity of each day tank, including allowances for recirculated fuel, usable tank capacity, and duration of fuel supply. Each sub-base tank shall be provided with connections for fuel supply line, fuel return line, fuel overflow line, local fuel fill port, gague, vent line, drain line, and float switch assembly for control. Fuel supply and return pumps shall be provided as part of the sub-base. A fuel return line cooler shall be provided as recommended by the manufacturer and assembler. The temperature of the fuel returning to the day tank shall be below the flash point of the fuel. A temperature sensing device shall be installed in the fuel supply line. Each engine-generator set provided with weatherproof enclosures shall have its day tank mounted within the enclosure. The fuel fill line shall be accessible without opening the enclosure.

a. Float Switches for Day Tanks: Provide tank-top mounted or external float cage, single-pole, single-throw type designed for use on fuel oil tanks. Arrange high level float switches to close on rise of liquid level, and low level float switches to close on fall of liquid level. Mount float cage units with isolating and drain valves. Contacts must be suitable for the station battery voltage.

(1) Critical low level float switch which must activate at 5 percent of normal liquid level must shut engine off.

(2) Low-low level float switch which must activate alarm at 30 percent of normal liquid level.

(3) Low level float switch which must open the fuel oil solenoid

valve and start the fuel transfer pump at 75 percent of normal liquid level.

(4) High level float switch which must close the fuel oil solenoid valve and stop the fuel transfer pump at 90 percent of normal liquid level.

(5) Critical high level float switch which must activate alarm at 95 percent of normal liquid level.

b. Leak Detector Switch for All Tanks: Actuates when fuel is detected in containment basin, stops fuel transfer pump, and closes the fuel oil solenoid valve.

c. Control Panel for All Tanks: Provide NEMA ICS 6, Type 3R, enclosed control panel for each day tank. Control panel must include the following accessories.

(1) Power available LED (green).

(2) Critical low fuel alarm contacts for shut down of engine.

(3) Low-low level fuel alarm LED.

(4) Low-low level fuel alarm contracts for remote annunciator.

(5) Critical high level fuel alarm LED.

(6) Leak detecting alarm LED.

(7) Alarm horn.

d. Tank Gages for All Tanks: Provide buoyant force type gages for fuel tanks with dial indicator not less than 4 inches in size and arranged for top mounting. Calibrate each reading dial or scale for its specific tank to read from empty to full, with intermediate points of 1/4, 1/2, and 3/4.

e. Integral Base Tanks Used as Primary Tank: Provide a 2 inch opening at the tank fill port, fitted an overfill prevention valve (OPV). Additionally, the fill opening must be perpendicular to the tank in order to allow operation of the OPV. Integral base tank must be sized and configured such that the filling and venting nozzles are outside the generator cabinet for ease of accessibility, inspection, and maintenance. Level gage must be in the line of sight from the fill port.

2.6.4.1 Fuel Transfer Pump

Fuel transfer pumps may be mounted on the day tank. Pump must be horizontal, positive displacement. Direct-connect pump to motor through a flexible coupling. Equip each pump with a bypass relief valve, if not provided with an internal relief valve. Provide motor and controller in accordance with the paragraphs ELECTRIC MOTORS and MOTOR CONTROLLERS, respectively.

2.6.4.2 Capacity

The tank must have capacity to supply fuel to the engine for an uninterrupted 24-hour period at 100 percent rated load without being refilled.

2.6.4.3 Local Fuel Fill

Each local fuel fill port on the day tank must have a screw-on cap.

2.6.4.4 Fuel Level Controls

Provide tanks with a float-switch assembly to perform the following functions:

a. Activate the "Low Fuel Level" alarm at 70 percent of the rated tank capacity.

b. Activate the "Overfill Fuel Level" alarm at 95 percent of the rated tank capacity.

2.6.4.5 Arrangement

Integral tanks may allow gravity flow into the engine. Gravity flow tanks and any tank that allows a fuel level above the fuel injectors must have an internal or external factory installed valve located as near as possible to the shell of the tank. The valve must close when the engine is not operating. Provide integral day tanks with any necessary pumps to supply fuel to the engine as recommended by the generator set manufacturer. The fuel supply line from the tank to the manufacturer's standard engine connection must be welded pipe.

2.6.5 Fuel Oil Cooler

Provide an air cooled fuel oil cooler if the temperature of the fuel returned to the tank from the engine will cause overheating of the tank fuel above the maximum fuel temperature allowed by the engine manufacturer when operating at maximum rated generator power output and low fuel level in the tank. The fuel oil cooler must be furnished by the engine manufacturer for the application and the installation must be complete including piping and power requirements.

2.7 LUBRICATION

Provide engine with a separate lube-oil system conforming to NFPA 30 and NFPA 37. Pressurize each system by engine-driven pumps. Regulate system pressure as recommended by the engine manufacturer. Provide a pressure relief valve on the crankcase for closed systems. Vent the crankcase in accordance with the manufacturer's recommendation. Do not vent the crankcase to the engine exhaust system. Crankcase breathers, if provided on engines installed in buildings or enclosures, must be piped to vent to the outside. The system must be readily accessible for service such as draining, refilling, etc. Each system must permit addition of oil and have oil-level indication with the set operating. The system must utilize an oil cooler as recommended by the engine manufacturer.

2.7.1 Lube-Oil Filter

Provide one full-flow filter for each pump. The filter must be readily

accessible and capable of being changed without disconnecting the piping or disturbing other components. Mark inlet and outlet connections.

2.7.2 Lube-Oil Sensors

Equip each engine with lube-oil pressure sensors located downstream of the filters and provide signals for required indication and alarms. Submit two complete sets of filters, required for maintenance, supplied in a suitable storage box. Provide these filters in addition to filters replaced after testing.

2.7.3 Precirculation Pump

Provide a motor-driven precirculation pump powered by the station battery, complete with motor starter, if recommended by the engine manufacturer.

2.8 COOLING SYSTEM

Provide each engine with its own cooling system to operate automatically while its engine is running. The cooling system coolant must use a combination of water and ethylene-glycol sufficient for freeze protection at the minimum winter outdoor temperature specified. The maximum temperature rise of the coolant across each engine must not exceed that recommended below. Submit a letter which certifies that the engine-generator set and cooling system function properly in the ambient temperature specified, stating the following values:

a. The maximum allowable inlet temperature of the coolant fluid.

b. The minimum allowable inlet temperature of the coolant fluid through the engine.

c. The maximum allowable temperature rise in the coolant fluid through the engine.

d. The minimum allowable inlet fuel temperature.

2.8.1 Coolant Pumps

Provide centrifugal coolant pumps. Each engine must have an engine-driven primary pump. Provide secondary pumps that are electric motor driven and have automatic controllers. Control raw-water circulating pump by manual-off-automatic controllers and must be electric motor driven.

2.8.2 Heat Exchanger

Provide heat exchanger with the size and capacity to limit the maximum allowable temperature rise in the coolant across the engine to that recommended and submitted for the maximum summer outdoor design temperature and site elevation. Submit manufacturer's data to quantify heat rejected to the space with the engine generator set at rated capacity. Provide heat exchangers that are corrosion resistant, suitable for service in ambient conditions of application.

2.8.2.1 Fin-Tube-Type Heat Exchanger (Radiator)

Heat exchanger may be factory coated with corrosion resistant film, provided that corrective measures are taken to restore the heat rejection capability of the radiator to the initial design requirement via over

sizing, or other compensating methods. Provide internal surfaces that are compatible with liquid fluid coolant used. Materials and coolant are subject to approval by the Contracting Officer. Provide heat exchangers that are pressure type incorporating a pressure valve, vacuum valve and a cap. Design caps for pressure relief prior to removal. Provide heat exchanger and cooling system that is capable of withstanding a minimum pressure of 7 psi and protect with a strong grille or screen guard. Provide heat exchanger with at least two tapped holes; equip one tapped hole with a drain cock, and plug the rest.

2.8.3 Expansion Tank

The cooling system must include an air expansion tank which will accommodate the expanded water of the system generated within the normal operating temperature range, limiting the pressure increase at all components in the system to the maximum allowable pressure at those components. The tank must be suitable for operating temperature of 250 degrees F and a working pressure of 125 psi. Provide welded steel tank , tested and stamped in accordance with ASME BPVC SEC VIII D1 for the stated working pressure. Do not use a bladder type tank. Support the tank by steel legs or bases for vertical or steel saddles for horizontal installation.

2.8.4 Thermostatic Control Valve

Provide a modulating type, thermostatic control valve in the coolant system to maintain the coolant temperature range submitted in paragraph SUBMITTALS.

2.8.5 Temperature Sensors

Equip each engine with coolant temperature sensors. Provide temperature sensors with signals for pre-high and high indication and alarms.

2.9 SOUND LIMITATIONS

Submit sound power level data for the packaged unit operating at 100 percent load in a free field environment. The data should demonstrate compliance with the sound limitation requirements of this specification. Submit certification from the manufacturer stating that the sound emissions meet the specification. Do not exceed the following sound pressure levels in any of the indicated frequencies when measured in a free field at a radial distance of 22.9 feet 7 meters at 45 degrees apart in all directions when operating at 100 percent load.

Frequency Band (Hz)	Maximum Acceptable Sound Level (Decibels)
31	87
63	87
125	77
250	70
500	64

Frequency Band (Hz)	Maximum Acceptable Sound Level (Decibels)
1,000	61
2,000	60
4,000	60
8,000	62

2.10 AIR INTAKE EQUIPMENT

Locate filters and silencers in locations that are convenient for servicing. Provide high-frequency filter type silencers and locate in the air intake system as recommended by the engine manufacturer. Provide silencer to reduce the noise level at the air intake so that the indicated pressure levels specified in paragraph SOUND LIMITATIONS will not be exceeded. A combined filter-silencer unit meeting requirements for the separate filter and silencer items may be provided. Provide copper expansion elements in air-intake lines.

Provide intake filter assemblies for each engine of the oil bath or dry type, as standard with the manufacturer. Filters must be capable of removing a minimum of 92 percent of dirt and abrasive 3 microns and larger from intake air. Size filters to suit engine requirements at 100 percent of rated full load. Design unit for field access for maintenance purposes.

2.11 EXHAUST SYSTEM

Provide a separate and complete system for each engine. Support piping to minimize vibration. Where a V-type engine is provided, use a V-type connector, with necessary flexible sections and hardware, to connect the engine exhaust outlets.

2.11.1 Flexible Sections and Expansion Joints

Provide a flexible section at each engine and an expansion joint at each muffler. Provide flexible sections and expansion joints that have flanged connections. Provide flexible sections made of convoluted seamless tube without joints or packing. Provide bellows type expansion joints. Provide stainless steel expansion and flexible elements suitable for engine exhaust gas at the maximum exhaust temperature that is specified by the engine manufacturer. Provide expansion and flexible elements that are capable of absorbing vibration from the engine and compensation for thermal expansion and contraction.

2.11.2 Exhaust Muffler

Provide a chamber type exhaust muffler. Provide welded steel muffler designed for outside mounting. Provide eyebolts, lugs, flanges, or other items as necessary for support in the location and position indicated. Do not exceed the engine manufacturer's recommended pressure drop. Outside mufflers must be zinc coated or painted with high temperature 400 degrees F resisting paint. The muffler and exhaust piping together must reduce the noise level to less than the maximum acceptable level listed for sound limitations in paragraph SOUND LIMITATIONS. Provide muffler with a drain valve, nipple, and cap at the low-point of the muffler.

2.11.3 Exhaust Piping

Slope horizontal sections of exhaust piping downward away from the engine to a drip leg for collection of condensate with drain valve and cap. Changes in direction must be long radius. Insulate exhaust piping, mufflers and silencers installed inside any building in accordance with paragraph THERMAL INSULATION and covered to protect personnel. Provide vertical exhaust piping with a hinged, gravity-operated, self-closing, rain cover.

Field installed exhaust piping must conform to the following:

a. Exhaust Piping: Provide flanges for connections to engines, exhaust mufflers, and flexible connections. Provide steel pipe conforming to ASTM A53/A53M for each engine complete with necessary fittings, flanges, gaskets, bolts, and nuts. Exhaust piping must be Schedule 40 pipe for 12 inches and smaller, standard weight for sizes 14 inches through 24 inches, and 0.25 inch wall thickness for sizes larger than 24 inches. Flanges must be Class 150 slip-on forged steel welding flanges in accordance with ASME B16.5, with material in accordance with ASTM A181/A181M, Grade I. Fittings must be butt welding conforming to ASTM A234/A234M, with wall thickness same as adjoining piping. Fittings must be of same material and wall thickness as pipe. Built-up miter welded fittings may be used. Miter angles of each individual section must not exceed 22.5 degrees total and not more than 11.25 degrees relative to the axis of the pipe at any one cut. Gaskets for exhaust piping must be of high temperature asbestos-free material suitable for the service and must be ASME B16.21, composition ring, 0.0625 inch thick. Bolting material for exhaust flanges must be alloy-steel bolt-studs conforming to ASTM A193/A193M, Grade B7 bolts and alloy-steel nuts conforming to ASTM A194/A194M, Grade 7. Bolts must be of sufficient length to obtain full bearing on the nuts and must project not more than two full threads beyond the nut. Provide stainless steel counterbalance type rain caps at termination of each exhaust pipe.

b. Expansion (Flexible) Joints: Provide sections of multiple corrugated stainless steel expansion joints in the engine exhaust piping for each engine to absorb expansion strains and vibration transmitted to the piping. Flexible joints must be suitable for operation at 200 degrees F above normal exhaust gas temperature at 100 percent load, 10,000 cycles, minimum. Joints must be flanged and located between engine exhaust manifold and exhaust piping, must be the same size as exhaust piping size, and must be designed and constructed for engine exhaust service.

c. Hangers and Supports: MSS SP-58.

d. Piping Sleeves: Provide where piping passes through masonry or concrete walls, floors, roofs, and partitions. Sleeves must be placed during construction. Unless indicated otherwise, pipe sleeves must comply with following requirements: sleeves in outside walls below and above grade, in floor, or in roof slabs, must be standard weight zinc coated steel pipe. Sleeves in partitions must be zinc coated sheet steel having a nominal weight of not less than 0.90 pound per square foot. Space between piping insulation and the sleeve must not be less than 0.25 inch. Sleeves must be held securely in proper position and location during construction. Sleeves must be sufficient

length to pass through entire thickness of walls, partitions, or slabs. Sleeves in floor slabs must extend 2 inches above the finished floor. Space between the pipe and the sleeve must be firmly packed with insulation and caulked at both ends of the sleeve with plastic waterproof cement.

2.12 PYROMETER

Provide a pyrometer, and thermocouple with calibrated leads to show the temperature of the combined exhaust. For a supercharged engine, provide additional points, thermocouples and leads to show the temperature in the turbocharger exhaust gas outlet and combustion air discharge passages. Graduated scale length less than 6 inches is not acceptable. Provide double pole selector switch with an "off" position, one set of points for each thermocouple, and suitable indicating dial. Calibrate the pyrometer, thermocouples, leads and compensating devices to show true exhaust temperature within plus or minus 1 percent above the highest temperature encountered at 110 percent load conditions.

2.13 EMISSIONS

The finished installation must comply with Federal, state, and local regulations and restrictions regarding the limits of emissions. Submit certification from the engine manufacturer stating that the engine exhaust emissions meet the federal, state, and local regulations and restrictions specified. At a minimum this certification must include emission factors for criteria pollutants including nitrogen oxides, carbon monoxide, particulate matter, sulfur dioxide, non-methane hydrocarbon, and for hazardous air pollutants (HAPs).

2.14 STARTING SYSTEM

Provide starting system for engine generator sets used in non-emergency applications as follows.

2.14.1 Controls

Provide an engine control switch with functions including: run/start (manual), off/reset, and, automatic mode. Provide start-stop logic for adjustable cycle cranking and cool-down operation. Arrange the logic for manual starting and fully automatic starting in accordance with paragraph AUTOMATIC ENGINE-GENERATOR-SET SYSTEM OPERATION. Provide electrical starting systems with an adjustable cranking limit device to limit cranking periods from 1 second up to the maximum duration.

2.14.2 Capacity

Provide starting system with sufficient capacity, at the maximum outdoor summer temperature specified to crank the engine without damage or overheating. The system must provide a minimum of three cranking periods with 15 second intervals between cranks. Each cranking period must have a maximum duration of 15 seconds. Starting must be accomplished using an adequately sized dc starter system with a positive shift solenoid to engage the starter motor and to crank the engine continuously for 60 seconds without overheating.

2.14.3 Electrical Starting

Manufacturers recommended dc system, utilizing a negative circuit ground. Starting motors must be in accordance with SAE ARP892.

2.14.3.1 Battery

Provide a starting battery system including the battery, battery rack, intercell connectors, spacers, automatic battery charger with overcurrent protection, metering and relaying. Provide battery in accordance with SAE J537. Size critical system components (rack, protection, etc.) to withstand the seismic acceleration forces specified. Provide lead-acid battery with sufficient capacity, at the minimum outdoor and maximum outdoor temperature specified, to provide the specified cranking periods. Valve-regulated lead-acid batteries are not acceptable.

Provide maintenance free, sealed, lead-acid, SAE Type D engine starting batteries. Battery configuration must be two parallel sets of two 12-volt batteries. Batteries must have sufficient capacity to provide 60 seconds of continuous cranking of the engine in an ambient temperature of 122 degrees F.

2.14.3.2 Battery Charger

Provide a current-limiting battery charger, conforming to UL 1236, that automatically recharges the batteries. Submit battery charger sizing calculations. The charger must be capable of an equalize charging rate for recharging fully depleted batteries within 24 hours and a floating charge rate for maintaining the batteries at fully charged condition. Provide an ammeter to indicate charging rate. Provide a voltmeter to indicate charging voltage. Provide a timer for the equalize charging-rate setting. A battery is considered to be fully depleted when the output voltage falls to a value which will not operate the engine generator set and its components.

Provide 120 volt ac, enclosed, automatic equalizing, dual-rate, solid-state, constant voltage type battery charger with automatic ac line compensation. DC output must be voltage regulated and current limited. Charger must have two ranges, float and equalize, and must provide continuous taper charging. The charger must have a continuous output rating of not less than 10 amperes and must be sized to recharge the engine starting batteries in a minimum of 8 hours while providing the control power needs of the engine-generator set. Enclosure must be NEMA ICS 6, Type 3R. The following accessories must be included:

a. DC ammeter

b. DC voltmeter

c. Equalize light

d. AC on light

e. Low voltage light

f. High voltage light

g. Equalize test button/switch

h. AC circuit breaker

i. Low dc voltage alarm relay

j. High dc voltage alarm relay

k. Current failure relay

l. AC power failure relay

2.14.4 Starting Aids

Provide one or more of other following methods to assist engine starting.

2.14.4.1 Glow Plugs

Design glow plugs to provide sufficient heat for combustion of fuel within the cylinders to guarantee starting at an ambient temperature of -25 degrees F.

2.14.4.2 Jacket-Coolant Heaters

Mount a thermostatically controlled electric heater in the engine coolant jacketing to automatically maintain the coolant within plus or minus 3 degrees F of the control temperature. The heater must operate independently of engine operation so that starting times are minimized. Power for the heaters must be 120 or 240 volts ac. Include necessary equipment, piping, controls, wiring, and accessories.

2.14.4.2.1 Prime Rated Sets

The control temperature must be the higher of the manufacturer's recommended temperature or the minimum coolant inlet temperature of the engine recommended in paragraph SUBMITTALS.

2.14.4.2.2 Standby Rated Sets

The control temperature must be the temperature recommended by the engine manufacturer to meet the starting time specified at the minimum winter outdoor temperature.

2.14.4.3 Lubricating-Oil Heaters

Mount a thermostatically controlled electric heater in the engine lubricating-oil system to automatically maintain the oil temperature within plus or minus 3 degrees F of the control temperature. The heater must operate independently of engine operation so that starting times are minimized. Power for the heaters must be 120 or 240 volts ac.

2.14.5 Exerciser

Provide exerciser in accordance with Section 26 36 23 AUTOMATIC TRANSFER SWITCH AND BY-PASS/ISOLATION SWITCH.

2.15 GOVERNOR

Provide a forward acting type engine speed governor system. Steady-state frequency band and frequency regulation (droop) must be in accordance with the operating limit values of the performance class specified in the

paragraph PERFORMANCE CLASS.

Provide engine with a governor which maintains the frequency within a bandwidth of the rated frequency, over a steady-state load range of zero to 100 percent of rated output capacity. Configure the governor for safe manual adjustment of the speed/frequency during operation of the engine-generator set, without special tools, from 90 to 110 percent of the rated speed/frequency, over a steady state load range of 0 to 100 percent or rated capacity. Submit two complete sets of special tools required for maintenance (except for electronic governor handset). Special tools are those that only the manufacturer provides, for special purposes, or to reach otherwise inaccessible parts. Provide a suitable tool box for tools. Provide one handset for each electronic governor when required to indicate and/or change governor response settings. Maintain the midpoint of the frequency bandwidth at the same value for steady-state loads over the range of zero to 100 percent of rated output capacity for isochronous governors.

2.16 GENERATOR

Provide synchronous type, one or two bearing, generator conforming to the performance criteria in NEMA MG 00001, equipped with winding terminal housings in accordance with NEMA MG 00001, equipped with an amortisseur winding, and directly connected to the engine. Submit calculations of the engine and generator output power capability, including efficiency and parasitic load data. Provide Class H insulation.

a. Select NEMA MG 00001, Part 16, standby duty, and temperature rise of 130 degrees C for engine-generator sets which are expected to operate for less than 300 hours per year. Select NEMA MG 00001, Part 22, continuous duty, and temperature rise of 105 degrees C for engine-generator sets expected to operate 300 hours or greater per year or rated 300 kW and above.

b. Select 2/3 pitch design option for engine-generator sets rated 300 kW and above.

c. Select 10-12 lead re-connectable for engine-generator sets rated 300 kW to 800 kW.

d. For applications requiring high SCR loading or in harsh environments laden with salts and chemicals, select vacuum pressure impregnation (VPI) insulated coils. When engine-generator sets are rated 800 kW and larger, also select form wound coils.

e. Provide salient-pole type, ac, brushless-excited, revolving field, air-cooled, self-ventilated, drip-proof guarded, coupled type, synchronous generator conforming to NEMA MG 00001, Parts 16 and 22, and IEEE C50.12. Generator must be rated for standby duty at 100 percent of the power rating of the engine-generator set as specified in the table shown in paragraph ENGINE GENERATOR PARAMETER SCHEDULE. Temperature rise of each of the various parts of the generator must not exceed 105 degrees C as measured by resistance, based on a maximum ambient temperature of 40 degrees C. Winding insulation must be Class H.

f. Design generator to protect against mechanical, electrical and thermal damage due to vibration, 25 percent overspeeds, or voltages and temperatures at a rated output capacity of 110 percent for prime

applications and 100 percent for standby applications.

g. Provide generator ancillary equipment meeting the short circuit requirements of NEMA MG 00001. Select drip-proof guarded option for generators without weatherproof enclosures.

h. Submit manufacturer's standard data for each generator (prototype data at the specified rating or above is acceptable), listing the following information:

(1) Direct-Axis sub-transient reactance (per unit).

(2) The generator kW rating and short circuit current capacity (both symmetric and asymmetric).

2.16.1 Waveform

The deviation factor of the line-to-line voltage at zero load and at balanced rated output capacity must not exceed 10 percent. The RMS of all harmonics must be less than 5.0 percent and that of any one harmonic less than 3.0 percent of the fundamental at rated output capacity. Design and configure engine-generator to meet the total harmonic distortion limits of IEEE 519.

2.17 EXCITER

Provide brushless generator exciter. Provide semiconductor rectifiers that have a minimum safety factor of 300 percent for peak inverse voltage and forward current ratings for all operating conditions, including 110 percent generator output at 104 degrees F ambient. The exciter and regulator in combination must maintain generator-output voltage within the limits specified.

2.17.1 Electromagnetic Interference (EMI) Suppression

Provide as an integral part of the generator and excitation system, EMI suppression complying with MIL-STD-461.

2.18 VOLTAGE REGULATOR

Provide a solid-state voltage regulator, separate from the exciter, for each generator. Maintain the voltage within a bandwidth of the rated voltage, over a steady-state load range of zero to 100 percent of rated output capacity. Configure regulator for safe manual adjustment of the engine-generator voltage output without special tools, during operation, from 90 to 110 percent of the rated voltage over the steady state load range of 0 to 100 percent of rated output capacity. Regulation drift exceeding plus or minus 0.5 percent for an ambient temperature change of 68 degrees F is not acceptable. Reactive droop compensation or reactive differential compensation must load share the reactive load proportionally between sets during parallel operation. Provide voltage regulator with a maximum droop of 2 percent of rated voltage over a load range from 0 to 100 percent of rated output capacity and automatically maintain the generator output voltage within the specified operational bandwidth.

2.19 GENERATOR ISOLATION AND PROTECTION

Provide necessary devices for electrical protection and isolation of each engine-generator set and its ancillary equipment. The generator circuit

breaker (IEEE Device 52) ratings must be consistent with the generator rated voltage and frequency, with continuous, short circuit withstand, and interrupting current ratings to match the generator capacity. Provide manually operated generator circuit breaker. Mount a set of surge capacitors at the generator terminals. Provide monitoring and control devices as specified in paragraph PANELS.

The generator circuit breaker must comply with UL 489 requirements for molded case, adjustable thermal magnetic trip type circuit breaker. The circuit breaker continuous current rating must be adequate for the power rating of the engine-generator set and the circuit breaker must be rated to withstand the short circuit current provided by the generator set. Provide circuit breaker in a NEMA ICS 6, Type 3R enclosure mounted on the engine-generator set.

2.19.1 Devices

Furnish with respective pieces of equipment. Motors, controllers, contactors, and disconnects must conform to Section 26 20 00 ELECTRICAL DISTRIBUTION SYSTEM. Provide electrical connections under Section 26 20 00 ELECTRICAL DISTRIBUTION SYSTEM. Provide controllers and contactors with maximum of 120-volt control circuits, and auxiliary contacts for use with controls furnished. When motors and equipment furnished are larger than size indicated, the cost of providing additional electrical service and related work must be included under this section.

2.20 SAFETY SYSTEM

Provide and install devices, wiring, remote panels, and local panels, etc., as a complete system to automatically activate the appropriate signals and initiate the appropriate actions. Provide a safety system with a self-test method to verify its operability. Provide alarm signals that have manual acknowledgment and reset devices. The alarm signal systems must reactivate for new signals after acknowledgment is given to any signal. Configure the systems so that loss of any monitoring device will be dealt with as an alarm on that system element.

2.20.1 Audible Signal

Provide audible alarm signal sound at a frequency of 70 Hz at a volume of 75 dB at 10 feet. The sound must be continuously activated upon alarm and silenced upon acknowledgment. Signal devices reccomended by the manufacturer and shall be provided with a silence switch.

2.20.2 Visual Signal

The visual alarm signal must be a panel light. The light must be normally off, activated to be blinking upon alarm. The light must change to continuously lit upon acknowledgement. If automatic shutdown occurs, the display must maintain activated status to indicate the cause of failure and must not be reset until cause of alarm has been cleared and/or restored to normal condition. Shutdown alarms must be red; all other alarms must be amber.

2.20.3 Alarms and Action Logic

2.20.3.1 Shutdown

Accomplish simultaneous activation of the audible signal, activation of the visual signal, stopping the engine, and opening the generator main circuit breakers.

2.20.3.2 Problem

Accomplish activation of the visual signal.

2.20.4 Safety Indications and Shutdowns

Provide a local alarm panel with the following shutdown and alarm functions in accordance with NFPA 110 level 2 mounted either on or adjacent to the engine generator set.

A remote alarm panel is not required for audible alarms, e.g., in the control room.

Indicator Function (at battery voltage)	NFPA 99 Level 1 CV S RA	NFPA 110 Level 1 CV S RA	NFPA 110 Level 2 CV S RA
Overcrank	X X X	X X X	X X O
Low water temperature	X NA X	X NA X	X NA O
High engine temperature pre-alarm	X NA X	X NA X	O NA NA
High engine temperature	X X X	X X X	X X O
Low lube oil pressure pre-alarm	X NA X	NA NA NA	NA NA NA
Low lube oil pressure	X X X	X X X	X X O
Overspeed	X X X	X X X	X X O
Low fuel main tank	X NA X	X NA X	O NA O
Low coolant level	X O X	X O X	X O X
EPS supplying load	X NA NA	X NA NA	O NA NA
Control switch not in automatic position	X NA X	X NA X	X NA X
High battery voltage	X NA NA	X NA NA	O NA NA
Low cranking voltage	X NA X	X NA X	O NA NA
Low voltage in battery	X NA NA	X NA NA	O NA NA
Battery charger ac failure	X NA NA	X NA NA	O NA NA
Lamp test	X NA NA	X NA NA	X NA NA

Indicator Function (at battery voltage)	NFPA 99 Level 1 CV S RA	NFPA 110 Level 1 CV S RA	NFPA 110 Level 2 CV S RA
Contacts for local and remote common alarm	X NA X	X NA X	X NA X
Audible alarm silencing switch	NA NA X	NA NA X	NA NA O
Low starting air pressure	X NA NA	X NA NA	O NA NA
Low starting hydraulic pressure	X NA NA	X NA NA	O NA NA
Air shutdown damper when used	X X X	X X X	X X O
Remote emergency stop	NA X NA	NA X NA	NA X NA

Symbology:
CV: Control panel-mounted visual.
S: Shutdown of EPS indication.
RA: Remote audible.
Symbology:
CV: Control panel-mounted visual.
S: Shutdown of EPS indication.
RA: Remote audible.
X: Required.
O: Optional.
NA: Not applicable.

2.20.5 Time-Delay on Alarms

For startup of the engine-generator set, install time-delay devices bypassing the low lubricating oil pressure alarm during cranking, and the coolant-fluid outlet temperature alarm. Submit the magnitude of monitored values which define alarm or action set points, and the tolerance (plus and/or minus) at which the devices activate the alarm or action for items contained within the alarm panels. The lube-oil time-delay device must return its alarm to normal status after the engine starts. The coolant time-delay device must return its alarm to normal status 5 minutes after the engine starts.

2.21 PANELS

Each panel must be of the type and kind necessary to provide specified functions. Mount panels on the engine-generator set base by vibration/shock absorbing type mountings. Mount instruments flush or semiflush. Provide convenient access to the back of panels to facilitate

maintenance. Calibrate instruments using recognized industry calibration standards. Provide a panel identification plate identifying the panel function. Provide a plate identifying the device and its function for each instrument and device on the panel. Provide switch plates identifying the switch-position function.

2.21.1 Enclosures

Design enclosures for the application and environment, conforming to NEMA ICS 6. Locking mechanisms shall be provided at panels local to the generator and shall be keyed alike.

Provide for each engine-generator set and fabricate from zinc coated or phosphatized and shop primed 16 gage minimum sheet steel in accordance with the manufacturer's standard design. Provide a complete, weatherproof enclosure for the engine, generator, and auxiliary systems and equipment. Support exhaust piping and silencer so that the turbocharger is not subjected to exhaust system weight or lateral forces generated in connecting piping that exceed the engine manufacturer's maximum allowed forces and moments. The housing must have sufficient louvered openings to allow entrance of outside air for engine and generator cooling at full load. Design louvered openings to exclude driving rain and snow. Provide properly arranged and sized, hinged panels in the enclosure to allow convenient access to the engine, generator, and control equipment for maintenance and operational procedures. Provide hinged panels with spring type latches which must hold the panels closed securely and will not allow them to vibrate. Brace the housing internally to prevent excessive vibration when the set is in operation

2.21.2 Analog

Provide analog electrical indicating instruments in accordance with UL 1437 with semi-flush mounting. Switchboard, switchgear, and control-room panel-mounted instruments must have 250 degree scales with an accuracy of not less than 99 percent. Unit-mounted instruments must be the manufacturer's standard with an accuracy of not less than 98 percent. The instrument's operating temperature range must be minus 4 to plus 158 degrees F. Distorted generator output voltage waveform of a crest factor less than 5 must not affect metering accuracy for phase voltages, hertz and amps.

2.21.3 Electronic

Electronic indicating instruments must be true RMS indicating instruments, 100 percent solid state, state-of-the-art, microprocessor controlled to provide specified functions. Provide control, logic, and function devices that are compatible as a system, sealed, dust and water tight, and that utilize modular components with metal housings and digital instrumentation. Provide an interface module to decode serial link data from the electronic panel and translate alarm, fault and status conditions to set of relay contacts. Instrument accuracy less than 98 percent for unit mounted devices and 99 percent for control room, panel mounted devices, throughout a temperature range of minus 4 to 158 degrees F is not acceptable. Provide LED or back lit LCD data display. Additionally, the display must provide indication of cycle programming and diagnostic codes for troubleshooting. Numeral height must be 0.5 inch .

2.21.4 Parameter Display

Provide indication or readouts of the tachometer, lubricating-oil pressure, ac voltmeter, ac ammeter, frequency meter, and safety system parameters. Specify a momentary switch for other panels.

2.22 SURGE PROTECTION

Electrical and electronic components must be protected from, or designed to withstand the effects of surges from switching and lightning.

2.23 AUTOMATIC ENGINE-GENERATOR-SET SYSTEM OPERATION

Provide fully automatic operation for the following operations: engine-generator set starting and load transfer upon loss of normal source; retransfer upon restoration of the normal source; sequential starting; paralleling, and load-sharing for multiple engine-generator sets; and stopping of each engine-generator set after cool-down. Devices must automatically reset after termination of their function.

2.23.1 Automatic Transfer Switch

Provide automatic transfer switches in accordance with Section 26 36 23 AUTOMATIC TRANSFER SWITCH AND BY-PASS/ISOLATION SWITCH.

2.23.2 Monitoring and Transfer

Provide devices to monitor voltage and frequency for the normal power source and each engine-generator set, and control transfer from the normal source and retransfer upon restoration of the normal source. Describe functions, actuation, and time delays as described in Section 26 36 23 AUTOMATIC TRANSFER SWITCH AND BY-PASS/ISOLATION SWITCH.

2.24 MANUAL ENGINE-GENERATOR-SET SYSTEM OPERATION

Provide complete facilities for manual starting and testing of each set without load, loading and unloading of each set, and synchronization of each set with an energized bus.

2.25 BASE

Provide a steel base. Design the base to rigidly support the engine-generator set, ensure permanent alignment of rotating parts, be arranged to provide easy access to allow changing of lube-oil, and ensure that alignment is maintained during shipping and normal operation. The base must permit skidding in any direction during installation and must withstand and mitigate the affects of synchronous vibration of the engine and generator. Provide base with suitable holes for anchor bolts and jacking screws for leveling.

2.26 PAINTING AND FINISHING

Clean, prime and paintthe engine-generator set in accordance with the manufacturer's standard color and practice.

2.27 FACTORY INSPECTION AND TESTS

Submit six complete reproducible copies of the factory inspection result on the checklist format specified below. Perform the factory tests on

each engine-generator set. The component manufacturer's production line test is acceptable as noted. Run each engine-generator set for at least 1 hour at rated output capacity prior to inspections. Complete inspections and make all necessary repairs prior to testing. Use engine generator controls and protective devices that are provided by the generator set manufacturer as part of the standard package for factory tests. When controls and switchgear are not provided as part of the generator set manufacturer's standard package, the actual controls and protective devices provided for the project are not required to be used during the factory test. The Contracting Officer may provide one or more representatives to witness inspections and tests.

2.27.1 Factory Inspection

Perform inspections prior to beginning and after completion of testing of the assembled engine-generator set. Look for leaks, looseness, defects in components, proper assembly, etc. and note any item found to be in need of correction as a necessary repair. Use the following checklist for the inspection:

INSPECTION ITEM	GOOD	BAD	NOTES
Drive belts			
Governor and adjustments			
Engine timing mark			
Starting motor			
Starting aids			
Coolant type and concentration			
Radiator drains			
Block coolant drains			
Coolant fill level			
All coolant line connections			
All coolant hoses			
Combustion air filter			
Combustion air silencer			
Lube oil type			
Lube oil sump drain			
Lube-oil filter			
Lube-oil-level indicator			

INSPECTION ITEM	GOOD	BAD	NOTES
Lube-oil-fill level			
All lube-oil line connections			
All lube-oil lines			
Fuel type and amount			
All fuel-line connections			
All fuel lines			
Fuel filter			
Coupling and shaft alignment			
Voltage regulators			
Battery-charger connections			
All wiring connections			
Instrumentation			
Hazards to personnel			
Base			
Nameplates			
Paint			
Exhaust-heat recovery unit			
Switchboard			
Switchgear			

2.27.2 Factory Tests

Submit a letter giving notice of the proposed dates of factory inspections and tests at least 14 days prior to beginning tests, including:

a. A detailed description of the manufacturer's procedures for factory tests at least 14 days prior to beginning tests.

b. Six copies of the Factory Test data described below in 8-1/2 by 11 inch binders having a minimum of 3 rings from which material may readily be removed and replaced, including a separate section for each test. Separate sections by heavy plastic dividers with tabs. Provide full size (8-1/2 by 11 inch minimum) data plots showing grid lines, with

full resolution.

(1) A detailed description of the procedures for factory tests.

(2) A list of equipment used, with calibration certifications.

(3) A copy of measurements taken, with required plots and graphs.

(4) The date of testing.

(5) A list of the parameters verified.

(6) The condition specified for the parameter.

(7) The test results, signed and dated.

(8) A description of adjustments made.

On engine-generator set tests where the engine and generator are required to be connected and operated together, the load power factor must be the power factor specified in the engine generator set parameter schedule. For engine-generator set with dual-fuel operating capability, perform the following tests using the primary fuel type. Perform electrical measurements in accordance with IEEE 120. Temperature limits in the rating of electrical equipment and for the evaluation of electrical insulation must be in accordance with IEEE 1. In the following tests where measurements are to be recorded after stabilization of an engine-generator set parameter (voltage, frequency, current, temperature, etc.), stabilization is considered to have occurred when measurements are maintained within the specified bandwidths or tolerances, for a minimum of four consecutive readings. Tests specifically for the generator may be performed utilizing any prime mover.

a. Insulation Resistance for Stator and Exciter Test, IEEE 115 and IEEE 43, to the performance criteria in NEMA MG 00001, Part 22. Generator manufacturer's production line test is acceptable.

b. High Potential Test, in accordance with IEEE 115 and NEMA MG 00001, test voltage in accordance with NEMA MG 00001. Generator manufacturer's production line test is acceptable.

c. Winding Resistance Test, Stator and Exciter, in accordance with IEEE 115. Generator manufacturer's production line test is acceptable.

d. Phase Balance Voltage Test, to the performance criteria specified in paragraph GENERATOR. This test can be performed with any prime mover. Generator manufacturer's production line test results are acceptable.

(1) Start and operate the generator at no load.

(2) Adjust a regulated phase voltage (line-to-neutral) to rated voltage.

(3) Read and record the generator frequency, line-to-neutral voltages, and the line-to-line voltages.

(4) Apply 75 percent rated load and record the generator frequency, line-to-neutral voltages, and the line-to-line voltages.

(5) Apply rated load and record the generator frequency, line-to-neutral voltages, and the line-to-line voltages.

(6) Calculate average line-neutral voltage and percent deviation of individual line-neutral voltages from average for each load condition.

e. Current Balance on Stator Winding Test, by measuring the current on each phase of the winding with the generator operating at 100 percent of Rated Output Capacity, with the load impedance equal for each of the three phases: to the performance criteria specified in paragraph GENERATOR.

f. Voltage Waveform Deviation and Distortion Test in accordance with IEEE 115 to the performance criteria specified in paragraph GENERATOR. Use high-speed recording instruments capable of recording voltage waveform deviation and all distortion, including harmonic distortion. Include appropriate scales to provide a means to measure and interpret results.

g. Voltage and Frequency Droop Test. Verify that the output voltage and frequency are within the specified parameters as follows:

(1) With the generator operating at no load, adjust voltage and frequency to rated voltage and frequency. Record the generator output frequency and line-line and line-neutral voltages.

(2) Increase load to Rated Output Capacity. Record the generator output frequency and line-line and line-neutral voltages.

(3) Calculate the percent droop for voltage and frequency with the following equations:

$$\text{Voltage droop percent} = \frac{\text{(No-Load Volts) - (Rated Capacity Volts)}}{\text{(Service-Load Volts)}} \times 100$$

$$\text{Frequency droop percent} = \frac{\text{(No-Load Hertz) - (Rated Capacity Hertz)}}{\text{(Service-Load Hertz)}} \times 100$$

(4) Repeat steps 1 through 3 two additional times without making any adjustments.

h. Frequency and Voltage Stability and Transient Response. Verify that the engine-generator set responds to addition and dropping of blocks of load in accordance with the transient response requirements. Document maximum voltage and frequency variation from bandwidth and verify that voltage and frequency return to and stabilize within the specified bandwidth, within the specified response time period. Document results in tabular form and with high resolution, high speed strip chart recorders or comparable digital recorders, as approved by the Contracting Officer. Include the following tabular data:

(1) Ambient temperature (at 15 minute intervals).

(2) Generator output current (before and after load changes).

(3) Generator output voltage (before and after load changes).

(4) Frequency (before and after load changes).

(5) Generator output power (before and after load changes).

(6) Graphic representations must include the actual instrument trace of voltage and frequency showing: charts marked at start of test; observed steady-state band; mean of observed band; momentary overshoot and undershoot (generator terminal voltage and frequency) and recovery time for each load change together with the voltage and frequency maximum and minimum trace excursions for each steady state load condition prior to and immediately following each load change. Generator terminal voltage and frequency transient recovery time for each step load increase and decrease.

(a) Perform and record engine manufacturer's recommended pre-starting checks and inspections.

(b) Start the engine, make and record engine manufacturer's after-starting checks and inspections during a reasonable warm-up period and no load. Verify stabilization of voltage and frequency within specified bandwidths.

(c) With the unit at no load, apply the Maximum Step Load Increase.

(d) Apply load in steps equal to the Maximum Step Load Increase until the addition of one more step increase will exceed the Service Load.

(e) Decrease load to the unit such that addition of the Maximum Step Load Increase will load the unit to 100 percent of Service Load.

(f) Apply the Maximum Step Load Increase.

(g) Decrease load to zero percent in steps equal to the Maximum Step Load Decrease.

(h) Repeat steps (c) through (g).

i. Test Voltage Unbalance with Unbalanced Load (Line-to-Neutral) to the performance criteria specified in paragraph GENERATOR. Prototype test data is acceptable in lieu of the actual test. Submit manufacturer's standard certification that prototype tests were performed for the generator model proposed. This test may be performed using any prime mover.

(1) Start and operate the generator set at rate voltage, no load, rated frequency, and under control of the voltage regulator. Read and record the generator frequency, line-to-neutral voltages, and the line-to-line voltages.

(2) Apply the specified load between terminals L_1-L_2, L_2-L_0, and L_3-L_0 in turn. Record all instrument readings at each line-neutral condition.

(3) Express the greatest difference between any two of the line-to-line voltages and any two of the line-to-neutral voltages as a percent of rated voltage.

(4) Compare the largest differences expressed in percent with the maximum allowable difference specified.

PART 3 EXECUTION

3.1 EXAMINATION

After becoming familiar with all details of the job, perform a Site Visit to verify the information shown on the drawings, before performing any work. Submit a letter stating the date the site was visited and listing discrepancies found. Notify the Contracting Officer in writing of any discrepancies.

3.2 GENERAL INSTALLATION

Provide clear space for operation and maintenance in accordance with NFPA 70 and IEEE C2. Submit a copy of the manufacturer's installation procedures and a detailed description of the manufacturer's recommended break-in procedure. Install pipe, duct, conduit, and ancillary equipment to facilitate easy removal and replacement of major components and parts of the engine-generator set.

3.3 PIPING INSTALLATION

Weld piping. Provide flanged valve connections. Provide flanged connections at equipment. Provide threaded connections to the engine if the manufacturers standard connection is threaded. Except where otherwise specified, use welded flanged fittings to allow for complete dismantling and removal of each piping system from the facility without disconnecting or removing any portion of any other system's equipment or piping. Make connections to equipment with vibration isolation-type flexible connectors. Support and align piping and tubing to prevent stressing of flexible hoses and connectors. Flash pipes extending through the roof. Install piping clear of windows, doors and openings, to permit thermal expansion and contraction without damage to joints or hangers, and install a 1/2 inch drain valve with cap at each low point.

The installation of gas engines must conform to the requirements of NFPA 37 and its references therein, including NFPA 54, NFPA 58, and ASME B31.3.

3.3.1 Support

Provide hangers, inserts, and supports to accommodate any insulation and conforming to MSS SP-58. Space supports no more than 7 feet on center for pipes 2 inches in diameter or less, no more than 12 feet on center for pipes larger than 2 inches but smaller than 4 inches in diameter, and not more than 17 feet on center for pipes larger than 4 inches in diameter. Provide supports at pipe bends or change of direction.

3.3.1.1 Wall

Make wall supports for pipe by suspending the pipe from appropriately sized Type 33 brackets with the appropriate ceiling and roof pipe supports.

3.3.2 Flanged Joints

Provide flanges that are Class 125 type, drilled, and of the proper size and configuration to match the equipment and engine connections. Provide gasketed flanged joints that are square and tight.

3.3.3 Cleaning

After fabrication and before assembly, piping interiors must be manually wiped clean of debris.

3.3.4 Pipe Sleeves

Fit pipes passing through construction such as ceilings, floors, or walls with sleeves. Extend each sleeve through and fasten in its respective structure and cut flush with each surface. Build the structure tightly to the sleeve. The inside diameter of each sleeve must be minimum 1/2 inch, and where pipes pass through combustible materials 1 inch larger than the outside diameter of the passing pipe or pipe insulation/covering.

3.4 ELECTRICAL INSTALLATION

Perform electrical installation in compliance with NFPA 70, IEEE C2, and Section 26 20 00 ELECTRICAL DISTRIBUTION SYSTEM. For vibration isolation, provide flexible fittings for conduit, cable trays, and raceways attached to engine-generator sets; provide flexible stranded conductor for metallic conductor cables installed on the engine generator set and from the engine generator set to equipment not mounted on the engine generator set; and provide crimp-type terminals or lugs for terminations of conductors on the engine generator set.

3.5 ONSITE INSPECTION AND TESTS

Perform and report on factory tests and inspections prior to shipment. Provide certified copies of manufacturer's test data and results. Test procedures must conform to ASME, IEEE, IEC, and ANSI standards, and to ISO requirements on testing, as appropriate and applicable. The manufacturer performing the tests must provide equipment, labor, and consumables necessary for tests and measuring and indicating devices must be certified to be within calibration. Tests must indicate satisfactory operation and attainment of specified performance. If satisfactory, equipment tested will be given a tentative approval. Equipment must not be shipped before approval of the factory test reports for the following tests.

Submit a letter giving notice of the proposed dates of onsite inspections and tests at least 14 days prior to beginning tests.

a. Submit a detailed description of the Contractor's procedures for onsite tests including the test plan and a listing of equipment necessary to perform the tests at least 14 days prior to beginning tests.

b. Submit six copies of the onsite test data described below in 8-1/2 by 11 inch binders having a minimum of 3 rings from which material may readily be removed and replaced, including a separate section for each test. Separate sections by heavy plastic dividers with tabs. Provide full size (8-1/2 by 11 inch minimum) data plots showing grid lines, with full resolution.

(1) A detailed description of the procedures for onsite tests.

(2) A list of equipment used, with calibration certifications.

(3) A copy of measurements taken, with required plots and graphs.

(4) The date of testing.

(5) A list of the parameters verified.

(6) The condition specified for the parameter.

(7) The test results, signed and dated.

(8) A description of adjustments made.

3.5.1 Test Conditions

3.5.1.1 Data

Make and record measurements of all parameters necessary to verify that each set meets specified parameters. If the results of any test step are not satisfactory, make adjustments, replacements, or repairs and repeat the step until satisfactory results are obtained. Unless otherwise indicated, record data in 15 minute intervals during engine-generator set operation and include: readings of all engine-generator set meters and gauges for electrical and power parameters; oil pressure; ambient temperature; and engine temperatures available from meters and gauges supplied as permanent equipment on the engine-generator set. Perform electrical measurements in accordance with IEEE 120. Definitions of terms are in accordance with IEEE 100. Provide temperature limits in the rating of electrical equipment and for the evaluation of electrical insulations in accordance with IEEE 1.

3.5.1.2 Power Factor

Submit the generator capability curve showing generator kVA output capability (kW vs. kvar) for both leading and lagging power factors ranging from 0 to 1.0. For all engine-generator set operating tests the load power factor must be the power factor specified in the engine-generator set parameter schedule.

3.5.1.3 Contractor Supplied Items

Provide equipment and supplies required for inspections and tests including fuel, test instruments, and loadbanks at the specified power factors.

3.5.1.4 Instruments

Verify readings of panel gauges, meters, displays, and instruments provided as permanent equipment during test runs, using test instruments of greater precision and accuracy. Test instrument accuracy must be within the following: current plus or minus 1.5 percent, voltage plus or minus 1.5 percent, real power plus or minus 1.5 percent, reactive power plus or minus 1.5 percent, power factor plus or minus 3 percent, frequency plus or minus 0.5 percent. Calibrate test instruments by a recognized standards laboratory within 30 days prior to testing.

3.5.1.5 Sequence

Provide the sequence of testing as specified in the approved testing plan unless variance is authorized by the Contracting Officer. Perform field testing in the presence of the Contracting Officer. Schedule and sequence tests in order to optimize run-time periods; however, follow the general order of testing: Construction Tests; Inspections; Pre-operational Tests; Safety Run Tests; Performance Tests; and Final Inspection.

3.5.2 Construction Tests

Perform individual component and equipment functional tests for fuel piping, coolant piping, and lubricating-oil piping, electrical circuit continuity, insulation resistance, circuit protective devices, and equipment not provided by the engine-generator set manufacturer prior to connection to the engine-generator set.

3.5.2.1 Piping Test

a. Flush lube-oil and fuel-oil piping with the same type of fluid intended to flow through the piping, until the outflowing fluid has no obvious sediment or emulsion.

b. Test fuel piping which is external to the engine-generator set in accordance with NFPA 30. Pressure all remaining piping which is external to the engine-generator set with air pressure at 150 percent of the maximum anticipated working pressure, but not less than 150 psi, for a period of 2 hours to prove the piping has no leaks. If piping is to be insulated, perform the test before the insulation is applied.

3.5.2.2 Electrical Equipment Tests

a. Perform low-voltage cable insulation integrity tests for cables connecting the generator breaker to the automatic transfer switch. Test low-voltage cable, complete with splices, for insulation resistance after the cables are installed, in their final configuration, ready for connection to the equipment, and prior to energization. Apply a test voltage of 500 volts dc for one minute between each conductor and ground and between all possible combinations conductors in the same trench, duct, or cable, with all other conductors in the same trench, duct, or conduit. Provide the minimum value of insulation as follows:

(1) R in meg-ohms = (rated voltage in kV plus 1) x 304.8/(length of cable in meters)

(2) R in meg-ohms = (rated voltage in kV plus 1) x 1000/(length of cable in feet)

(3) Each cable failing this test must be repaired or replaced. The repair cable must be retested until failures have been eliminated.

b. Ground-Resistance Tests. Measure the resistance of each grounding electrode and the ground ring using the fall-of-potential method defined in IEEE 81. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. Take measurements in normally dry weather, not less than 48 hours after rainfall. Provide site diagram indicating location of test probes with associated distances, and provide a plot of resistance vs.

distance. The combined resistance of separate systems may be used to meet the requirements resistance, but the specified number of electrodes must still be provided as follows:

(1) Single rod electrode - 10 ohms.

c. Examine and test circuit breakers and switchgear in accordance with the manufacturer's published instructions for functional testing.

3.5.3 Inspections

Perform the following inspections jointly by the Contracting Officer and the Contractor, after complete installation of each engine-generator set and its associated equipment, and prior to startup of the engine-generator set. Submit a letter certifying that all facilities are complete and functional; that each system is fully functional; and that each item of equipment is complete, free from damage, adjusted, and ready for beneficial use. Perform checks applicable to the installation. Document and submit the results of those which are physical inspections (I) in accordance with paragraph SUBMITTALS. Present manufacturer's data for the inspections designated (D) at the time of inspection. Verify that equipment type, features, accessibility, installation and condition are in accordance with the contract specification. Provide manufacturer's statements to certify provision of features which cannot be verified visually.

Drive belts	I
Governor type and features	I
Engine timing mark	I
Starting motor	I
Starting aids	I
Coolant type and concentration	D
Radiator drains	I
Block coolant drains	I
Coolant fill level	I
Coolant line connections	I
Coolant hoses	I
Combustion air filter	I
Intake air silencer	I
Lube oil type	D
Lube oil sump drain	I
Lube-oil filter	I

Lube-oil level indicator	I
Lube-oil fill level	I
Lube-oil line connections	I
Lube-oil lines	I
Fuel type	D
Fuel level	I
Fuel-line connections	I
Fuel lines	I
Fuel filter	I
Access for maintenance	I
Voltage regulator	I
Battery-charger connections	I
Wiring and terminations	I
Instrumentation	I
Hazards to personnel	I
Base	I
Nameplates	I
Paint	I
Exhaust-heat system	I
Exhaust muffler	I
Switchboard	I
Switchgear	I
Access provided to controls	I
Enclosure is weather resistant	I
Engine and generator mounting bolts (application)	I

3.5.4 Engine Tests

Perform customary commercial factory tests in accordance with ISO 3046 on each engine and associated engine protective device, including, but not limited to the following:

a. Perform dynamometer test at rated power. Record horsepower at rated speed and nominal characteristics such as lubricating oil pressure, jacket water temperature, and ambient temperature.

b. Test and record the values at which the low oil pressure alarm and protective shutdown devices actuate prior to assembly on the engine.

c. Test and record values at witch the high jacket water temperature alarm and protective shutdown devices actuate prior to assembly on the engine.

3.5.5 Generator Tests

Tests must be performed on the complete factory assembled generator prior to shipment. Conduct tests in accordance with IEEE 115, IEC 60034-2A, and NEMA MG 00001.

3.5.5.1 Routine Tests

Perform the following routine tests on the generators and their exciters:

a. Resistance of armature and field windings.

b. Mechanical balance.

c. Phases sequence.

d. Open circuit saturation curve and phase (voltage) balance test.

e. Insulation resistance of armature and field windings.

f. High potential tes.t

3.5.5.2 Design Tests

Submit the following design tests made on prototype machines that are physically and electrically identical to the generators specified.

a. Temperature rise test

b. Short circuit saturation curve and current balance test

3.5.6 Assembled Engine-Generator Set Tests

Perform the following tests on the assembled engine-generator set.

3.5.6.1 Initial Stabilization Readings

Operate the engine-generator set and allow the set to stabilize at rated kW at rated power factor, rated voltage, and rated frequency. During this period record instrument readings for output power (kW), terminal voltage, line current, power factor, frequency (rpm) generator (exciter) field voltage and current, lubricating oil pressure, jacket water temperature,

and ambient temperature at minimum intervals of 15 minutes. Adjust the load, voltage, and frequency to maintain rated load at rated voltage and frequency. Adjustments to load, voltage, or frequency controls must be recorded on the data sheet at the time of adjustment. Stabilization must be considered to have occurred when four consecutive voltage and current recorded readings of the generator (or exciter) field either remain unchanged or have only minor variations about an equilibrium condition with no evident continued increase or decrease in value after the last adjustment to the load, voltage, or frequency has been made.

3.5.6.2 Regulator Range Test

Remove load and record instrument readings (after transients have subsided). Adjust voltage to the maximum attainable value or to a value just prior to actuation of the overvoltage protection device. Apply rated load and adjust voltage to the minimum attainable value or a value just prior to activation of the under-voltage protection device. The data sheets must indicate the voltage regulation as a percent of rated voltage and the maximum and minimum voltages attainable. Voltage regulation must be defined as follows:

$$\text{Percent Regulation} = \frac{(\text{No-Load Voltage}) - (\text{Rated-Load Voltage})}{(\text{Rated-Load Voltage})} \times 100$$

3.5.6.3 Frequency Range Test

Adjust the engine-generator set frequency for the maximum attainable frequency at rated load. Record instrument readings. Adjust the engine-generator set frequency for the specified minimum attainable frequency at rated load. Record instrument readings. Reduce the load to zero and adjust the engine-generator set frequency for the maximum attainable frequency. Record instrument readings. Adjust the engine-generator set frequency for the minimum attainable frequency. Record instrument readings. The data sheet must show the maximum and minimum frequencies attained at rated load, and at no load.

3.5.6.4 Transient Response Test

Drop the load to no load and re-apply rated load three times to ensure that the no load and rated load voltage and frequency values are repeatable and that the frequency and voltage regulation is within the limits specified. Record generator terminal voltage and frequency using a high speed strip chart recorder. The data sheet must show the following results:

a. Frequency

(1) Stability bandwidth or deviation in percent of rated frequency.

(2) Recovery time.

(3) Overshoot and undershoot.

b. Voltage

(1) Stability bandwidth or deviation in percent of rated voltage.

(2) Recovery time.

(3) Overshoot and undershoot.

3.5.7 Pre-operational Tests

3.5.7.1 Protective Relays

Visually and mechanically inspect, adjust, test, and calibrate protective relays in accordance with the manufacturer's published instructions. Include pick-up, timing, contact action, restraint, and other aspects necessary to ensure proper calibration and operation. Implement relay settings in accordance with the installation coordination study. Manually or electrically operate relay contacts to verify that the proper breakers and alarms initiate. Field test relaying current transformers in accordance with IEEE C57.13.1.

3.5.7.2 Insulation Test

Test generator and exciter circuits insulation resistance in accordance with IEEE 43. Take stator readings including generator leads to main disconnect at the circuit breaker. Record results of insulation resistance tests. Readings must be within limits specified by the manufacturer. Verify mechanical operation, insulation resistance, protective relay calibration and operation, and wiring continuity of main disconnect assembly. Do not damage generator components during test.

3.5.7.3 Engine-Generator Connection Coupling Test

When the generator provided is a two-bearing machine, inspect and check the engine-generator connection coupling by dial indicator to prove that no misalignment has occurred. Use the dial indicator to measure variation in radial positioning and axial clearance between the coupling halves. Take readings at four points, spaced 90 degrees apart. Align solid couplings and pin-type flexible couplings within a total indicator reading of 0.0005 to 0.001 inch for both parallel and angular misalignment. For gear-type or grid-type couplings, 0.002 inch will be acceptable.

3.5.8 Safety Run Test

For the following tests, repeat the associated safety tests if any parts are changed, or adjustments made to the generator set, its controls, or auxiliaries.

a. Perform and record engine manufacturer's recommended prestarting checks and inspections.

b. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections during a reasonable warm-up period.

c. Activate the manual emergency stop switch and verify that the engine stops.

d. Remove the high and pre-high lubricating oil temperature sensing elements from the engine and temporarily install a temperature gauge in their normal locations on the engine (required for safety, not for recorded data). Where necessary provide temporary wiring harness to connect the sensing elements to their permanent electrical leads.

e. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections during a reasonable warm-up period. Operate the engine-generator set at no load until the output voltage and frequency stabilize. Monitor the temporarily installed temperature gauges. If either temperature reading exceeds the value required for an alarm condition, activate the manual emergency stop switch.

f. Immerse the elements in a vessel containing controlled-temperature hot oil and record the temperature at which the pre-high alarm activates and the temperature at which the engine shuts down. Remove the temporary temperature gauges and reinstall the temperature sensors on the engine.

g. Remove the high and pre-high coolant temperature sensing elements from the engine and temporarily install a temperature gauge in their normal locations on the engine (required for safety, not for recorded data). Where necessary provide temporary wiring harness to connect the sensing elements to their permanent electrical leads.

h. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections during a reasonable warm-up period. Operate the engine generator-set at no load until the output voltage and frequency stabilize.

i. Immerse the elements in a vessel containing controlled-temperature hot oil and record the temperature at which the pre-high alarm activates and the temperature at which the engine shuts down. Remove the temporary temperature gauges and reinstall the temperature sensors on the engine.

j. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections during a reasonable warm-up period.

k. Operate the engine generator-set for at least 2 hours at 75 percent of Service Load.

l. Verify proper operation and set-points of gauges and instruments.

m. Verify proper operation of ancillary equipment.

n. Manually adjust the governor to increase engine speed past the over-speed limit. Record the RPM at which the engine shuts down.

o. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections and operate the engine generator-set for at least 15 minutes at 75 percent of Service Load.

p. Manually adjust the governor to increase engine speed to within 2 percent of the over-speed trip speed previously determined and operate at that point for 5 minutes. Manually adjust the governor to the rated frequency.

q. Manually fill the day tank to a level above the overfill limit. Record the level at which the overfill alarm sounds. Verify shutdown of the fuel transfer pump. Drain the day tank down below the overfill limit.

r. Shut down the engine. Remove the time-delay low lube oil pressure alarm bypass and try to start the engine.

s. Attach a manifold to the engine oil system (at the oil pressure sensor port) that contains a shutoff valve in series with a connection for the engine's oil pressure sensor followed by an oil pressure gauge ending with a bleed valve. Move the engine's oil pressure sensor from the engine to the manifold. Open the manifold shutoff valve and close the bleed valve.

t. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections and operate the engine generator-set for at least 15 minutes at 75 percent of Service Load.

u. Close the manifold shutoff valve. Slowly allow the pressure in the manifold to bleed off through the bleed valve while watching the pressure gauge. Record the pressure at which the engine shuts down. Catch oil spillage from the bleed valve in a container. Add the oil from the container back to the engine, remove the manifold, and reinstall the engine's oil pressure sensor on the engine.

v. Start the engine, record the starting time, make and record engine manufacturer's after-starting checks and inspections and operate the engine generator-set for at least 15 minutes at 100 percent of Service Load. Record the maximum sound level in each frequency band at a distance of 75 feet from the end of the exhaust and air intake piping directly along the path of intake and discharge for horizontal piping; or at a radius of 75 feet from the engine at 45 degrees apart in all directions for vertical piping. If a sound limiting enclosure is provided, modify or replace the enclosure, the muffler, and intake silencer must be modified or replaced as required to meet the sound requirements contained within this specification

w. Manually drain off fuel slowly from the day tank to empty it to below the low fuel level limit and record the level at which the audible alarm sounds. Add fuel back to the day tank to fill it above low level alarm limits.

3.5.9 Performance Tests

In the following tests, where measurements are to be recorded after stabilization of an engine-generator set parameter (voltage, frequency, current, temperature, etc.), stabilization is considered to have occurred when measurements are maintained within the specified bandwidths or tolerances, for a minimum of four consecutive readings. For the following tests, repeat the associated tests if any parts are changed, or adjustments made to the generator set, its controls, or auxiliaries.

3.5.9.1 Continuous Engine Load Run Test

Test the engine-generator set and ancillary systems at service load to demonstrate durability; verify that heat of extended operation does not adversely affect or cause failure in any part of the system; and check all parts of the system. If the engine load run test is interrupted for any reason, repeat the entire test. After each change in load in the following test, measure the vibration at the end bearings (front and back of engine, outboard end of generator) in the horizontal, vertical, and axial directions. Verify that the vibration is within the allowable

range. Take data taken at 15 minute intervals and include the following:

Electrical: Output amperes, voltage, real and reactive power, power factor, frequency.

Pressure: Lube-oil.

Temperature: Coolant, Lube-oil, Exhaust, Ambient.

a. Perform and record engine manufacturer's recommended prestarting checks and inspections. Include as a minimum checking of coolant fluid, fuel, and lube-oil levels.

b. Start the engine, make and record engine manufacturer's after-starting checks and inspections during a reasonable warmup period.

c. Operate the engine generator-set for 2 hours at 75 percent of Service Load.

d. Increase load to 100 percent of Service Load and operate the engine generator-set for 4 hours.

e. For prime rated units, increase load to 110 percent of Service Load and operate the engine generator-set for 2 hours.

f. Decrease load to 100 percent of Service Load and operate the engine generator-set for 2 hours or until all temperatures have stabilized.

g. Remove load from the engine-generator set.

3.5.9.2 Voltage and Frequency Droop Test

For the following steps, verify that the output voltage and frequency return to and stabilize within the specified bandwidth values following each load change. Record the generator output frequency and line-line and line-neutral voltages following each load change.

a. With the generator operating at no load, adjust voltage and frequency to rated voltage and frequency.

b. Increase load to 100 percent of Rated Output Capacity. Record the generator output frequency and line-line and line-neutral voltages.

c. Calculate the percent droop for voltage and frequency with the following equations.

$$\text{Voltage droop percent} = \frac{\text{No-load volts - rated output capacity volts}}{\text{Rated output capacity volts}} \times 100$$

$$\text{Frequency droop percent} = \frac{\text{No load hertz - rated output capacity hertz}}{\text{Rated output capacity volts}} \times 100$$

d. Repeat steps a. through c. two additional times without making any adjustments.

3.5.9.3 Voltage Regulator Range Test

a. While operating at no load, verify that the voltage regulator adjusts from 90 to 110 percent of rated voltage.

b. Increase load to 100 percent of Rated Output Capacity. Verify that the voltage regulator adjusts from 90 to 110 percent of rated voltage.

3.5.9.4 Governor Adjustment Range Test

a. While operating at no load, verify that the governor adjusts from 90 to 110 percent of rated frequency.

b. Increase load to 100 percent of Rated Output Capacity. Verify that the governor adjusts from 90 to 110 percent of rated frequency.

3.5.9.5 Frequency and Voltage Stability and Transient Response

Verify that the engine-generator set responds to addition and dropping of blocks of load in accordance with the transient response requirements. Document maximum voltage and frequency variation from bandwidth and verify that voltage and frequency return to and stabilize within the specified bandwidth, within the specified response time period. Document results in tabular form and with high resolution, high speed strip chart recorders or comparable digital recorders, as approved by the Contracting Officer. Include the following tabular data:

(1) Ambient temperature (at 15 minute intervals).

(2) Generator output current (before and after load changes).

(3) Generator output voltage (before and after load changes).

(4) Frequency (before and after load changes).

(5) Generator output power (before and after load changes.

(6) Include the actual instrument trace of voltage and frequency in graphic representations showing:

Charts marked at start of test; observed steady-state band; mean of observed band; momentary overshoot and undershoot (generator terminal voltage and frequency) and recovery time for each load change together with the voltage and frequency maximum and minimum trace excursions for each steady state load condition prior to and immediately following each load change. Generator terminal voltage and frequency transient recovery time for each step load increase and decrease.

a. Perform and record engine manufacturer's recommended prestarting checks and inspections.

b. Start the engine, make and record engine manufacturer's after-starting checks and inspections during a reasonable warm-up period and no load. Verify stabilization of voltage and frequency within specified bandwidths.

c. With the unit at no load, apply the Maximum Step Load Increase.

d. Apply load in steps equal to the Maximum Step Load Increase until the

addition of one more step increase will exceed the Service Load.

e. Decrease load to the unit such that addition of the Maximum Step Load Increase will load the unit to 100 percent of Service Load.

f. Apply the Maximum Step Load Increase.

g. Decrease load to zero percent in steps equal to the Maximum Step Load Decrease.

h. Repeat steps c. through g.

3.5.10 Automatic Operation Tests for Stand-Alone Operation

Test the automatic loading system to demonstrate automatic starting, of each engine-generator set. Utilize the actual loads to be served for this test, and the loading sequence is the indicated sequence. Perform this test for a minimum of two successive, successful tests. Include the following data:

(1) Ambient temperature (at 15 minute intervals).

(2) Generator output current (before and after load changes).

(3) Generator output voltage (before and after load changes).

(4) Generator output frequency (before and after load changes).

a. Initiate loss of the primary power source and verify automatic sequence of operation.

b. Restore the primary power source and verify sequence of operation.

c. Verify resetting of controls to normal.

3.6 GROUNDING

NFPA 70 and IEEE C2, except that grounding systems must have a resistance to solid earth ground not exceeding 5 ohms.

3.6.1 Grounding Electrodes

Provide driven ground rods as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Connect ground conductors to the upper end of ground rods by exothermic weld or compression connector. Provide compression connectors at equipment end of ground conductors.

3.6.2 Engine-Generator Set Grounding

Provide separate copper grounding conductors and connect them to the ground system as indicated. When work in addition to that indicated or specified is required to obtain the specified ground resistance, the provision of the contract covering "Changes" must apply.

3.6.3 Connections

Make joints in grounding conductors by exothermic weld or compression connector. Exothermic welds and compression connectors must be installed as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION

paragraph regarding GROUNDING.

3.6.4 Grounding and Bonding Equipment

UL 467, except as indicated or specified otherwise.

3.7 START-UP ENGINEER

Provide the services of a qualified factory trained start-up engineer, regularly employed by the engine-generator set manufacturer. The start-up services must include conducting preliminary operations and functional acceptance tests. The start-up engineer must be present at the engine generator set installation-site, full-time, while preliminary operations and functional acceptance tests are being conducted.

3.8 PREREQUISITES FOR FUNCTIONAL ACCEPTANCE TESTING

Completion of the following requirements is mandatory prior to scheduling functional acceptance tests for the engine-generator set and auxiliary equipment.

3.8.1 Performance of Acceptance Checks and Tests

The acceptance checks and tests must be accomplished by the testing organization as described in Section 26 08 00 APPARATUS INSPECTION AND TESTING.

3.8.2 Generator Sets

Complete as specified in the paragraph ACCEPTANCE CHECKS AND TESTS.

3.8.2.1 Automatic Transfer Switches

Complete acceptance checks and tests as specified in Section 26 36 23 AUTOMATIC TRANSFER SWITCHES AND BY-PASS/ISOLATION SWITCH.

3.8.3 Preliminary Operations

The start-up engineer must conduct manufacturer recommended start-up procedures and tests to verify that the engine-generator set and auxiliary equipment are ready for functional acceptance tests. Give the Contracting Officer 15 days' advance notice that preliminary operations will be conducted. After preliminary operation has been successfully conducted, the start-up engineer will notify the Contracting Officer in writing stating the engine-generator set and auxiliary equipment are ready for functional acceptance tests.

3.8.4 Preliminary Assembled Operation and Maintenance Manuals

Preliminary assembled operation and maintenance manuals must have been submitted to and approved by the Contracting Officer. Manuals must be prepared as specified in the paragraph ASSEMBLED OPERATION AND MAINTENANCE MANUALS.

3.8.5 Functional Acceptance Test Procedure

Test procedure must be prepared by the start-up engineer specifically for the engine-generator set and auxiliary equipment. The test agenda must cover the requirements specified in the paragraph FUNCTIONAL ACCEPTANCE

TESTS. The test procedure must indicate in detail how tests are to be conducted. A statement of the tests that are to be performed without indicating how the tests are to be performed is not acceptable. Indicate what work is planned on each workday and identify the calendar dates of the planned workdays. Specify what additional technical support personnel is needed such as factory representatives for major equipment. Specify on which testing workday each technical support personnel is needed. Data recording forms to be used to document test results are to be submitted with the proposed test procedure. A list of test equipment and instruments must also be included in the test procedure.

3.8.6 Test Equipment

Test equipment and instruments must be on hand prior to scheduling field tests or, subject to Contracting Officer approval, evidence must be provided to show that arrangements have been made to have the necessary equipment and instruments on-site prior to field testing.

3.9 FIELD QUALITY CONTROL

Give Contracting Officer 30 days' notice of dates and times scheduled for tests which require the presence of the Contracting Officer. The Contracting Officer will coordinate with the using activity and schedule a time that will eliminate or minimize interruptions and interference with the activity operations. The Contractor must be responsible for costs associated with conducting tests outside of normal working hours and with incorporating special arrangements and procedures, including temporary power conditions. The Contractor must provide labor, equipment, fuel, test load, and consumables required for the specified tests. The test load must be a cataloged product. Calibration of measuring devices and indicating devices must be certified. Refer to Section 26 20 00 ELECTRICAL DISTRIBUTION SYSTEM, for requirements for a cataloged product. Perform the following field tests.

3.9.1 Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations, and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.9.1.1 Circuit Breakers - Low Voltage Insulated Case/Molded Case

a. Visual and Mechanical Inspection

(1) Compare nameplate data with specifications and approved shop drawings.

(2) Inspect circuit breaker for correct mounting.

(3) Operate circuit breaker to ensure smooth operation.

(4) Inspect case for cracks or other defects.

(5) Verify tightness of accessible bolted connections and cable connections by calibrated torque-wrench method. Thermo-graphic survey is not required.

(6) Inspect mechanism contacts and arc chutes in unsealed units.

b. Electrical Tests

(1) Perform contact-resistance tests.

(2) Perform insulation-resistance tests.

(3) Adjust breaker(s) for final settings in accordance with engine-generator set manufacturer's requirements.

3.9.1.2 Current Transformers

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Verify correct connection.

(4) Verify that adequate clearances exist between primary and secondary circuit.

(5) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method. Thermo-graphic survey is not required.

(6) Verify that all required grounding and shorting connections provide good contact.

b. Electrical Tests

(1) Perform insulation-resistance tests.

(2) Perform polarity tests.

(3) Perform ratio-verification tests.

3.9.1.3 Metering and Instrumentation

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Verify tightness of electrical connections.

b. Electrical Tests

(1) Determine accuracy of meters at 25, 50, 75, and 100 percent of full scale.

(2) Calibrate watt-hour meters according to manufacturer's published data.

(3) Verify all instrument multipliers.

(4) Electrically confirm that current transformer secondary circuits are intact.

3.9.1.4 Battery Systems

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method. Thermo-graphic survey is not required.

(4) Measure electrolyte specific gravity and temperature and visually check fill level.

(5) Verify adequacy of battery support racks, mounting, anchorage, and clearances.

b. Electrical Tests

(1) Set charger float and equalizing voltage levels.

(2) Verify all charger functions and alarms.

(3) Measure each cell voltage and total battery voltage with charger energized and in float mode of operation.

(4) Perform a capacity load test.

3.9.1.5 Engine-Generator Set

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Inspect for correct anchorage and grounding.

b. Electrical and Mechanical Tests

(1) Perform an insulation-resistance test on generator winding with respect to ground. Calculate polarization index.

(2) Perform phase rotation test to determine compatibility with load requirements.

3.9.1.6 Grounding System

a. Visual and Mechanical Inspection

(1) Inspect ground system for compliance with contract plans and specifications.

b. Electrical Tests

(1) Perform ground-impedance measurements utilizing the fall-of-potential method defined in IEEE 81. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. Take measurements in normally dry weather, not less than 48 hours after rainfall. Provide site diagram indicating location of test probes with associated distances, and provide a plot of resistance vs. distance.

3.9.2 Functional Acceptance Tests

The tests must be performed by the start-up engineer. Upon successful test completion, the start-up engineer must provide the Contracting Officer with a written test report within 15 calendar days showing the tests performed and the results of each test. The report must include the completed approved test data forms and certification from the start-up engineer that the test results fall within the manufacturer's recommended limits and meet the specified requirements performance. The report must be dated and signed by the start-up engineer, and submitted for approval by the Contracting Officer. The Contracting Officer will witness final acceptance tests. Testing must include, but not be limited to, the following:

a. Verify proper functioning of each engine protective shutdown device and pre-shutdown alarm device. Testing of the devices must be accomplished by simulating device actuation and observing proper alarm and engine shutdown operation.

b. Verify proper functioning of the engine over-speed trip device. Testing of the over-speed trip device must be accomplished by raising the speed of the engine-generator set until an over-speed trip is experienced.

c. Verify proper functioning of the crank cycle/terminate relay. Testing of the relay must be accomplished by engaging the starter motor with the engine being prevented from running. Observe the complete crank/rest cycle as described in the paragraph STARTING SYSTEM.

d. Verify proper functioning of the following automatic and manual operations. Testing must include, but not be limited to, the following:

(1) Loss of Utility: Initiate a normal power failure with connected test load of rated kW at 1.0 power factor. Record time delay on start, cranking time until engine starts and runs, time to come up to operating speed, voltage and frequency overshoot, and time to achieve steady state conditions with all switches transferred to emergency position.

(2) Return of Utility: Return normal power and record time delay on retransfer for each automatic transfer switch, and time delay on engine cool-down and shutdown.

(3) Manual starting.

(4) Emergency stop.

e. Operate the engine-generator set at rated current (amperes) until the

jacket water temperature stabilizes. Stabilization will be considered to have occurred when three consecutive temperature readings remain unchanged. Continue to operate the generator set for an additional 2 hours. Record instrument readings for terminal voltage, line current, frequency (Hz), engine speed rpm, lubricating oil pressure, jacket water temperature, and ambient temperature at 5 minute intervals for first 15 minutes and at 15 minute intervals thereafter.

3.10 DEMONSTRATION

Upon completion of the work and at a time approved by the Contracting Officer, the Contractor must provide instructions by a qualified instructor to the Government personnel in the proper operation and maintenance of the equipment. Government personnel must receive training comparable to the equipment manufacturer's factory training. The duration of instruction must be for not less than one 8 hour working day for instruction of operating personnel and not less than one 8 hour working day for instruction of maintenance personnel.

3.10.1 Instructor's Qualification Resume

Instructors must be regular employees of the engine-generator set manufacturer. The instruction personnel provided to satisfy the requirements above must be factory certified by the related equipment manufacturer to provide instruction services. Submit the name and qualification resume of instructor to the Contracting Officer for approval.

3.10.2 Training Plan

Submit training plan 30 calendar days prior to training sessions. Training plan must include scheduling, content, outline, and training material (handouts). Content must include, but not be limited to, the following:

3.10.2.1 Operating Personnel Training

This instruction includes operating the engine-generator set, auxiliary equipment including automatic transfer switches in all modes, and the use of all functions and features specified.

3.10.2.2 Maintenance Personnel Training

Training must include mechanical, hydraulic, electrical, and electronic instructions for the engine-generator set and auxiliary equipment including automatic transfer switches.

a. Mechanical Training: Must include at least the following:

(1) A review of mechanical diagrams and drawings.

(2) Component location and functions.

(3) Troubleshooting procedures and techniques.

(4) Repair procedures.

(5) Assembly/disassembly procedures.

(6) Adjustments (how, when, and where).

(7) Preventive maintenance procedures.

(8) Review of flow diagram.

(9) Valve locations and function.

(10) Valve and hydraulic equipment adjustment and maintenance procedures.

(11) Hydraulic system maintenance and servicing.

(12) Lubrication points, type, and recommended procedures and frequency.

b. Electrical and Electronic Maintenance Training: Must include at least the following:

(1) A review of electrical and electronic systems including wiring diagrams and drawings.

(2) Troubleshooting procedures for the machine and control systems.

(3) Electrical and electronic equipment servicing and care.

(4) Use of diagnostics to locate the causes of malfunction.

(5) Procedures for adjustments (locating components, adjustments to be made, values to be measured, and equipment required for making adjustments).

(6) Maintenance and troubleshooting procedures for microprocessor or minicomputer where applicable.

(7) Circuit board repair procedures where applicable (with schematics provided).

(8) Use of diagnostic tapes.

(9) Recommended maintenance servicing and repair for motors, switches, relays, solenoids, and other auxiliary equipment and devices.

3.11 ONSITE TRAINING

Conduct a training course for the operating staff as designated by the Contracting Officer. The training period must consist of a total 8 hours of normal working time and must start after the system is functionally completed but prior to final acceptance.

a. Submit a letter giving the date proposed for conducting the onsite training course, the agenda of instruction, a description of the digital video recording to be provided. The course instructions must cover pertinent points involved in operating, starting, stopping, servicing the equipment, as well as major elements of the operation and maintenance manuals. Additionally, the course instructions must demonstrate routine maintenance procedures as described in the operation and maintenance manuals.

b. Submit a digital video recording of the entire training session.

c. One full size reproducible Mylar ach drawing must accompany the booklets. Mylars must be rolled and placed in a heavy cardboard tube with threaded caps on each end. The manual must include step-by-step procedures for system startup, operation, and shutdown; drawings, diagrams, and single-line schematics to illustrate and define the electrical, mechanical, and hydraulic systems together with their controls, alarms, and safety systems; the manufacturer's name, model number, and a description of equipment in the system. The instructions must include procedures for interface and interaction with related systems to include automatic transfer switches. Each booklet must include a CD containing an ASCII file of the procedures.

d. Provide approved operation and maintenance manuals for the training course. Post approved instructions prior to the beginning date of the training course. Coordinate the training course schedule with the using service's work schedule, and submit for approval 14 days prior to beginning date of proposed beginning date of training.

3.12 INSTALLATION

Installation must conform to the applicable requirements of IEEE C2, NFPA 30, NFPA 37, and NFPA 70.

3.13 FINAL TESTING AND INSPECTION

a. Start the engine, record the starting time, make and record all engine manufacturer's after-starting checks and inspections during a reasonable warm-up period.

b. Increase the load in steps no greater than the Maximum Step Load Increase to 100 percent of Service Load, and operate the engine-generator set for at least 30 minutes. Measure the vibration at the end bearings (front and back of engine, outboard end of generator) in the horizontal, vertical, and axial directions. Verify that the vibration is within the same range as previous measurements and is within the required range.

c. Remove load and shut down the engine-generator set after the recommended cool down period.

d. Remove the lube oil filter and have the oil and filter examined by the engine manufacturer for excessive metal, abrasive foreign particles, etc. Verify any corrective action for effectiveness by running the engine for 8 hours at Service Load, then re-examine the oil and filter.

e. Remove the fuel filter and examine the filter for trash, abrasive foreign particles, etc.

f. Visually inspect and check engine and generator mounting bolts for tightness and visible damage.

g. Replace air, oil, and fuel filters with new filters.

3.14 MANUFACTURER'S FIELD SERVICE

The engine generator-set manufacturer must furnish a qualified representative to supervise the installation of the engine generator-set,

assist in the performance of the onsite tests, and instruct personnel as to the operational and maintenance features of the equipment.

3.15 POSTED DATA AND INSTRUCTIONS

Post Data and Instructions prior to field acceptance testing of the engine generator set.

a. Provide two sets of typed instructions/data in 8-1/2 x 11 inch format, laminated in weatherproof plastic, and placed in three-ring vinyl binders. Place the binders as directed by the Contracting Officer. Provide the instructions prior to acceptance of the engine generator set installation.

b. Include a one-line diagram, wiring and control diagrams and a complete layout of the system in the first set. Include the condensed operating instructions describing manufacturer's pre-start checklist and precautions; startup procedures for test-mode, manual-start mode, and automatic-start mode (as applicable); running checks, procedures, and precautions; and shutdown procedures, checks, and precautions in the second set. Include procedures for interrelated equipment (such as heat recovery systems, co-generation, load-shedding, and automatic transfer switches).

c. Submit instructions including: the manufacturers pre-start checklist and precautions; startup procedures for test-mode, manual-start mode, and automatic-start mode (as applicable); running checks, procedures, and precautions; and shutdown procedures, checks, and precautions. Include procedures for interrelated equipment (such as heat recovery systems, co-generation, load-shedding, and automatic transfer switches). Provide weatherproof instructions, laminated in plastic, and post where directed.

3.16 ACCEPTANCE

Submit drawings which accurately depict the as-built configuration of the installation, upon acceptance of the engine-generator set installation. Revise layout drawings to reflect the as-built conditions and submit them with the as-built drawings. Final acceptance of the engine-generator set will not be given until the Contractor has successfully completed all tests and all defects in installation material or operation have been corrected.

-- End of Section --

SECTION 26 36 23

AUTOMATIC TRANSFER SWITCHES AND BY-PASS/ISOLATION SWITCH
02/26

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM B117	(2025) Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM D709	(2017) Standard Specification for Laminated Thermosetting Materials

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 602	(2007) Recommended Practice for Electric Systems in Health Care Facilities - White Book

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2025) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ICS 2	(2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA ICS 4	(2015) Application Guideline for Terminal Blocks
NEMA ICS 6	(1993; R 2016) Industrial Control and Systems: Enclosures

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2026; TIA 26-1; ERTA 26-1; TIA 26-2; TIA 26-3; TIA 26-4; TIA 26-5; TIA 26-6; TIA 26-7; ERTA 26-2; ERTA 26-3) National Electrical Code
NFPA 99	(2024, TIA 24-2) Health Care Facilities Code

NFPA 110	(2025) Standard for Emergency and Standby Power Systems

UL SOLUTIONS (UL)

UL 508	(2018; Reprint Jul 2021) UL Standard for Safety Industrial Control Equipment
UL 1008	(2022) UL Standard for Safety Transfer Switch Equipment
UL 1066	(2022) UL Standard for Safety Low-Voltage AC and DC Power Circuit Breakers Used in Enclosures

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Automatic Transfer Switch Drawings; G, RO

SD-03 Product Data

Automatic Transfer Switches; G, OMA

By-Pass/Isolation Switch (BP/IS); G, OMA

SD-06 Test Reports

Acceptance Checks and Tests; G, RO

Functional Acceptance Tests; G, RO

Factory Testing; G, RO

Factory Test Reports; G, RO

SD-07 Certificates

Proof of Listing; G, RO

SD-10 Operation and Maintenance Data

Operation and Maintenance Manual; G, RO

1.3 OPERATION AND MAINTENANCE MANUAL

Assemble and bind manuals in durable, hard-covered, water resistant binders. Assemble and index the manuals per the following table of contents:

a. Manufacturer's O&M per "SD-10 Operation and Maintenance Data".

b. Catalog data required by "SD-03 Product Data"

c. Drawings required by "SD-02 Shop Drawings".

1.3.1 Additions to Operation and Maintenance Manuals

In addition to requirements of SD-10 Data Package 5, include the followings on the actual equipment provided:

a. An outline drawing, front, top, and side views.

b. Prices for spare parts and supply list.

c. Date of Purchase.

d. Corrective maintenance procedures.

e. Operating manual outlining step-by-step procedures for system startup, operation, and shutdown.

f. Include simplified wiring and control diagrams in the manual for system as installed.

g. Provide typical contact voltage drop readings under specified conditions for use during periodic maintenance. Provide instructions for determination of contact integrity.

1.4 QUALITY ASSURANCE

1.4.1 Proof of Listing

Submit proof of listing by UL 1008.

1.4.2 Automatic Transfer Switch Drawings

Include the following as a minimum:

a. An outline drawing, including front, top, and side views.

b. Provide a nameplate of corrosion-resistant material with not less than 1/8 inch tall characters showing manufacturer's name and equipment ratings. Mount nameplate to front of enclosure and meet the nameplate requirements of NEMA ICS 2.

c. Provide detail drawings that include manufacturer's name and catalog number, electrical ratings, total system transfer statement, reduced normal supply voltage at which transfer to the alternate supply is initiated, transfer delay times, short-circuit current rating, wiring diagram, description of interconnections, testing instructions, acceptable conductor type for terminals, tightening torque for each wire connector, and other required UL 1008 markings.

d. Submit interface equipment connection diagram showing conduit and wiring between ATS and related equipment. Provide diagrams showing interlocking provisions and cautionary notes, if any.

e. Drawings are to indicate adequate clearance for operation, maintenance, and replacement of operating equipment devices.

1.4.3 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship must be in accordance with the mandatory and advisory provisions of NFPA 70 unless more stringent requirements are specified or indicated

1.4.4 Standard Product

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship, and:

a. Have been in satisfactory commercial or industrial use for 2 years prior to bid opening including applications of equipment and materials under similar circumstances and of similar size.

b. Have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.

c. Where two or more items of the same class of equipment are required, provide products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.4.4.1 Alternative Qualifications

Products having less than a 2-year field service record are acceptable if the manufacturer has been regularly engaged in the design and production of automatic transfer switches and if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.4.4.2 Material and Equipment Manufacturing Date

Products manufactured more than 1 years prior to date of delivery to site are not acceptable.

1.5 DELIVERY AND STORAGE

Protect equipment placed in storage from humidity and temperature variations, moisture, water intrusion, dirt, dust, or other contaminants. In harsh environments where temperatures exceed non-operational parameters established within this specification, provide an environmentally controlled equipment storage facility to ensure temperature parameters are within equipment specification. Provide documentation of same to the Government when storage is implemented.

1.6 ENVIRONMENTAL CONDITIONS

Provide an ATS that is suitable for prolonged performance under following service conditions:

a. Operating altitude: Sea level to 3,300 ft. (Systems applied at higher altitudes are to be derated in accordance with the manufacturer's

instructions).

b. Operating ambient temperature range: -40 to 122 degrees F.

c. Operating relative humidity: 0 to 90 percent, without condensation.

PART 2 PRODUCTS

2.1 AUTOMATIC TRANSFER SWITCHES

Each automatic transfer switch must be rated and marked for total system transfer and have the current and voltage ratings as indicated. Provide a switch operating mechanism that is electrically operated, have quick-make, quick-break, load break contacts, and be mechanically held in both positions. Switches utilizing circuit breakers are not acceptable. Provide an ATS that is UL listed. ATS must be manufactured and tested in accordance with applicable requirements of NEMA ICS 2, UL 1008 and UL 1066. ATS must conform to NFPA 110. Provide the ATS with the following characteristics:

a. Voltage: 240 volts ac.

b. Amperage: 400 amps ac. Provide an ATS with a continuous load current rating of the switch rating.

c. Number of Phases: One.

d. Number of Wires: Three.

e. Frequency: 60 Hz.

f. Poles: Three switched.

g. ATS Withstand Current Rating: ATS must be rated to close on and withstand the available RMS symmetrical short circuit current at the ATS terminals. The ATS must be listed in accordance with UL 1008 for 3 18 cycle close and withstand ratings. Minimum UL listed close and withstand ratings at 208 VAC must be 30 kA.

h. Nonwelding Contacts: Provide contacts that are nonwelding at the available fault current rating. Contacts must be suitable for repetitive power transfer switching. Switches rated 800 amps and above must have segmented, blow-on construction for high withstand and close-on capability and be protected by separate arcing contacts.

i. Phase Contacts: Provide contacts with silver alloy composition. Provide neutral contacts with 200 percent the current rating of the phase contacts.

j. Configuration. Provide an ATS for use in emergency systems described in NFPA 70. Provide an ATS that is listed for emergency use.

k. ATS Configuration. Provide an open transition ATS.

l. Service Entrance Rated. Provide an integrated circuit breaker and automatic transfer switch. Provide a separate deadfront compartment for the circuit breaker on switches 600 amp and larger. Provide label indicating that the ATS is the service disconnect. Provide a circuit breaker that is rated for 100 percent of the switch contact current

rating. All components, except as noted herein, are to have a continuous load rating.

m. Viewing Ports. Provide contacts that are viewable from the front of the device when the door is open. Comply with the requirements found in IEEE 602 and NFPA 99

2.1.1 Undervoltage Sensing - Normal/Preferred Source

Undervoltage Sensing - Normal Source. Provide undervoltage sensing for each phase in the normal/preferred source. Sense low phase-to-ground voltage on each phase. Provide sensing circuit with adjustable dropout, 75-98 percent of nominal value and adjustable pickup, 85-100 percent of nominal value. Factory set dropout value to 85 percent. Factory set pickup value to 90 percent.

2.1.2 Adjustable Time Delay - Override Transfer

Adjustable Time Delay - Override Transfer. For override of normal-source voltage sensing to delay transfer and engine starting signals. Engine starting control contacts with adjustable commit-to-start delay circuit, 0.0-6.0 seconds. Factory set at 1 second.

2.1.3 Voltage/Frequency Lockout Relay - Alternate/Emergency Source

Voltage/Frequency Lockout Relay. Single-phase sensing must be provided on the normal and emergency source. Prevent premature transfer to alternate/emergency source. Provide pickup voltage that is adjustable from 85-100 percent of nominal. Factory set for pickup at 90 percent. Provide pickup frequency that is adjustable from 90-97 percent of nominal. Factor set frequency pickup for 95 percent.

2.1.4 Adjustable Time Delay - Transfer to Alternate/Emergency Power Source

Adjustable Time Delay - Transfer to Alternate Power Source. Transfer to alternate power source time delay for transfer switches as indicated, adjustable 0-5 minutes. Factory set to 0 seconds. ATS is to monitor the frequency and voltage of alternate power source and transfer when frequency and voltage are stabilized.

2.1.5 Adjustable Time Delay- Re-transfer to Normal/Preferred Source

Adjustable Time Delay- Transfer to Source. Re-transfer to normal source time delay, adjustable 0-30 minutes. Factory set at 10 minutes. Time delay is automatically defeated upon loss or sustained undervoltage of alternate power source, provided that normal source has been restored.

2.1.6 Engine-Generator Exerciser

Exerciser. Solid-state, programmable-time switch exerciser to allow automatic starting of the generator set, subsequent load transfer, retransfer of load and shuts down engine after a preset cool-down period. Initiates exercise cycle at preset intervals adjustable from on a daily, weekly, bi-weekly or monthly basis.. Running periods are adjustable from 10-30 minutes. Factory settings are for 7-day exercise cycle, 20 minute running period and 5-minute cool-down period. Exerciser features include the following:

a. Exerciser Transfer Selector Switch: Permits selection of exercise with

and without load transfer or dual independent exercisers that allow for unloaded and loaded schedule testing.

b. Push-button programming control with digital display of settings.

c. Integral battery operation of time switch when normal control power is not available.

2.1.7 Engine Shutdown Time Delay

Engine Shutdown. Provide time delay that is adjustable from 0 to 30 minutes and is factory set at 10 minutes.

2.1.8 Engine Starting Contacts

Provide 2 isolated normally closed and 2 isolated normally open contact which is rated 5 A at 250 VAC/30 VDC minimum.

2.1.9 Motor Disconnect And Timing Relay

Motor Disconnect and Timing Relay: Controls designate starters so they disconnect motors before transfer and reconnect them selectively at an adjustable time interval after transfer. Control connection to motor starters is through wiring external to automatic transfer switch. Time delay for reconnecting individual motor loads is adjustable between 1 and 60 seconds, and settings are as indicated. Relay contacts handling motor-control circuit inrush and seal currents are rated for actual currents to be encountered.

2.1.10 Unassigned Auxiliary Contacts

Provide two normally open and two normally closed, single-pole, double-throw auxiliary contacts for each switch position rated at 10 amperes at 240 volts.

2.1.11 Front Panel Devices

Provide devices mounted on cabinet front consisting of:

a. Mode selector switch with the following positions and associated functions. Selector switch can be part of the microprocessor controller consisting of an LCD screen with a graphical interface or as a stand-alone test switch.

(1) TEST - Simulates loss of normal/preferred source system operation.

(2) NORMAL - Transfers system to normal/preferred source bypassing re-transfer time delay.

b. Switch position indicating lights or graphical LCD display. Indicate source to which load is connected.

c. Source-Available Monitor. Provide source-available indicating lights or graphical LCD display monitor that is labeled to show when one or both sources of power are available. If indicating lights are used, then the preference is to have Green be normal/preferred power and Red be for alternate/emergency power; however, other color schemes are allowed if clearly marked.

d. Provide a transfer override switch. Provide automatic transfer switch microprocessor based controller, which offers field selectable/adjustable inputs and outputs for transfer switch operation. Override switch must bypass automatic transfer controls so ATS will transfer and remain connected to generator power source, regardless of condition of normal/preferred source. Provide an indicating light to show override status. If alternate source fails and normal source is available, ATS is to automatically retransfer to normal source.

e. Lamp test button.

2.1.12 Closed-Transition Transfer Switch

Include the following functions and characteristic for an automatic transfer switch that is to operate in a closed-transition manner.

a. Fully automatic make-before-break operation.

b. Load transfer without interruption, through momentary interconnection of both power sources not exceeding 100 ms, but no less than 50 ms.

c. Initiation of No-Interruption Transfer: Controlled by in-phase monitor and sensors confirming both sources are present and acceptable.

(1) Initiation occurs without active control of generator.

(2) Controls ensure that closed-transition load transfer closure occurs only when the 2 sources are within plus or minus 5 electrical degrees maximum, and plus or minus 5 percent maximum voltage difference.

d. Failure of power source serving load initiates automatic break-before-make transfer.

2.1.13 In-Phase Monitor

Provide an in-phase monitor that consists of a factory-wired, internal relay that controls transfer so it occurs only when the two sources are synchronized in phase. Relay compares phase relationship and frequency difference between normal and emergency sources and initiates transfer when both sources are within 5 electrical degrees, and only if transfer can be completed within 60 electrical degrees. Transfer is initiated only if both sources are within 2 Hz of nominal frequency and 70 percent or more of nominal voltage Manufacturer is to provide information regarding what conditions a transfer cannot be accomplished.

2.2 BY-PASS/ISOLATION SWITCH (BP/IS)

Include non-load-break by-pass/isolation switches for the indicated automatic transfer switches. Designs which disconnect or interrupt the load when bypassing are not acceptable. Include the following features for each combined by-pass/isolation switch and automatic transfer switch:

a. Bypass/isolation switch (BP/IS) and associated ATS are to be made by the same manufacturer and must be completely interconnected and tested at factory and at project site as specified.

b. ATS is to be manufactured, listed and tested in accordance with

paragraph AUTOMATIC TRANSFER SWITCH. BP/IS switch current, voltage, closing, and short-circuit withstand closing ratings are to be equal or exceed comparable ratings specified for ATS and have the same phase arrangement and number of poles.

c. Provide externally operated and arranged selector switch or handle so designed and constructed not to stop in an intermediate or neutral position during operation and that one person can safely bypass the ATS. Accomplish isolation of the ATS externally by one person. Bypass and isolation handles must be permanently affixed and operable without opening the enclosure door. Provide interlocks that ensure ATS is disconnected from source and load during isolation. Interlocks prevent ATS operation, except for testing and maintenance, while isolated. BP/IS operation is to be accomplished without disconnecting switch load terminal conductors. Equipment which require separate tools, keys, or other devices to operate the bypass/isolation mechanism which may not be present during an emergency is not acceptable.

d. Provide drawout transfer switch that provides physical separation from bypass switch and live parts and accessibility for testing and maintenance operation.

e. Provide contacts that have the same contact temperature that do not exceed those of the ATS contacts when carrying rated load. Provide contacts as specified for associated ATS, including provisions for inspection of contacts without disassembly of BP/IS or removal of entire contact enclosure. Provide manufacturer instructions for determining contact integrity in order To facilitate maintenance.

f. The ATS controls remain functional with the ATS isolated or in bypass mode to permit monitoring of the normal power source and automatic starting of the generator in the event of a loss of the normal power source. In the isolated mode, the bypass section is capable of functioning as a manual transfer to transfer the load to either power source for maintenane purposes or when automatic control has failed. Equipment that requires automatic controls to be functional to operate the bypass switch is not acceptable.. The ATS can be completely removed from the enclosure, if required for maintenance or repair, while the bypass section continues to power the load.

g. Construct Bypass/isolation switch for convenient removal of parts from front of switch enclosure without removal of other parts or disconnection of external power conductors.

h. Achieve load by-pass to the source with no load interruption. Bypass/isolation equipment that breaks the load is not accpetalbe.

i. Provide drawout bypass switch that provides physical separation from ATS and live parts and accessibility for testing and maintenance operation. Provide automatic shutters that closed to isolate the bus.

j. Provide a means to ensure the switch is transferred to the alternate or emergency power source when normal power source becomes unavailable.

2.2.1 Markings

Mark isolation handle positions with engraved plates or other approved means to indicate position or operating condition of associated ATS, as

follows:

a. Provide an indication that shows that BP/IS section is providing power to the load.

b. Provide indication of ATS isolation/test position.

c. Provide suitable control labels and instruction signs describing operating instructions.

d. Indicating lamps or LCD screen for indicating that shows the source availability, bypass switch position, transfer switch position, and isolation handle position. If indicating lights are used, provide a lamp test button that turns the indicating lights on, but does not cause any function to take place.

2.2.2 Interconnection

Interconnect BP/IS and associated ATS with suitably sized copper bus bars silver-plated at each connection point, and braced to withstand magnetic and thermal forces created at withstand current rating specified for associated ATS.

2.3 ENCLOSURE

Provide an enclosure that meets the following:

a. Provide ATS and accessories in a wall-mounted, unventilated NEMA 250, Type 4, smooth sheet metal enclosure constructed in accordance with applicable requirements of NEMA ICS 6, UL 508, UL 1066, and UL 1008. Provide door with suitable hinges, locking handle latch, and gasketed jamb. Provide at least No. 14 metal gauge.

b. Factory wiring within enclosure and field wiring terminating within enclosure must comply with NFPA 70. Provide wire that is permanently tagged or marked near terminal at each end with wire number shown on approved detail drawing, when wiring is not color coded. Conform terminal block to NEMA ICS 4. Arrange terminals for entrance of external conductors from top and bottom of enclosure as shown. Main switch terminals, including neutral terminal if used, must be pressure type suitable for termination of external copper conductors shown.

c. Provide thermostatically controlled heater within enclosure to prevent condensation over temperature range stipulated in paragraph ENVIRONMENTAL CONDITIONS.

2.3.1 Construction

Construct enclosure for ease of removal and replacement of ATS components and control devices from front without disconnection of external power conductors or removal or disassembly of major components.

2.3.2 Cleaning and Painting

Protect both the inside and outside surfaces of an enclosure, including means for fastening against corrosion by enameling, galvanizing, plating, powder coating, or other equivalent means. Protection is not required for metal parts that are inherently resistant to corrosion, bearings, sliding surfaces of hinges, or other parts where such protection is impractical.

Provide manufacturer's standard finish material, process, and color that is free from runs, sags, peeling, or other defects. An enclosure marked Type 1, 3R, 4 or 12 is acceptable if there is no visible rust at the conclusion of a salt spray (fog) test using the test method in ASTM B117, employing a 5 percent by weight, salt solution for 24 hours. Type 4X enclosures are acceptable following performance of the above test with an exposure time of 200 hours.

2.3.3 Field Fabricated Nameplates

Nameplate is to comply with ASTM D709. Provide laminated plastic nameplates for each equipment enclosure as specified or as indicated on the drawings. Provide an inscription on each nameplate that identifies the name of the equipment, sources of power, calculated short circuit with date and the location e.g. 'SWB-1 Electrical Room 103'. Provide nameplates that are made of melamine plastic, 0.125 inch thick, white with black center core. Provide the nameplate with a surface that is matte finished and that has square corners.. Accurately align lettering and engrave into the core. Provide nameplates that are at least 1.0 by 2.5 inches with a minimum lettering size of 0.25 inch high normal block style.

2.4 FACTORY TESTING

Submit a description of proposed field test procedures, including proposed date and steps describing each test, its duration and expected results, not less than 2 weeks prior to test date. Submit certified factory and field test reports, within 14 days following completion of tests. Provide reports that are certified and dated and that demonstrate that tests were successfully completed prior to shipment of equipment.

2.4.1 Prototype Factory Testing

A prototype of specified ATS is to be factory tested in accordance with UL 1008. In addition, perform factory tests on each ATS as follows:

a. Insulation resistance test to ensure integrity and continuity of entire system

b. Main switch contact resistance test.

c. Visual inspection to verify that each ATS is as specified.

d. Mechanical test to verify that ATS sections are free of mechanical hindrances.

e. Electrical tests to verify complete system electrical operation and to set up time delays and voltage sensing settings.

2.4.2 Factory Test Reports

Provide three certified copies of factory test reports from the manufacturer.

PART 3 EXECUTION

3.1 INSTALLATION

Installation must conform to the requirements of NFPA 70 and manufacturer's recommendation.

3.2 PREREQUISITES FOR FUNCTIONAL ACCEPTANCE TESTING

Completion of the following requirements is mandatory prior to scheduling functional acceptance tests for the automatic transfer switch.

3.2.1 Performance of Acceptance Checks and tests

Complete as specified in paragraph entitled AUTOMATIC TRANSFER SWITCH ACCEPTANCE CHECKS AND TESTS. The Acceptance Checks and Tests are to be accomplished by the Testing organization as described in Section 26 08 00 APPARATUS INSPECTION AND TESTING.

3.2.2 Manufacturers O&M Information

The manufacturers O&M information required by the paragraph entitled "SD-10 Operation and Maintenance Data", is to be submitted to and approved by the Contracting Officer.

3.2.3 Test Equipment

Ensure all test equipment and instruments is on hand prior to scheduling field tests, or subject to Contracting Officer's approval, evidence must be provided to show that arrangements have been made to have the necessary equipment and instruments on site prior to field testing.

3.3 FIELD QUALITY CONTROL

Give Contracting Officer 15 days notice of dates and times scheduled for tests which require the presence of the Contracting Officer. The Contracting Officer will coordinate with the using activity and schedule a time that will eliminate or minimize interruptions and interference with the activity operations. The contractor is responsible for costs associated with conducting tests outside of normal working hours and with incorporating special arrangements and procedures, including temporary power conditions. The contractor provides labor, equipment, apparatus, including test load, and consumables required for the specified tests. Calibration of all measuring devices and indicating devices must be certified. Provide the services of a qualified factory-trained manufacturer's representative to assist the contractor in installation and start-up of the equipment specified under this section. The manufacturer's representative is to provide technical direction and assistance to the contractor in general assembly of the equipment, connections and adjustments, and testing of the assembly components contained herein. Perform the following field tests in accordance with the manufacturer's recommendations and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.3.1 Automatic Transfer Switch Acceptance Checks and Tests

a. Visual and Mechanical Inspection

(1) Compare equipment nameplate data with specifications and approved shop drawings.

(2) Inspect physical and mechanical condition.

(3) Confirm correct application of manufacturer's recommended

lubricants.

(4) Verify that manual transfer warnings are attached and visible.

(5) Verify tightness of all control connections.

(6) Verify tightness of accessible bolted connections by calibrated torque-wrench method. Thermographic survey is not required.

(7) Perform manual transfer operation.

(8) Verify positive mechanical interlocking between normal and alternate sources.

b. Electrical Tests

(1) Measure contact-resistance. Correct values that exceed 500 microhms and values for 1 pole deviating by more than 50 percent from other poles.

(2) Perform insulation-resistance on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole for one minute. Perform tests in both source positions.

(3) Verify settings and operations of control devices.

(4) Calibrate and set all relays and timers.

3.3.2 Functional Acceptance Tests

Functional Acceptance Tests must be coordinated with Section 26 32 15 ENGINE-GENERATOR SET STATIONARY 15-2500 KW, WITH AUXILIARIES. Include simulating power failure and demonstrating the following operations for each automatic transfer switch. Demonstrate in service that the automatic transfer switches are in good operating condition, and function not less than five times.

a. Perform automatic transfer tests:

(1) Simulate loss of normal/preferred power.

(2) Return to normal/preferred power.

(3) Simulate loss of emergency/alternate power.

(4) Simulate all forms of single-phase conditions.

b. Verify correct operation and timing of the following functions:

(1) Normal source voltage-sensing relays.

(2) Engine start sequence.

(3) Time delay upon transfer.

(4) Alternate source voltage-sensing relays.

(5) Automatic transfer operation.

(6) Interlocks and limit switch function.

(7) Time delay and retransfer upon normal power restoration.

(8) By-pass/isolation functional modes and related automatic transfer switch operations.

3.3.3 Infrared Scanning

After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each switch. Remove all access panels so joints and connections are accessible to portable scanner.

a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after acceptance.

b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

c. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.4 TRAINING

Provide 4 hours of training to maintenance personnel on the proper operation, maintenance and adjustment of the automatic transfer switch. Coordinate this training with that of the generator equipment.

-- End of Section --

SECTION 26 41 00

LIGHTNING PROTECTION SYSTEM
08/23

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 81	(2025) IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2026; TIA 26-1; ERTA 26-1; TIA 26-2; TIA 26-3; TIA 26-4; TIA 26-5; TIA 26-6; TIA 26-7; ERTA 26-2; ERTA 26-3) National Electrical Code
NFPA 780	(2026) Standard for the Installation of Lightning Protection Systems

U.S. AIR FORCE (USAF)

DAFMAN 32-1065	(2020) Grounding and Electrical Systems

U.S. DEPARTMENT OF DEFENSE (DOD)

UFC 3-575-01	(2012; with Change 1, 2021) Lightning and Static Electricity Protection Systems

UL SOLUTIONS (UL)

UL 96	(2025) UL Standard for Safety Lightning Protection Components
UL 96A	(2023) UL Standard for Safety Installation Requirements for Lightning Protection Systems
UL Electrical Construction	(2012) Electrical Construction Equipment Directory

1.2 RELATED REQUIREMENTS

1.2.1 Verification of Dimensions

Confirm all details of work, verify all dimensions in field, and advise Contracting Officer of any discrepancy before performing work. Obtain prior approval of Contracting Officer after engineering approval and before making any departures from the design.

1.2.2 System Requirements

Provide a system furnished under this specification consisting of the latest products of a manufacturer regularly engaged in production of lightning protection system components. Products must be UL listed for use on lightning protection systems unless this rating does not exist for items in question.

Comply with NFPA 70, NFPA 780, UL 96, and UFC 3-575-01.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Lightning Protection and Grounding System Test Plan; G, RO

Grounding Systems Testing; G, RO

SD-07 Certificates

Component UL Listed and Labeled; G, RO

Lightning Protection System Inspection Certificate; G, RO

1.4 QUALITY ASSURANCE

In each standard referred to herein, consider the advisory provisions to be mandatory, as though the word "shall" or "must" has been substituted for "should," wherever it appears. Interpret references that require LPS expertise in these standards to mean Base Civil Engineer (BCE) or BCE-designated representative with LPS training certification.

1.4.1 Installation Drawings

1.4.1.1 Overall System Drawings

Submit installation shop drawing for the overall lightning protection system. Include on the drawings the physical layout of the equipment (plan view and elevations), mounting details, relationship to other parts of the work, and wiring diagrams.

1.4.1.2 Major Components

Submit detail drawings for each major component including manufacturer's descriptive and technical literature, catalog cuts, and installation instructions.

1.4.2 Component UL Listed and Labeled

Submit proof of compliance that components are UL Listed and Labeled for use on lightning protection systems. Listing alone in UL Electrical Construction, which is the UL Electrical Construction Directory, is not acceptable evidence. In lieu of Listed and Labeled, submit written certificate from an approved, nationally-recognized testing

organization equipped to perform such services, stating that items have been tested and conform to requirements and testing methods of Underwriters Laboratories (UL).

1.4.3 Lightning Protection and Grounding System Test Plan

Provide lightning protection system and grounding system test plans in compliance with NFPA 780 and DAFMAN 32-1065 chapters 8 and 10, and Attachment 7. DAFMAN 32-1065, Attachment 7, contains a Sample Visual Inspection Form (Figure A7.6) and a Sample 24-month Resistance/Continuity Test/Visual Inspection of LPS and Grounding System (Figure A7.7). Substitute-Forms may be used, but those forms created or substituted by the base must include the same contents and information as the samples provided in Attachment 7, Figures A7.6 and A7.7. As a minimum, include a sketch of the facility and surrounding lightning protection system as part of the specific test plan for each structure. Include the requirements as "Testing of Catenary Lightning Protection System" in the test plan. For explosives facilities, the rolling sphere must be superimposed in elevation drawings, on all three of these types of lightning protection systems for installations with a high strike density as indicated in the NOAA Strike Density Maps. This may be accomplished by Computer Aided Design (CAD).

1.4.4 Lightning Protection System Inspection Certificate of Qualifications

Provide an approved third-party inspector who meets training certification requirements for final acceptance of the LPS. Inspection and certification of the LPS must be completed and certified in writing, before occupancy of the building. Compliance requirements are in UFC 3-575-01. Signed Certificate of Qualifications must be placed in the LPS records.

Note that the Contracting Officer may not accept the LPS system without a recommendation from a qualified person identified in the project documents.

1.5 SITE CONDITIONS

Confirm all details of work, verify all dimensions in the field, and advise the Contracting Officer of any discrepancy before starting any work, if known at that time, or when it becomes known while performing work. Obtain prior approval of the BCE or BCE-designated representative with LPS training certification before design changes are made.

PART 2 PRODUCTS

2.1 MATERIALS

See NFPA 70, NFPA 780, UFC 3-575-01, DAFMAN 32-1065. Do not use a combination of materials that forms an electrolytic couple of such nature that corrosion is accelerated in the presence of moisture unless moisture is permanently excluded from the junction of such metals. Where unusual conditions exist which would cause corrosion of conductors, provide conductors with protective coatings, such as tin or lead, or oversize conductors. Where a mechanical hazard is involved, increase conductor size to compensate for the hazard or protect conductors. When metallic conduit or tubing is provided, electrically bond conductor to conduit or tubing at the upper and lower ends by clamp type connectors or welds (including exothermic). All lightning protection components, such as bonding plates, air terminals, air terminal supports and braces, chimney

bands, clips, connector fittings, and fasteners are to comply with the requirements of UL 96 classes, as applicable.

2.1.1 Main and Bonding Conductors

Main and Bonding Conductors should be NFPA 780 and UL 96 Class I or Class II materials, as applicable. For explosives, Class II materials are in accordance with NFPA 780, Chapter 8.

2.1.2 Conductors

Provide copper conductors, as applicable. See NFPA 780, UFC 3-575-01, DAFMAN 32-1065.

2.2 COMPONENTS

2.2.1 Ground Rods

Provide ground rods conforming to NFPA 780. Provide ground rods that are not less than 5/8 inch in diameter and 8 feet in length. Do not mix ground rods of copper-clad steel and solid copper on the job.

2.2.2 Connections and Terminations

Provide connectors for splicing conductors that conform to UL 96, class as applicable. Conductor connections can be made by compression clamps or welds (including exothermic). Provide style and size connectors required for the installation.

2.2.3 Connector Fittings

Provide connector fittings for "end-to-end", "Tee", or "Y" splices that conform to NFPA 780 and UL 96.

PART 3 EXECUTION

3.1 LIGHTNING PROTECTION SYSTEMS

Provide a lightning protection system that meets the requirements of NFPA 780 and UFC 3-575-01.

3.1.1 Catenary Lightning Protection System

A catenary lightning protection system consists of at least two wooden poles or metallic masts with overhead wires (cross conductors). Install air terminals on wooden masts at least 10 inches higher than the top of the wooden pole, or use steel saddles on top of the wooden pole for conductor placement if saddle is at least 6 inches above the wooden pole. Provide at two paths to ground for an overhead ground wire (cross conductor) and down conductors, to transport the current from a direct strike to grounding electrodes that are 5/8 in. by 8 ft. The class (diameter at the top of the pole and the pole height) of wooden pole must be designed to withstand the horizontal force of the cross conductor and any ice loading it could be subject to. Metallic masts used in a catenary lighting protection system do not require air terminals, but must be rated for use on electrical distribution or transmission lines because of horizontal forces that must be considered when sizing and selecting the metallic mast manufacturer. Consider resonant frequency in the design, if applicable, and use appropriate damping designed by the mast

manufacturer. A rolling sphere proof of protection is a required submittal that must be approved prior to sizing or ordering the masts. This system shall comply with NFPA 780. Note that for randomly-shaped facilities (non-rectangular facilities), a catenary system is not required to be symmetrical. To maintain symmetry on the widest part of the building, the overhead ground wire (cross conductor) length sometimes drives the height of the masts by several sizes to compensate for added weight of the cross conductor and the fact that it could be laden with ice during winter, in some areas of a country. This system shall comply with NFPA 780 and UFC 3-575-01, and DAFMAN 32-1065.

3.1.2 Down Conductors

A minimum of two paths to ground shall be provided on any system. This may be by two down conductors or with a down conductor in combination with other metallic connections to ground. Protect exposed down conductors from physical damage from ground level up to 6 feet. If this protection is a metal conduit, both ends must be bonded to the down conductor passing through it. For Schedule 80 conduit providing this protection, no bonding at both ends is necessary. Schedule 80 conduit or metallic conduit may be painted to match the surrounding surface. NO CONNECTIONS OR FASTENERS OF ANY LIGHTNING PROTECTION SYSTEM MAY BE PAINTED because this affects the ease with which lightning current can pass to ground.

3.1.3 Ground Connections

Attach each down conductor and ground ring electrode to a ground rod below grade by exothermic weld for all buried connections and exothermic weld or compression connectors for connections inside test wells. Terminate all down conductors to a grounding electrode inside a test well. Test connections and record resistances and continuity readings prior to covering.

Accessible connections above ground level and in test wells can be grounded with mechanical clamping, meeting installation requirements in NFPA 780.

3.1.4 Installation of Grounding Electrodes (Ground Rods)

Extend driven ground rods vertically into the existing undisturbed earth for a distance of not-less-than 8 feet if exothermic welds are used for bonds. Inside test wells, the 5/8 in. by 8 ft rod may be driven to a point above the base of the test well, that will provide working/testing access to the mechanically-fastened bond. Set ground rods not less than 3 feet nor more than 6 feet (see NFPA 780) from the structural foundation, and at least 3 feet beyond the drip line for the facility. After the completed installation, measure the total resistance to ground using the fall-of-potential method described in IEEE 81. Maximum allowed resistance of a single driven ground rod is 25 ohms (NFPA 70). If resistance-to-ground of a single ground rod for the lightning protection system exceeds 25 ohms and another ground rod is driven in accordance with NFPA 780, 25 ohms does not apply to this test point. See NFPA 70 exception to Article 250.53.

For explosives facilities: For a ground ring electrode, provide continuous No. 1/0 (minimum) bare stranded copper cable (NFPA 780-2023, Chapter 8, *Explosives Facilities*).

3.2 APPLICATIONS

3.2.1 Personnel Ramps and Covered Passageways

Lightning Protection is required in accordance with NFPA 780 and UFC 3-575-01.

3.3 RESTORATION

Where sod has been removed, replace sod as soon as possible after completing the backfilling. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work, to original condition. Overfill the trench to accommodate for settling. Include necessary topsoil, fertilizing, liming, seeding, sodding, sprigging or mulching in any restoration, to match existing. Maintain disturbed surfaces and replacements until final acceptance. Return to site after six months to fill in compacted surface.

3.4 FIELD QUALITY CONTROL

3.4.1 Lightning Protection Systems Testing

A 100 percent test point test and inspection is required by all services. Identify test points for lightning protection system connections and bonds. Provide a sketch (NTS) with identified test points as part of the contract acceptance. Number points in a manner consistent with the installation (Base or Post) nomenclature for existing lightning protection systems; for example, use letters or numbers to track the test results. Test each lightning protection system connection to ensure continuity across each connection or bond is 1 ohm or less, and record the value indicated on a copy of the test form located at the back of DAFMAN 32-1065, Attachment 7.

a. LPS testing must also be accomplished on smaller projects, such as roofing and HVAC projects, where lightning protection systems are installed on any facility with existing LPS, to ensure the LPS is not damaged or reconfigured during construction.

b. Comply with UL 96A. A third-party inspector (not the designer and not the installer) must be present for the 100 percent inspection and data documentation by the contractor. This is to take place prior to project acceptance. Note that in many cases Air Force personnel have been trained to inspect and accept projects as the third-party inspector. Verify this before contract award.

3.4.2 Grounding Systems Testing

A 100 percent test point resistance test and inspection is required. Identify all test points for grounding system connections and bonds. Provide a sketch (NTS) with identified test points as part of the contract acceptance. Number points in a manner consistent with the installation (Base or Post) nomenclature for existing grounding systems; for example, use letters or numbers to track the test results. Test each grounding system connection or bond to ensure resistance-to-ground is 25 ohms or less or as excepted by NFPA 70 or NFPA 780. Record the resistance measurement on a copy of the test form located at the back of DAFMAN 32-1065 for Air Force or a similar form provided by the Army or Navy. Test the ground rod for resistance to ground before making connections to the rod. Tie the grounding system together and test for

resistance to ground. Make resistance measurements in dry weather, and not earlier than 48 hours after rainfall. Include in the written report: locations of test points, measured values for continuity and ground resistances, and soil conditions at the time that measurements were made. Submit results of each test to the Contracting Officer.

-- End of Section --

SECTION 26 56 00

EXTERIOR LIGHTING
08/21

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO LTS	(2013; Errata 2013) Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-16	(2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2024) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2023) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM B117	(2025) Standard Practice for Operating Salt Spray (Fog) Apparatus

EUROPEAN UNION (EU)

Directive 2011/65/EU	(2011) Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment

ILLUMINATING ENGINEERING SOCIETY (IES)

ANSI/IES LM-79	(2019) Approved Method: Electrical and Photometric Measurements of Solid State Lighting Products
ANSI/IES LM-80	(2020) Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays and Modules
ANSI/IES LS-1	(2020) Lighting Science: Nomenclature and Definitions for Illuminating Engineering

ANSI/IES RP-8	(2018; Addenda 1 2020; Errata 1-2 2021) Recommended Practice for Design and Maintenance of Roadway and Parking Facility Lighting
ANSI/IES TM-15	(2020) Technical Memorandum: Luminaire Classification System for Outdoor Luminaires
ANSI/IES TM-21	(2021) Technical Memorandum: Projecting Long-TermLuminous, Photon, and Radiant Flux Maintenance of LED Light Sources
IES Lighting Library	IES Lighting Library

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 100	(2000; Archived) The Authoritative Dictionary of IEEE Standards Terms
IEEE C62.41.2	(2002) Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C136.3	(2020) Roadway and Area Lighting Equipment - Luminaire Attachments
ANSI C136.13	(2020) Roadway and Area Lighting Equipment - Metal Brackets for Wood Poles
ANSI C136.21	(2014) American National Standard for Roadway and Area Lighting Equipment - Vertical Tenons Used with Post-Top-Mounted Luminaires
NEMA 250	(2020) Enclosures for Electrical Equipment (1000 Volts Maximum)
NEMA ANSLG C78.377	(2024) Electric Lamps– Specifications for the Chromaticity of Solid State Lighting Products
NEMA C82.77-10	(2020) Harmonic Emission Limits - Related Power Quality Requirements
NEMA C136.31	(2023) Roadway and Area Lighting Equipment - Luminaire Vibration
NEMA ICS 2	(2000; R 2020) Industrial Control and Systems Controllers, Contactors, and Overload Relays Rated 600 V
NEMA SSL 1	(2016) Electronic Drivers for LED Devices, Arrays, or Systems
NEMA SSL 3	(2011) High-Power White LED Binning for

General Illumination

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2026; TIA 26-1; ERTA 26-1; TIA 26-2; TIA 26-3; TIA 26-4; TIA 26-5; TIA 26-6; TIA 26-7; ERTA 26-2; ERTA 26-3) National Electrical Code

UL SOLUTIONS (UL)

UL 773	(2016; Reprint Jul 2020) UL Standard for Safety Plug-In, Locking Type Photocontrols for Use with Area Lighting
UL 773A	(2016; Reprint Jan 2024) UL Standard for Safety Nonindustrial Photoelectric Switches for Lighting Control
UL 1310	(2018; Reprint Jun 2022) UL Standard for Safety Class 2 Power Units
UL 1598	(2021; Reprint Jan 2024) UL Standard for Safety Luminaires
UL 8750	(2020; Reprint Aug 2024) UL Standard for Safety Light Emitting Diode (LED) Equipment for Use in Lighting Products

1.2 RELATED REQUIREMENTS

Materials not considered to be luminaires, luminaire accessories, or lighting equipment are specified in Section(s) 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

1.3 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications and on the drawings must be as defined in IEEE 100 and ANSI/IES LS-1.

b. For LED luminaire light sources, "Useful Life" is the operating hours before reaching 70 percent of the initial rated lumen output (L70) with no catastrophic failures under normal operating conditions. This is also known as 70 percent "Rated Lumen Maintenance Life" as defined in ANSI/IES LM-80.

c. For LED luminaires, "Luminaire Efficacy" (LE) is the appropriate measure of energy efficiency, measured in lumens/watt. This is gathered from LM-79 data for the luminaire, in which absolute photometry is used to measure the lumen output of the luminaire as one entity, not the source separately and then the source and housing together.

d. Total Harmonic Distortion (THD) is the Root Mean Square (RMS) of all the harmonic components divided by the total fundamental current.

e. The "Groundline Section" of wood poles is that portion of the pole between one foot above, and 2 feet below the groundline.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Luminaire Drawings; G, RO

Pole Drawings; G, RO

Control System One-Line Diagram; G, RO

SD-03 Product Data

Luminaires; G, OMA

Light Sources; G, OMA

LED Drivers; G, OMA

Luminaire Warranty; G, RO

Lighting Controls Warranty; G, RO

Pole Warranty; G, RO

Photosensors; G, OMA

Lighting Contactor; G, OMA

Poles; G, OMA

Brackets

Obstruction Marker Luminaires; G, OMA

SD-05 Design Data

Luminaire Design Data; G, OMA

SD-06 Test Reports

ANSI/IES LM-79 Test Report; G, RPO

ANSI/IES LM-80 Test Report; G, RO

ANSI/IES TM-21 Test Report; G, RO

SD-08 Manufacturer's Instructions

Poles

SD-10 Operation and Maintenance Data

Lighting System, Data Package 5; G, RO

Exterior Lighting Control System, Data Package 5; G, RO

1.5 QUALITY ASSURANCE

Data, drawings, and reports must employ the terminology, classifications and methods prescribed by the IES Lighting Library as applicable, for the lighting system specified.

1.5.1 Drawing Requirements

1.5.1.1 Luminaire Drawings

Include dimensions, effective projected area (EPA), weight, accessories, and installation and construction details. Photometric data, including CRI, CCT, TM-15-11 BUG rating, LED driver type, aiming diagram, zonal lumen data, and candlepower distribution data per LM-79 must accompany shop drawings.

1.5.1.2 Pole Drawings

Include dimensions, wind load determined in accordance with AASHTO LTS ASCE 7-16, pole deflection, pole class, and other applicable information.

1.5.2 Luminaire Design Data

a. Provide distribution data according to IES classification type as defined in IES Lighting Library and ANSI/IES RP-8.

b. B.U.G. rating for the installed position as defined by ANSI/IES TM-15 and shielding as defined by ANSI/IES RP-8.

c. Provide safety certification and file number for the luminaire family. Include listing, labeling and identification in accordance with NFPA 70 (NEC). Applicable testing bodies are determined by the US Occupational Safety Health Administration (OSHA) as Nationally Recognized Testing Laboratories (NRTL) and include: CSA (Canadian Standards Association), ETL (Edison Testing Laboratory), and UL (Underwriters Laboratories).

d. Provide long term lumen maintenance projections for each LED luminaire in accordance with ANSI/IES TM-21. Data used for projections must be obtained from testing in accordance with ANSI/IES LM-80.

e. Provide wind loading calculations for luminaires mounted on poles. Weight and effective projected area (EPA) of luminaires and mounting brackets must not exceed maximum rating of pole as installed in particular wind zone area.

1.5.3 ANSI/IES LM-79 Test Report

Submit test report on manufacturer's standard production model of specified luminaire. Testing must be performed at the same operating drive current as specified luminaire. Include all applicable and required data as outlined under "14.0 Test Report" in ANSI/IES LM-79.

1.5.4 ANSI/IES LM-80 Test Report

Submit report on manufacturer's standard production LED light source

(package, array, or module) of specified luminaire. Testing must be performed at the same operating drive current as specified luminaire. Include all applicable and required data as outlined under "8.0 Test Report" in ANSI/IES LM-80.

1.5.5 ANSI/IES TM-21 Test Report

Submit test report on manufacturer's standard production LED light source (package, array or module) of specified luminaire. Testing must be performed at the same operating drive current as specified luminaire. Include all applicable and required data, as well as required interpolation information as outlined under "7.0 Report" in ANSI/IES TM-21.

1.5.6 Test Laboratories

Test laboratories for the ANSI/IES LM-79 and ANSI/IES LM-80 test reports must be one of the following:

a. National Voluntary Laboratory Accreditation Program (NVLAP) accredited for solid-state lighting testing as part of the Energy-Efficient Lighting Products laboratory accreditation program.

b. One of the qualified labs listed on the Department of Energy - Energy Efficiency & Renewable Energy, Solid-State Lighting web site.

c. One of the EPA-Recognized Laboratories listed at for LM-80 testing.

1.5.7 Regulatory Requirements

Equipment, materials, installation, and workmanship must be in accordance with the mandatory provisions of NFPA 70 unless more stringent requirements are specified or indicated. Provide luminaires and assembled components that are approved by and bear the label of UL for the applicable location and conditions unless otherwise specified.

1.5.8 Standard Products

Provide materials and equipment that are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products must have been in satisfactory commercial or industrial use for six months prior to bid opening. The six-month period must include applications of equipment and materials under similar circumstances and of similar size. The product must have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the six-month period. Where two or more items of the same class of equipment are required, these items must be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.5.8.1 Alternative Qualifications

Products having less than a six-month field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.5.8.2 Material and Equipment Manufacturing Date

Do not use products manufactured more than six months prior to date of delivery to site, unless specified otherwise.

1.6 DELIVERY, STORAGE, AND HANDLING OF POLES

1.6.1 Steel Poles

Do not store poles on ground. Support poles so they are at least one foot above ground level and growing vegetation. Do not remove factory-applied pole wrappings until just before installing pole.

1.7 WARRANTY

Support all equipment items by service organizations which are reasonably convenient to the equipment installation in order to render satisfactory service to the equipment on a regular and emergency basis during the warranty period of the contract.

1.7.1 Luminaire Warranty

Provide and transfer to the government the original LED luminaire manufacturers standard commercial warranty for each different luminaire manufacturer used in the project.

a. Provide a written five year minimum replacement warranty for material, luminaire finish, and workmanship. Provide written warranty document that contains all warranty processing information needed, including customer service point of contact, whether or not a return authorization number is required, return shipping information, and closest return location to the luminaire location.

    (1) Finish warranty must include failure and substantial deterioration such as blistering, cracking, peeling, chalking, or fading.

    (2) Material warranty must include:

        (a) All LED drivers and integral control equipment.

        (b) Replacement when more than 15 percent of LED sources in any lightbar or subassembly(s) are defective, non-starting, or operating below 70 percent of specified lumen output.

b. Warranty period must begin in accordance with the manufacturer's standard warranty starting date.

c. Provide replacements that are promptly shipped, without charge, to the using Government facility point of contact and that are identical to or an improvement upon the original equipment. All replacements must include testing of new components and installation.

1.7.2 Lighting Controls Warranty

Provide and transfer to the government the original lighting controls manufacturers standard commercial warranty for each different lighting controls manufacturer used in the project. Warranty coverage must begin from date of final system commissioning or three months from date of

delivery, whichever is the earliest. Warranty service must be performed by a factory-trained engineer or technician.

a. Unless otherwise noted, provide a written five year minimum warranty on the complete system for all systems with factory commissioning. Provide warranty that covers 100 percent of the cost of any replacement parts and services required over the five years which are directly attributable to the product failure. Failures include, but are not limited to, the following:

(1) Software: Failure of input/output to execute switching or dimming commands.

(2) Damage of electronic components due to transient voltage surges.

(3) Failure of control devices, including but not limited to photosensors and motion sensors.

b. Provide a written five year minimum warranty on all input devices against defect in workmanship or materials provided by device manufacturer.

c. Provide a written five year minimum warranty on all control components attached to luminaires against defect in workmanship or materials.

1.7.3 Pole Warranty

Provide and transfer to the government the original pole manufacturers standard commercial warranty for each different pole manufacturer used in the project. Warranty coverage must begin from date of final system commissioning or three months from date of delivery, whichever is the earliest. Provide a written 3 year minimum replacement warranty for material, luminaire finish, and workmanship. Warranty service must be performed by a factory-trained engineer or technician.

1.8 OPERATION AND MAINTENANCE MANUALS

1.8.1 Lighting System

Provide operation and maintenance manuals for the lighting system in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA that provide basic data relating to the design, operation, and maintenance of the lighting system. Include the following:

a. Manufacturers' operating and maintenance manuals.

b. Luminaire shop drawings for modified and custom luminaires.

c. Luminaire Manufacturers' standard commercial warranty information as specified in paragraph LUMINAIRE WARRANTY.

1.8.2 Exterior Lighting Control System

Provide operation and maintenance manuals for the exterior lighting control system in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA that provide basic data relating to the design, operation, and maintenance of the exterior lighting control system. Include the following:

a. Control System One-Line Diagram

b. Product data for all devices, including installation and programming instructions.

c. Training materials, such as videos or in-depth manuals, that cover basic operation of the lighting control system and instructions on modifying the control system. Training materials must include calibration, adjustment, troubleshooting, maintenance, repair, and replacement.

PART 2 PRODUCTS

2.1 PRODUCT COORDINATION

2.2 LUMINAIRES

UL 1598, NEMA C82.77-10. Provide luminaires as indicated in the luminaire schedule and XL plates or details on project plans, complete with light source, wattage, and lumen output indicated. All luminaires of the same type must be provided by the same manufacturer. Luminaires must be specifically designed for use with the LED driver and light source provided.

2.2.1 Luminaires

UL 8750, ANSI/IES LM-79, ANSI/IES LM-80. For all luminaires, provide:

a. Complete system with LED drivers and light sources.

b. Housing constructed of non-corrosive materials. All new aluminum housings must be anodized or powder-coated. All new steel housings must be treated to be corrosion resistant.

c. ANSI/IES TM-21, ANSI/IES LM-80. Minimum L70 lumen maintenance value of 50,000 hours unless otherwise indicated in the luminaire schedule. Luminaire drive current value must be identical to that provided by test data for luminaire in question.

d. Minimum efficacy as specified in the luminaire schedule. Theoretical models of initial lamp lumens per watt are not acceptable. If efficacy values are not listed in the luminaire schedule, provide luminaires that meet the following minimum values:

Luminaire Style	Minimum Luminaire Efficacy
Area and Roadway (pole mounted, arm mounted)	119 LPW
Pedestrian Post-Top (pole mounted, arm mounted)	97 LPW
Bollard	45 LPW
Accent (adjustable landscape, sign lighting)	35 LPW
Linear Accent (facade, wallwash)	80 LPW

Luminaire Style	Minimum Luminaire Efficacy
Exterior Wall Sconce	50 LPW
Steplight	30 LPW
Parking Garage Luminaire	113 LPW

e. Product rated for operation within an ambient temperature range of minus 40 degrees F to 122 degrees F.

f. UL listed for wet locations.

g. IES Lighting Library. Light distribution and NEMA field angle classifications as indicated in luminaire schedule on project plans.

h. Housing finish that is baked-on enamel, anodized, or baked-on powder coat paint. Finish must be capable of surviving ASTM B117 salt fog environment testing for 2500 hours minimum without blistering or peeling.

i. LED driver and light source package, array, or module are accessible for service or replacement without removal or destruction of luminaire.

j. ANSI/IES TM-15. Does not exceed the BUG ratings as listed in the luminaire schedule. If BUG ratings are not listed in the luminaire schedule, provide luminaires that meet the following minimum values for each application and mounting conditions:

Lighting Application	Mounting Conditions	BUG Rating
Area and Roadway	All	B3-U0-G3
Pedestrian Post-Top	All	B2-U1-G1
Exterior Wall Sconce	Above 4 feet AFF	B1-U0-G2
Exterior Wall Sconce	Below or at 4 feet AFF	B4-U0-G4
Steplight	Above 4 feet AFF	B1-U1-G2
Steplight	Below or at 4 feet AFF	B4-U1-G4
Parking Garage Luminaire	Ceiling mounted	B4-U4-G3

k. Fully assembled and electrically tested prior to shipment from factory.

l. Finish color is as indicated in the luminaire schedule or detail on the project plans.

m. Lenses constructed of clear tempered glass or UV-resistant acrylic.

n. All factory electrical connections are made using crimp, locking, or latching style connectors. Twist-style wire nuts are not acceptable.

o. NEMA C136.31. Comply with 3G vibration testing.

p. Luminaire arm bolts constructed from 304 stainless steel or zinc-plated steel.

q. Wiring compartment on pole-mounted, street and area luminaires is accessible without the use of hand tools to manipulate small screws, bolts, or hardware.

r. Incorporate modular electrical connections, and construct luminaires to allow replacement of all or any part of the optics, heat sinks, LED drivers, surge suppressors and other electrical components using only a simple tool, such as a manual or cordless electric screwdriver.

s. ANSI C136.3. For all roadway and area luminaires, provide products with an integral tilt adjustment of plus or minus 5 degrees to allow the unit to be leveled.

2.2.2 Obstruction Marker Luminaires

Provide obstruction marker luminaires for facilities as required by the FAA and in accordance with Section 26 56 20 AIRFIELD AND HELIPORT LIGHTING AND VISUAL NAVIGATION AIDS.

2.3 LIGHT SOURCES

NEMA ANSLG C78.377, NEMA SSL 3. Provide type, lumen rating, and wattage as indicated in luminaire schedule on project plans.

2.3.1 LED Light Sources

Provide LED light sources that meet the following requirements:

a. NEMA ANSLG C78.377. Emit white light and have a nominal Correlated Color Temperature (CCT) of 3000 Kelvin.

b. Minimum Color Rendering Index (CRI) of 80.

c. Directive 2011/65/EU. Restriction of Hazardous Substances (RoHS) compliant.

d. Light source color consistency by utilizing a binning tolerance within a 4-step McAdam ellipse.

2.4 LED DRIVERS

NEMA SSL 1, UL 1310. Provide LED Drivers that are electronic, UL Class 1 or Class 2, constant-current type and meet the following requirements:

a. The combined LED driver and LED light source system is greater than or equal to the minimum luminaire efficacy values as listed in the luminaire schedule provided.

b. Operate at a voltage of 120/240 volts at 50/60 hertz, with input voltage fluctuations of plus or minus 10 percent.

c. Power Factor (PF) greater than or equal to 0.90 at full input power and across specified dimming range.

d. Maximum Total Harmonic Distortion (THD) less than or equal to 20 percent at full input power and across specified dimming range.

e. Operates for at least 50,000 hours at maximum case temperature and 90 percent non-condensing relative humidity.

f. Meets the "Elevated" (10kV/10kA) requirements per IEEE C62.41.2 -2002. Manufacturer must indicate whether failure of the electrical immunity system can possibly result in disconnect of power to luminaire. Provide surge protection that is integral to the LED driver.

g. Contains integral thermal protection that reduces the output power to protect the driver and light source from damage if the case temperature approaches or exceeds the driver's maximum operating temperature.

h. Complies with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 15, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).

i. Class A sound rating for all drivers mounted under a covered structure, such as a canopy, or where otherwise appropriate.

j. Directive 2011/65/EU. Restriction of Hazardous Substances (RoHS) compliant.

k. UL listed for wet locations typical of exterior installations.

l. Non-dimmable.

m. Rated to operate between ambient temperatures of minus 40 degrees F and 122 degrees F.

2.5 LIGHTING CONTROLS

2.5.1 Devices

2.5.1.1 Photosensors

UL 773, UL 773A. Provide Photosensors that meet the following requirements:

a. Hermetically sealed, silicon diode light sensor type, rated at 1000 watts, 240 volts, 50/60 Hz with single-pole, single-throw contacts.

b. Turns ON at 1 to 3 footcandles and turns OFF at 3 to 15 footcandles.

c. Designed to fail to the ON position.

d. Housing is constructed of die cast aluminum, rated to operate within a temperature range of minus 40 to 158 degrees F.

e. Time delay that prevents accidental switching from transient light sources.

f. Directional lens in front of the cell to prevent fixed light sources

from creating a turnoff condition.

g. Designed for 20-year service to match life expectancy of long-life LED fixtures and exceed 15,000 operations at full load. Provide photosensors with zero-cross technology to withstand severe in-rush current and extend relay life.

h. Provide photosensors with metal oxide varistor (MOV) type surge protection.

2.5.1.2 Lighting Contactor

NEMA ICS 2. Provide a electrically-held lighting contactor housed in a NEMA 4X enclosure conforming to NEMA ICS 6. Contactor must have 12 poles, configured as normally open (NO). Contacts must be rated 600 volts, 60 amperes for a resistive load. Coil operating voltage must be 240 volts. Contactor must have silver cadmium oxide double-break contacts and must require no arcing contacts. Provide contactor with hand-off-automatic on-off selector switch.

2.6 POLES

ASCE 7-16. Provide round tapered poles designed for wind loading of 150 miles per hour while supporting luminaires and all other appurtenances indicated. The effective projected areas (EPA) of luminaires and appurtenances used in calculations must be specific for the actual products provided on each pole. Provide poles that are anchor-base type designed for use with underground supply conductors. Poles must have oval-shaped hand hole having a minimum clear opening of 3 by 5 inches. Secure hand hole covers by stainless steel captive screws. Provide metal poles with an internal grounding connection accessible from the hand hole near the bottom of each pole. Install a means of wire disconnection accessible from the hand hole. Do not install square poles. Provide poles from a Manufacturer with a standard provision for protecting the finish during shipment and installation. Do not install scratched, stained, chipped, or dented poles.

2.6.1 Steel Poles

Provide steel poles with hot-dipped galvanized in accordance with ASTM A123/A123M factory finish. Provide poles that meet the following requirements:

a. Minimum 11-gage steel with minimum yield/strength of 48,000 psi

b. Pole is mounted by anchor bolts.

c. Consists of tapered tubular members, either round in cross section or polygonal.

d. Pole shaft is one piece and is of welded construction with no bolts, rivets, or other means of fastening except as specifically approved.

e. Base covers are of structural quality hot-rolled carbon steel plate, with a minimum yield of 36,000 psi.

f. Markings are approximately 3 to 4 feet above grade and includes manufacturer, year of manufacture, top and bottom diameters, and length.

g. Grounding connection is designed to prevent electrolysis when used with copper ground wire.

2.6.2 Brackets and Supports

ANSI C136.3, ANSI C136.13, and ANSI C136.21. Provide pole brackets that are not less than 1 1/4 inch galvanized steel pipe secured to pole. Slip-fitter or pipe-threaded brackets may be used, but brackets must be coordinated to luminaires provided, and brackets for use with one type of luminaire must be identical. Brackets for pole-mounted street lights must correctly position luminaire no lower than mounting height indicated. Mount brackets not less than 24 feet above street. Provide special mountings or brackets as indicated and of metal which will not promote galvanic reaction with luminaire head.

2.6.3 Pole Foundations

Provide anchor bolts consisting of a steel rod with a minimum yield strength of 50,000 psi; the top 12 inches of the rod must be galvanized in accordance with ASTM A153/A153M. Concrete must be as specified in Section 03 30 53 MISCELLANEOUS CAST-IN-PLACE CONCRETE and Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.7 EQUIPMENT IDENTIFICATION

2.7.1 Manufacturer's Nameplate

Each item of equipment must have a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.7.2 Labels

UL 1598. Luminaires must be clearly marked for operation of specific light sources and drivers according to proper light source type. Note the following luminaire characteristics in the format "Use Only _____":

a. Correlated color temperature (CCT) and color rendering index (CRI) for all luminaires.

b. Driver and dimming protocol.

Markings related to light source type must be clear and located to be readily visible to service personnel, but unseen from normal viewing angles when light sources are in place. LED drivers must have clear markings indicating dimming type and indicate proper terminals for the various outputs.

2.8 FACTORY APPLIED FINISH

NEMA 250. Provide all luminaires and lighting equipment with factory-applied painting system that as a minimum meets requirements of corrosion-resistance testing.

PART 3 EXECUTION

3.1 INSTALLATION

3.1.1 Luminaires

Install all luminaires in accordance with the luminaire manufacturer's written instructions. Install all luminaires at locations and heights as indicated on the project plans. Level all luminaires in accordance to manufacturer's written instructions. Aim all luminaires in accordance with aiming diagram.

3.1.2 LED Drivers

Provide LED drivers integral to luminaire as constructed by the manufacturer.

3.1.3 Field-Applied Painting

Provide field applied painting for luminaire type . Paint lighting equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria.

3.1.4 Steel Poles

Provide pole foundations with galvanized steel anchor bolts, threaded at the top end and bent 90 degrees at the bottom end. Provide ornamental covers to match pole and galvanized nuts and washers for anchor bolts. Concrete for anchor bases, polyvinyl chloride (PVC) conduit bells, and ground rods must be as specified in Section 03 30 53 MISCELLANEOUS CAST-IN-PLACE CONCRETE and Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Thoroughly compact backfill with compacting arranged to prevent pressure between conductor, jacket, or sheath and the end of conduit ell. Adjust poles as necessary to provide a permanent vertical position with the bracket arm in proper position for luminaire location.

3.1.5 Pole Setting

Set pole to depth as indicated. Poles in straight runs must be in a straight line. Dig holes large enough to permit the proper use of tampers to the full depth of the hole. Place backfill in the hole in 6 inch maximum layers and thoroughly tamp. Place surplus earth around the pole in a conical shape and pack tightly to drain water away.

3.1.6 Lighting Controls

3.1.6.1 Photosensors

Aim photosensor according to manufacturer's recommendations. Mount sensor on or beside each luminaire when switch is provided in cast weatherproof aluminum housing with swivel arm.

3.1.7 Grounding

Ground noncurrent-carrying parts of equipment including metal poles, luminaires, mounting arms, brackets, and metallic enclosures as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

3.2 FIELD QUALITY CONTROL

3.2.1 Tests

Upon completion of installation, verify that equipment is properly installed, connected, and adjusted. Perform initial operational test, consisting of the entire system energized for 72 consecutive hours without any failures of any kind occurring in the system. All circuits must test clear of faults, grounds, and open circuits.

3.2.1.1 Lighting Control Verification Test

Verify lighting control system and devices operate according to approved sequence of operations. Verification tests are to be completed after commissioning.

-- End of Section --

SECTION 26 56 20

AIRFIELD AND HELIPORT LIGHTING AND VISUAL NAVIGATION AIDS
02/19

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A123/A123M	(2024) Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153/A153M	(2023) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM D1248	(2016) Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE C2	(2023) National Electrical Safety Code

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

NEMA C119.1	(2023) Electric Connectors - Sealed Insulated Underground Connector Systems Rated 600 Volts

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2026; TIA 26-1; ERTA 26-1; TIA 26-2; TIA 26-3; TIA 26-4; TIA 26-5; TIA 26-6; TIA 26-7; ERTA 26-2; ERTA 26-3) National Electrical Code
NFPA 70B	(2026) Standard for Electrical Equipment Maintenance

U.S. FEDERAL AVIATION ADMINISTRATION (FAA)

FAA AC 70/7460-1	(2016; Rev L; Change 2) Obstruction Marking and Lighting
FAA AC 150/5345-7	(2013; Rev F) Specification for L-824 Underground Electrical Cable for Airport Lighting Circuits
FAA AC 150/5345-26	(2021; Rev E) FAA Specification for L-823 Plug and Receptacle, Cable Connectors

FAA AC 150/5345-42	(2024; Rev K) Specification for Airport Light Bases, Transformer Housings, Junction Boxes and Accessories
FAA AC 150/5345-43	(2019; Rev J) Specification for Obstruction Lighting Equipment
FAA AC 150/5345-46	(2016; Rev E; Errata 1 2023) Specification for Runway and Taxiway Light Fixtures
FAA AC 150/5345-47	(2005; Rev B) Specification for Series to Series Isolation Transformers for Airport Lighting Systems
FAA AC 150/5345-53	(2012; Rev D) Airport Lighting Equipment Certification Program
FAA AC 150/5370-10	(2018; Rev H; Errata 1 2019) Standard Specifications for Construction of Airports
FAA E-2519	(1972; Rev A) Types I and II
FAA FO 6850.19	(1978) Frangible Coupling

UL SOLUTIONS (UL)

UL 6	(2022) UL Standard for Safety Electrical Rigid Metal Conduit-Steel
UL 360	(2025) UL Standard for Safety Liquid-Tight Flexible Metal Conduit
UL 486A-486B	(2025) UL Standard for Safety Wire Connectors
UL 797	(2007; Reprint Apr 2023) UL Standard for Safety Electrical Metallic Tubing -- Steel
UL Electrical Construction	(2012) Electrical Construction Equipment Directory

1.2 SYSTEM DESCRIPTION

Provide airfield lighting and visual navigation aids as indicated.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Protection plan; G, RO

Training; G, RO

SD-02 Shop Drawings

Lighting and visual navigation aids; G, RO

Composite drawings showing coordination of work of one trade with that of other trades and with structural and architectural elements of the work. Provide sufficient detail to show overall dimensions of related items, clearances, and relative locations of work in allotted spaces. Indicate where conflicts or clearance problems exist between the various trades.

Posted instructions; G, RO

SD-03 Product Data

When equipment or materials are specified to conform to the standards or publications and requirements of AASHTO, ANSI, ASTM, AEIC, ETL, IEEE, IES, NEMA, NFPA, or UL, or to an FAA, FS, or MS, include proof that the items furnished under this section conform to the specified requirements. The label or listing in UL Electrical Construction or ETL or the manufacturer's certification or published catalog specification data statement that the items comply with applicable specifications, standards, or publications and with the manufacturer's standards will be acceptable evidence of such compliance. Provide manufacturer prepared certificates when the manufacturer's published data or drawings do not indicate conformance with other requirements of these specifications.

Taxiway edge lights; G, OMA

Obstruction lighting; G, OMA

Light bases, each type; G, OMA

Isolation transformers; G, OMA

Encapsulated isolation transformers; G, OMA

Constant current regulators, each size; G, OMA

Frangible couplings; G, RO

Type P-605 Sealant; G, RO

Type P-606 Sealant; G, RO

Materials and equipment; G, RO

SD-06 Test Reports

Visual inspection; G, OMA

Progress testing for series lighting circuits; G, RO

Counterpoise system test and inspection; G, RO

Operating test; G, RO

Distribution conductors, 600-volt class; G, RO

Electrical acceptance tests; G, RO

Low-voltage continuity tests; G, RO

High-voltage insulation resistance tests; G, RO

Constant current regulators, each size; G, RO

SD-07 Certificates

Qualifications of contractor; G, RO

Certified documentation of qualifications, as specified.

Special tools; G, RO

List of special tools and test equipment required for installation, maintenance and testing of the products supplied by the Contractor. Items to be listed include, but are not limited to, the following:

4-Jack positioning jig, for in-pavement light bases.; G, RO

Elevated light level; G, RO

Crimping tool; G, RO

Cable penciler

List of parts; G, RO

A list of parts and components for the system by manufacturer's name, part number, nomenclature, and stock level required for maintenance and repair necessary to ensure continued operation with minimal delays.

SD-08 Manufacturer's Instructions

Posted instructions; G, RO

Submit proposed disgrams, instructions, and other sheets prior to posting.

SD-10 Operation and Maintenance Data

Constant current regulators, Data Package 5; G, RO

Maintenance and repair instructions; G

Instructions necessary to check out, troubleshoot, repair, and replace components of the systems, as specified.

Posted operations and maintenance instructions

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

SD-11 Closeout Submittals

As-built drawings

1.4 MAINTENANCE MATERIAL SUBMITTALS

1.4.1 Spare Parts

Provide spare parts as indicated in this specification as part of this contract. The spare parts must be provided at the end of construction. They must be in addition to any items consumed during construction or in testing.

1.5 QUALITY CONTROL

1.5.1 Regulatory Requirements

In each standard referred to herein, consider the advisory provisions to be mandatory, as though the word "must" has been substituted for "should" wherever it appears. Interpret references in these standards to "authority having jurisdiction," or words of similar meaning, to mean Contracting Officer.

1.5.1.1 Code Compliance

Comply with the requirements and recommendations of NFPA 70 and IEEE C2 and local codes where required.

1.5.2 Standard Products

a. Use only approved equipment listed in FAA AC 150/5345-53 with addendum for the date of delivery the exception of Air Force threshold lights and Army heliport fixture colors and intensities. Inspect wire and cable for date of manufacture. Materials must be certified and listed as "Approved Airport Lighting Equipment" downloadable from: http://www.faa.gov/arp/pdf/534553ad.pdf. Do not use wire and cable manufactured more than one year before delivery to job site.

b. Provide materials and equipment listed by FAA, UL, or ETL, when such equipment is listed or approved. Do not use askarel, tetrachlorethylene and insulating liquids containing polychlorinated biphenyls (PCBs) in equipment.

c. Material and equipment must be a standard product of a manufacturer regularly engaged in the manufacture of the product and essentially duplicate items that have been in satisfactory use for at least 2 years prior to bid opening.

d. Where two or more items of the same class of equipment are required, provide products of a single manufacturer; however, the component parts of the item need not be products of the same manufacturer unless stated in this section.

1.5.3 Qualifications of Contractor

a. Provide documentation demonstrating the aviation lighting equipment contractor and installation electricians are experienced in installing, testing and maintaining aviation lighting systems of a similar complexity. Similar complexity, in increasing complexity, are

the following: elevated edge lights and signs, in-pavement lights, and approach light systems. Include a list of government projects and 3 years of experience in constructing similar projects. Include written certification that systems have performed satisfactorily for not less than 18 months. Provide a list of airfield lighting schools or seminars attended in the last 5 years.

b. Submit certification containing the names and the qualifications of persons recommended to perform the splicing and termination of medium-voltage cables approved for installation under this contract. Indicate that any person recommended to perform actual splicing and termination has been adequately trained in the proper techniques and has had at least 3 recent years of experience in splicing and terminating the same or similar types of cables approved for installation. Any person recommended by the Contractor may be required to perform a dummy or practice splice and termination, in the presence of the Contracting Officer, before being approved as a qualified installer of medium-voltage power or series lighting cables. If that additional requirement is imposed, provide short sections of the approved types of cables with the approved type of splice and termination kits, and detailed manufacturer's instruction for the proper splicing and termination of the approved cable types.

1.5.4 Protection Plan

Submit detailed procedures to prevent damage to existing facilities or infrastructures. If damage does occur, the procedures must address repair and replacement of damaged property at the Contractor's expense.

1.5.5 Prevention of Corrosion

1.5.5.1 Metallic Materials

Protect metallic materials against corrosion as specified. Do not use aluminum in contact with earth or concrete. Do not use aluminum conductors.

1.5.5.2 Ferrous Metal Hardware

Ferrous metal hardware must be hot-dip galvanized in accordance with ASTM A123/A123M and ASTM A153/A153M.

1.6 DELIVERY, STORAGE, AND HANDLING

The Contractor must deliver, store and secure all airfield lighting materials an equipment in accordance with the manufacturers' requirements.

1.7 PROJECT/SITE CONDITIONS

Items furnished under this section must be specifically suitable for the following unusual service conditions:

1.7.1 Altitude

Any equipment must be suitable for operation up to an altitude of 10,000 feet.

1.7.2 Other

Material or equipment to be installed underground; in handholes, manholes, or underground vaults; or in light bases, must be suitable for submerged operation.

1.7.3 Environmental Requirements

The airfield for this project has the following requirements:

Location - JB McGuire-Dix-Lakehurst
Altitude - 140 feet above mean sea level.
Maximum Exterior Temperature - 105 degrees F.
Minimum Exterior Temperature - 5 degrees F.
Maximum Relative Humidity - 95 percent non-condensing.

1.7.4 Existing Airfield Lighting Systems

Demolish or protect in place as directed on the drawings.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

Provide airfield lighting and visual navigation aids as indicated on contract drawings.

2.2 AIRFIELD LIGHTING CONTROL AND MONITORING SYSTEM (AFLCMS)

The FAA has determined that acceptable airfield lighting control and monitoring systems can be configured in three levels of features. They include personal computer (PC) based systems, programmable logic controller (PLC) based systems, and systems configured with pilot relay panels or basic PLC systems.

2.3 TAXIWAY LIGHTING SYSTEMS

Include edge lights, , hold position lights, and all associated equipment, power supplies and controls, mounting devices, and interconnecting wiring to provide complete systems. If LED fixtures are used, provide fixtures that are compatible with the associated constant current regulators.

2.3.1 Taxiway Edge Lights

FAA AC 150/5345-46, Type L-861T(L) LED for elevated taxiway edge lights with 45-watt, 6.6A lamp and blue lens or yellow lens or LED as indicated and FAA AC 150/5345-46, Type L-852ET(L) LED, Class 1 for semiflush taxiway edge lights with a 115-watt, 6.6A lamp and blue filter.

2.4 OBSTRUCTION LIGHTING AND MARKING

2.4.1 Obstruction Lights

Mark obstructions on or near the airfield and/or lighted as indicated. Use obstruction marker lights emitting aviation red flashing and/or steady burning light. Use multiple-socket assembly FAA AC 150/5345-43, Type L-810 light fixtures. For multiple flashing lights on a circuit, flash the lights in unison. Use single- or double-unit type obstruction marker lights as indicated. Energize the obstruction lights series or multiple

circuits as indicated.

Do not use LED-based obstruction lights on military facilities.

2.5 LIGHT BASES

FAA AC 150/5345-42 Type L-867 or L-868 . Use steel bases, Class 1, Size B as indicated or as required to accommodate the fixture or device installed. Use Size C where more than one distributed control module is installed in the light base. Where used as pull boxes in (single or multiple) can plazas use L-867D bases. Provide base plates, cover plates, and adapter plates to accommodate various sizes of fixtures.

Furnish each base with internal and external one-hole ground lugs for attaching ground or counterpoise cables.

Furnish each base with a 4 foot braided, #6 AWG equivalent ground strap with one-hole lug compression fittings. Utilize straps made for the purpose of grounding the light fixture to the base can interior grounding lug.

2.6 SNOW PLOW RINGS

Provide cast ductile iron bi-directional snow plow rings for in-pavement light fixtures, as indicated. The rings must be suitable for the light fixture and L-868 light base cans indicated. Rings must have four stainless steel spring pins and black powder coat finish. Ring must be provided with a silicone rubber O-ring and six ceramic fluoropolymer coated bolts and 2-piece locking washers.

2.7 ISOLATION TRANSFORMERS

2.7.1 Encapsulated Isolation Transformers

FAA AC 150/5345-47, Type (G) L-830. Provide each transformer with rating as indicated. Insulation Level Primary voltage rating 5000 volts RMS, Secondary 600 V RMS. Operating Temperature range minus 131 degrees F to plus 149 degrees F. Resistant to UV exposure and ozone. Suitable for areas contaminated with oils, aircraft fuels, soil acids, alkalis, and deicing fluids. Compatible with FAA Style 2 and Style 9 connectors.

2.8 CONSTANT CURRENT REGULATORS

Existing regulators to be used.

2.9 MATERIALS AND HARDWARE

2.9.1 Wire and Cable

Use copper conductors installed in conduit. Do not provide or install wire and cable manufactured more than one year before delivery to the job site.

2.9.1.1 Conductor Sizes

Conductor size conforming to American Wire Gage (AWG) or metric trade size. Use stranded conductors for sizes larger #8 AWG. Unless otherwise indicated #8 AWG and smaller may be solid or stranded.

2.9.1.2 Wire and Cable for Series Lighting Circuits

a. FAA AC 150/5345-7, Type L-824 for crosslinked polyethylene Type C 5000-volt cable. Use unshielded cable for series airfield and heliport lighting.

2.9.1.3 Safety (Equipment) Grounding System

Safety (Equipment) Grounding System for constant voltage (parallel) circuits: minimum #6 AWG bare stranded copper, annealed or soft drawn.

2.9.1.4 Cable Tags

Install cable tags for each cable or wire at duct entrances entering or leaving manholes, handholes, and at each terminal within the lighting vault, and in all base cans. Use stainless steel, bronze or copper strip cable tags, approximately 1/16 inch thick or hard plastic 1/8 inch thick suitable for immersion in salt water and impervious to petroleum products. Use sufficient material length for imprinting the legend on one line using raised letters. Permanently mark or stamped with letters not less than 1/4 inch in height as indicated. Two-color laminated plastic is acceptable. When providing plastic tags utilize white colored with markings of black color to provide contrast so that identification can be easily read. Use nylon or stainless steel ties must be of a type that will not deteriorate when exposed to water with a high saline content and to petroleum products.

2.9.1.5 Cable Connectors and Splices

FAA AC 150/5345-26, Item L-823 for connections and splices appropriate for FAA Type L-824 cable.

2.9.2 Conduit, Conduit Fittings, and Boxes

2.9.2.1 Rigid Metal Conduit (RMC) or Electrical Metallic Tubing (EMT) and Fittings

UL 6 and UL 797.

2.9.2.2 Liquid-tight Flexible Metal Conduit (LFMC)

UL 360 liquid-tight flexible metal conduit. See Sections 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION and 26 20 00 ELECTRICAL DISTRIBUTION SYSTEM.

2.9.2.3 Outlet Boxes for use with RMC, EMT, of LFMC

See 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.9.2.4 Plastic Duct for Concrete Encasement

Provide as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.9.2.5 Plastic Conduit for Direct Burial

Provide as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.9.2.6 High Density Polyethylene (HDPE) Electrical Conduit for Directional Bore

Provide as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.9.2.7 Frangible Couplings and Adapters

FAA FO 6850.19 and FAA E-2519. Provide upper section of frangible coupling with one of the following:

a. Unthreaded for slip-fitter connections.

b. 2-13/32 inch 16N-1A modified thread for nut and compression ring to secure 2 inch EMT.

c. 2 inch 11-1/2-N.P.T. (tapered) with 7/32 inch nominal wall thickness to accept rigid conduit coupling.

d. Frangible Couplings for specialized applications as approved.

e. Electrical Metallic Tubing UL 797, where indicated for use with frangible couplings and adapters.

2.9.3 Electrical Tape

Provide as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.9.4 Ground Rods

As specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

2.9.5 Bolts and Hardware

2.9.5.1 Locking Type Washers

Use locking washers of the two-piece wedge-lock design to prevent damage to the fixture. Do not use split-ring, serrated or star type lock washers.

2.9.5.2 Anti-Seize Compound

Use anti-seize compounds for elevated light fixtures with stainless steel bolts but not for ceramic-metallic/fluorocarbon polymer coated bolts for in-pavement light fixtures. Use as recommended by the fixture manufacturer to provide the required clamping force except as indicated in Part 3 of this specification.

2.9.5.3 Ceramic-Metallic/Fluorocarbon Polymer Coated Bolts

Ceramic-metallic/fluorocarbon polymer coated bolts must be used for in-pavement light fixtures or may be used where recommended by the fixture manufacturer in lieu of using an anti-seize compound.

2.9.5.4 Stainless Steel Bolts for Elevated Fixtures

Use anti-seize lubricating compound.

2.9.6 Sealants for Fixtures and Wires in Drilled Holes or Saw Kerfs

FAA AC 150/5370-10, Type P-605 and P-606, for use in asphaltic concrete (AC) or Portland cement concrete (PCC) pavement compatible with AC pavement and having a minimum elongation of 50 percent. Do not use formulations of Type P-606 which are compatible with PCC pavement only.

2.9.7 Manufacturer's Nameplates

Provide on each item of equipment a nameplate bearing the manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; the nameplate of the distributing agent will not be acceptable.

2.9.8 Field Fabricated Nameplates

Provide field fabricated nameplates as specified in Section 26 20 00 ELECTRICAL DISTRIBUTION SYSTEM.

2.10 ACCESSORIES

2.10.1 Special Tools

List of special tools and test equipment required for installation, maintenance of testing of the products supplied by the Contractor. Items to be listed include, but are not limited to, the following:

4-Jack Positioning Jig, used to install the light base to ensure correct orientation and leveling of in-pavement fixtures.

Crimping Tool

Cable Penciler

Elevated Light Level

PART 3 EXECUTION

3.1 LIGHT FIXTURE INSTALLATION REQUIREMENTS

3.1.1 General Installation Requirements

Conform to IEEE C2, NFPA 70, NFPA 70B, and requirements specified herein. Circuits installed underground must conform to the requirements of Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION, except as required herein. Steel conduits installed underground must be installed and protected from corrosion in conformance with the requirements of Section 26 20 00 ELECTRICAL DISTRIBUTION SYSTEM. Electrical metallic tubing (EMT) must not be installed underground or encased in concrete. Except as covered herein, perform excavation, trenching, and backfilling in accordance with the requirements of Section 31 00 00 EARTHWORK.

3.1.2 Airfield Light Fixture Installation

Use 2-part locking type washers for the installation of all airfield light fixtures. Tighten bolts to washer manufacturers recommended torque based on bolt type used. Use only adjustable torque limiting tools.

Where stainless steel bolts are used for elevated fixture installation use

an anti-seize lubricating compound.

Where ceramic-metallic/fluorocarbon polymer coated bolts are used for in-pavement fixture installation do not use anti-seize lubricating compounds.

3.1.3 Light Base Installation

3.1.3.1 Installation in Cored Pavement

Wipe down the sides and bottom of each light base immediately prior to installation. For bored hole installations cover the inside faces of bored hole and bottom and sides of light base with a coating of compatible P-606 sealant that will completely fill the void between concrete and base. Use a jig or holding device when installing each light fixture to ensure positioning to the proper elevation, alignment, level control, and azimuth control. Orient the light fixture with the light beams parallel to the runway or taxiway centerline and facing in the required direction. Outermost edge of fixture must be level with the surrounding pavement. Remove surplus sealant or flexible embedding material. The holding device must remain in place until sealant has reached its initial set. Properly arrange fixture lead wires with respect to their connecting position. Block the wireway entrance into the light recess to retain the sealant material during curing.

3.1.3.2 Installation in Concrete Bed

Where light base can is partially embedded in concrete with jig or holding devices, leave device in place for minimum 24 hours. Let base can set for an additional 48 hours before remaining concrete is placed to the top of the light base.

3.1.4 Frangible Requirements

Install frangible supports, couplings, and adapters as indicated or specified. At the 1000 foot cross bar and beyond, mount approach lights up to 6 feet above concrete foundation on threaded frangible couplings and 2 inch electrical metallic tubing (EMT). For mounting heights greater than 6 feet, mount approach lights on low-impact resistant frangible towers as indicated. The elevation of approach lights must be as indicated on drawings.

3.1.5 Elevated Light Fixtures

Elevated lights must be frangibly mounted, not to exceed 14 inches in height except where higher mounting is permitted in snow accumulation areas. For equipment exceeding 14 inches in height, frangibly mount as indicated. Use a 4-jack positioning jig to install the light base to ensure correct orientation and leveling. The individual setting the jig must fully understand reference marks that are provided by the surveyor. Check azimuth by survey before the concrete anchor is placed and again before paving. A factory representative of the light base manufacture must be on-site when the first light base is being installed and verify that the installation crew understands proper azimuth and elevation required for the light base. Do not place the near light base edge closer than two feet from a planned pavement joint. If conflict occurs, immediately notify the Contracting Officer Representative of the conflict.

3.1.5.1 Elevated Light Level

Level elevated light fixture using manufacturers system required for fixture type.

3.1.6 In-Pavement Airfield and Heliport Lights

Remove water, debris, and other foreign substances prior to installing in-pavement light base and light. Use a 4-jack positioning jig, obtained from the L-868 base manufacturer, to install the light base to ensure correct orientation and leveling. The individual setting the jig must fully understand reference marks that are provided by the surveyor. Check azimuth by survey before the concrete anchor is placed and again before paving. A factory representative of the light base manufacture must be on-site when the first light base is being installed and verify that the installation crew understands proper azimuth & elevation required for the light base. Do not place the near light base edge closer than two feet from a planned pavement joint. If conflict occurs, immediately notify the Contracting Officer Representative of the conflict.

3.1.6.1 In-Pavement Light Installation

For in-pavement installations, pavement around the light base must be level with the surrounding pavement; dished or mounded pavement near the light base is not acceptable.

3.1.6.2 Snow Plow Ring Installation

For in-pavement fixtures that require snow plow rings, coordinate the light base can, light fixture and snow plow ring to meet the installation tolerances shown in the paragraph Light Fixture Installation Tolerances. The Contractor may need to provide spacer rings to meet these tolerances. The top edge of the snow plow ring must be slightly higher than the top of the light fixture. Install the silicone rubber O-ring to seal the light base can. Install the ceramic fluoropolymer coated bolts to attach the light fixture and snow plow ring to the light base can.

3.1.7 Light Fixture Installation Tolerances

	IN-PAVEMENT	ELEVATED
ELEVATION (relative to finished pavement surface)	+0 inch, -1/16 inch (fixture edge on low side in snow areas or on high side in non-snow areas)	+1/4 inch, -0 inch
AZMUTH (*) (w/respect to line parallel to RW/TW centerline)	+/- 1/2 degree	+/- 1/2 degree
LEVEL	+/- 1/2 degree	+/- 1/2 degree

	IN-PAVEMENT	ELEVATED
STATIONING (in line parallel to RW/TW centerline)	+/- 2 inch	+/- 2 inch
OFFSET (perpendicular to RW/TW centerline)	+/- 1/4 inch	+/- 1/4 inch

(*)For omni-directional fixtures the Azimuth does not apply.

3.1.8 Enclosures in Saw Kerfs and Drilled Holes

3.1.8.1 Holes for Light Fixtures

Bore holes in existing pavement to the dimensions indicated with a diamond-edged bit to provide a smooth, straight cut. Bottom of hole must be flat or slightly concave, except that an area at least 1 inch wide around the perimeter must be flat. Fill surfaces deeper than the prescribed depth with sealant to the level of the flat area and allow sealant to cure before further placement.

3.1.8.2 Holes for Transformer Enclosures

Drill or excavate holes through concrete pavement and remove loose material. Fill hole with concrete to depth indicated. Provide a minimum of 3 inches of concrete at bottom of hole.

3.1.8.3 Saw Kerfs and Splice Chambers

Cut saw kerfs and splice chambers in pavements where indicated. Saw cuts must be in straight lines with vertical sides. Width and depth of saw cuts must be adequate for the required number of wires. Chamfer the vertical edges of saw kerfs at intersections. Where a saw kerf crosses a construction joint, increase the depth sufficiently to allow for slack wire under the joint. Enclose the wire in flexible tubing which extends not less than 2 feet each side of the joint.

3.1.8.4 Sandblasting

Sandblast saw kerfs, grooves, and holes to remove foreign or loose material. Use approved equipment maintained in good working order. Utilize the proper size and quality of sand necessary to perform the work. Use nozzles of the proper size in relation to the groove or holes to be cleaned. Replace nozzles enlarged by wear as necessary. Sandblast air
pressure must be not less than 90 psi.

3.1.8.5 Cleaning

Immediately prior to installation of wire or light fixtures, flush saw kerfs and holes with a high velocity water jet or steam, and then clean and dry with a high velocity air jet to remove dirt, water, and foreign material.

3.1.9 Isolation Transformers

Conform to FAA AC 150/5345-26 for transformer lead connections. Plug transformer secondary connectors directly into a mating connector on the transformer secondary leads. During installation, cover mating surfaces of connectors until connected and clean when plugged together. At joint where connectors come together, install heat shrinkable tubing with waterproof sealant or with two half-lapped layers of tape over the entire joint. Joint must prevent entrapment of air which might subsequently loosen the joint.

3.2 CABLES

3.2.1 Cable Installation

In addition to the requirements of Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION, use kit type connectors to splice 5 kV single-conductor series lighting cables. During installation, keep mating surfaces of connectors covered until connected and clean when plugged together. At joint where connectors come together, install heat shrinkable tubing with waterproof sealant. Joint must prevent entrapment of air which might subsequently loosen the joint.

3.2.2 Low Voltage Cables

For splices in wires #8 AWG single conductor cable, use FAA AC 150/5345-26 Type L-823 connectors Splices below grade or in wet locations must be sealed type conforming to NEMA C119.1 or must be waterproofed by a sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring a thermosetting resin into a mold that surrounds the joined conductors.

Cable must be rated 600 volts, except that secondaries of isolation transformer to in-pavement lights installed in pavement saw kerf and 48 volt DC control cables may be 300 volts. Other parts of cable systems such as splices and terminations must be rated at not less than 600 volts. Splices in wires #10 AWG and smaller must be made with an insulated, solderless, pressure type connector, conforming to the applicable requirements of UL 486A-486B. Splices in wires #8 AWG single conductor cable must be made with FAA AC 150/5345-26 Type L-823 connectors Splices below grade or in wet locations must be sealed type conforming to NEMA C119.1 or must be waterproofed by a sealant-filled, thick wall, heat shrinkable, thermosetting tubing or by pouring a thermosetting resin into a mold that surrounds the joined conductors.

3.2.3 Airfield 5kV Series Lighting Cables

3.2.3.1 Connectors

Use kit type connectors to splice 5 kV single-conductor series lighting cables. During installation and prior to covering with earth, cover mating surfaces of connectors until connected and clean when plugged together. At joint where connectors come together, install heat shrinkable tubing with waterproof sealant with two half-lapped layers of tape over the entire joint. Joint must prevent entrapment of air which might subsequently loosen the joint.

3.2.3.2 Crimping Tool

Use only splice kit manufacturer's crimping tool on splice connectors for all primary and secondary airfield cable splices. Crimping tool must have an embossed die with gauge marks for gauge of cable being used.

3.2.3.3 Cable Penciler

Airfield cable insulation must only be removed using cabling penciler made specifically for airfield cable.

3.2.4 Installation of Circuit Wires in Saw Kerfs

Place wires in saw kerfs and anchor them at bottom by means of rubber or plastic wedges or noncorrosive metal clips placed every 2 or 3 feet or as often as necessary to hold the wire down. Encase wires crossing existing joints in a 24 inch length of flexible tubing of polyethylene material conforming to ASTM D1248, Type II or Type III, to break the bond between the wires and the sealing material. Center flexible tubing on the joint and ensure the tubing is of sufficient size to accommodate the wires to allow for movement of the wires as the joint opens and closes. Wrap ends of tubing with tape to prevent entrance of sealing materials. The adjacent joint area must be packed temporarily with roving material, such as hemp, jute, cotton or flax, to prevent sealing material from flowing into the open joint. Carefully mix and apply sealing materials in accordance with the manufacturer's instructions and at the recommended temperature. Remove surplus or spilled material.

3.2.4.1 Splicing Fixtures to the Wires in Pavement Saw Kerfs

Use preinsulated watertight connector sleeves crimped with a tool that requires a complete crimp before tool can be removed. Tape splice with plastic insulating tape.

3.2.5 Cable Markers

Provide cable markers or tags for each cable at duct entrances entering or leaving manholes or handholes and at each termination within the lighting vault. Provide not less than two tags per cable in in each manhole or handhole, one near each duct entrance hole. Immediately after cable installation, permanently attached tags to cables and wires so that they cannot be accidentally detached.

3.2.6 Maximum Allowable Non-Armored Cable Pulling Tension, Using Dynamometer

Cable	Tension LB
2 - 1/C #8 solid	275
3 - 1/C #8 solid	367
4 - 1/C #8 solid	550
2 - 1/C #6 stranded	420
3 - 1/C #6 stranded	630
4 - 1/C #6 stranded	840

Cable	Tension LB
1 - 2/C #8 stranded	305
1 - 3/C #8 stranded	395
1 - 4/C #8 stranded	585
1 - 2/C #6 stranded	455
1 - 3/C #6 stranded	685
1 - 4/C #6 stranded	880
1 - 6/C #12 stranded	315
1 - 12/C #12 stranded	630
1 - 12 pair #19 solid	230
1 - 25 pair #19 solid	541
1 - 50 pair #19 solid	1061
1 - 100 pair #19 solid	2000

3.3 COUNTERPOISE

Install counterpoise above multiple conduits/duct banks for airfield lighting cables, with the intent being to provide a complete cone of protection over the airfield lighting cables. When multiple conduits and/or duct banks for airfield cable are installed in the same trench, the number and location of counterpoise conductors above the conduits must be adequate to provide a cone of protection measured 22 1/2 degrees each side of vertical. Install one continuous length of conductor, except where distance exceeds the length usually supplied. Install the counterpoise approximately 6 inches above single duct lines that are not adjacent to pavement. Where trenches or duct lines intersect, electrically interconnect the counterpoise wires. Connect the counterpoise conductor to a ground rod at every 2,000feet of cable run, at lighting vault(s) (but not to vault equipment), and at feeder connection to light circuit(s). Install the counterpoise conductor in a separate duct under roads, railroads and paved areas, above the highest duct containing electrical or communications circuits.

For in-pavement light fixtures, connect the counterpoise to the exterior one-hole ground lug on fixture bases installed in pavement subject to routine aircraft traffic (runway touchdown zone lights, runway centerline lights, runway guard lights and taxiway centerline lights). Where fixture bases are installed in pavement not subject to routine aircraft traffic (runway and taxiway edge lights) do not connect the counterpoise to fixture bases. In such cases, install the counterpoise at a location half way between the fixture line and the defined runway or taxiway edge. Use exothermic welding for all counterpoise connections. Provide counterpoise ground rods at maximum 2,000 foot spacing.

The counterpoise must be connected to the exterior one-hole ground lug on fixture bases. Use bolted ground clamps when bases are supplied with ground lug. Bolts and fasteners must be bronze or stainless steel. Torque to manufacturer's recommendation.

3.4 SAFETY (EQUIPMENT) GROUNDING SYSTEM

The purpose of the safety ground is to protect personnel from possible contact with an energized light base that may result from a shorted power

cable or isolation transformer. Install and connect a #16 AWG conductor by one of the following methods from base to a ground rod

a. Connect each fixture base to a dedicated ground rod located outside the base on the side opposite the counterpoise.

b. Bond a group of adjacent fixture bases to a common safety ground conductor.

Connect the safety ground conductor to ground rods by exothermic welding and bolted connections. A safety ground is not required for in-pavement fixture bases where a counterpoise is connected to the exterior ground lug. In all cases connect the light fixture, whether in-pavement or elevated, to the base interior ground lug by means of a braided ground strap specified in paragraph "Light Bases".

3.5 DUCT LINES

Duct lines as required in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION and as indicated. Ducts must be installed in trench for 24 hours before trench is backfilled to allow ducts to reach final ground temperature.

3.6 MANHOLES AND HANDHOLES

The manholes and handholes as required in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.6.1 Handholes Within Paved Areas

Handholes within paved areas must have their top surface flush with grade, -0 to +1/4 inch.

3.6.2 Handholes Within Unpaved Areas

Handholes within unpaved areas must have their top surface +1 to +2 inches above grade.

3.7 MARKING AND LIGHTING OF AIRWAY OBSTRUCTIONS

Mark and light all towers, poles, smokestacks, buildings of certain shapes and sizes, and other obstructions in accordance with FAA AC 70/7460-1 and as indicated.

3.7.1 Painting of Airway Obstructions

Conform with FAA AC 70/7460-1 and as indicated for patterns and colors to mark obstructions.

3.7.2 Obstruction Marker Lights

Install obstruction marker lights on radio towers, elevated water tanks, smokestacks, buildings, and similar structures with 1 inch zinc-coated rigid steel conduit stems using standard tees and elbows, except that lowering devices, when required, must be installed in accordance with equipment manufacturer's recommendations.

3.8 CONSTANT CURRENT REGULATORS

Regulators are existing

3.9 APPLICATION

3.9.1 Exothermic Welding

Utilize only personnel who are experienced in and regularly engaged in this type of work to make these connections. Prior to any installations in the field, provide documentation demonstrating the welding kits, materials and procedures to be used for welded connections are satisfactory. Comply with the manufacturer's recommendations and the following:

a. Remove all slag from welds.

b. The light fixture base cans shall be provided with internal and external one-hole ground lugs that are coated with hot dipped galvanizing, the same as the rest of the base cans. The external ground lug should be bolted to a separate ground lug which is exothermically welded to a #4 AWG stranded bare copper grounding cable. That is connected to a ground rod for Air Force or Army projects or the counterpoise for Navy projects.

3.9.2 Field Fabricated Nameplate Mounting

Provide number, location, and letter designation of nameplates as indicated. Fasten nameplates to the device with a minimum of two sheet-metal screws or two rivets.

3.9.3 Equipment for Silicone Sealant

Equipment for silicone sealant must be air-powered pump, components, and hoses as recommended by the sealant manufacturer. Hoses and seals must be lined to prevent moisture penetration and withstand pumping pressures. Equipment must be free of contamination from previously used other type sealant.

3.9.4 Concrete

Concrete used in underground structures, such as manholes, handholes, pull boxes and foundations must have minimum 28-day strength of 4000 psi. Similar structures in areas where freeze/thaw conditions are common, must have minimum 28-day strength of 4500 psi. Concrete used for non-structural items, such as equipment pads, must have minimum 28-day strength of 2000 psi.

3.9.5 Grounding

Ground non-current carrying metallic parts associated with electrical equipment as specified in Section 33 71 02 UNDERGROUND ELECTRICAL DISTRIBUTION.

3.10 FIELD QUALITY CONTROL

Notify the Contracting Officer five working days prior to each test. Correct all deficiencies and repeat tests. Field test reports must be

written, signed and provided as each circuit or installation item is completed. Include resistance-to-ground and resistance between conductors field tests, and continuity measurements for each circuit. For each series circuit measure the input voltage and output current of the constant current regulator at each intensity. For multiple circuits measure the input and output voltage of the transformer for each intensity setting. Provide report documenting the visual inspection of the lights operation, markings appearance, and installed fixtures or units.

3.10.1 Visual Inspection

Inspection reports must be prepared and provided as each stage of installation is completed. Identify the activity by contract number, location, quantity of material placed, and compliance with requirements.

3.10.2 Operating Test

Upon completion of tests, show by demonstration in service that circuits, control equipment, and lights covered by the contract are in good operating condition. Operate each switch in the control tower lighting panels so that each switch position is engaged at least twice. During this process, observe lights and associated equipment to determine that each switch controls properly corresponding circuit. Provide telephone or radio communication between the operator and the observers. Repeat tests from the alternate control station, from the remote control points, and again from the local control switches on the regulators. Test each lighting circuit by operating the lamps at maximum brightness for not less than 30 minutes. Visually examine at the beginning and at the end of this test to ensure that the correct number of lights are burning at full brightness. Conduct one day and one night operating test for the Contracting Officer.

Provide performance test reports, upon completion and testing of the installed system, in booklet form showing all field tests performed to adjust each component and all field tests performed to provide compliance with the specified performance criteria. For each test, indicate the final position of controls.

3.10.3 Distribution Conductors, 600-Volt Class

Using an instrument which applies a voltage of approximately 500 volts providing a direct reading in resistance, performing testing to verify that no short circuits or accidental grounds exist.

3.10.4 Counterpoise System Test and Inspection

At accessible locations, visually inspect counterpoise system to ensure continuity of counterpoise system. Test continuity of counterpoise system to the vault grounding system in manhole closest to the vault.

3.10.5 Progress Testing for Series Lighting Circuits

Conduct a megger test on each section of circuit or progressive combinations of sections as they are installed. Test each section or progressive combination of sections with a megohmmeter providing a voltage of approximately 1000 volts, a direct reading in resistance. Document all results. Eliminate faults found by these tests, and re-test before proceeding with the circuit installation.

3.10.6 Electrical Acceptance Tests

Perform acceptance tests for series and multiple airfield and heliport lighting circuits only on complete lighting circuits. Each series and multiple lighting circuit must receive a high voltage insulation test. Check that cable insulation resistance to ground is not less than 50 megohms per FAA-C-1391, Installation and Splicing of Underground Cable.

3.10.7 Low-Voltage Continuity Tests

Test each series circuit for electrical continuity. Eliminate faults indicated by this test and perform retest before proceeding with the high-voltage insulation resistance test.

3.10.8 High-Voltage Insulation Resistance Tests

Subject each series lighting circuit to a high-voltage insulation resistance test by measurement of the insulation leakage current with a suitable high-voltage test instrument which has a steady, filtered direct current output voltage and limited current. High-voltage tester must include an accurate voltmeter and microammeter for reading voltage applied to the circuit and resultant insulation leakage current. Do not exceed voltage test values specified below.

a. Test Procedure: Disconnect both leads from regulator output terminals and support so that air gaps of at least 3 inches or as defined by FAA AC 150/5345-7 Table 1 exists between bare conductors and ground. Clean and dry cable sheaths for a distance of 1 feet from ends of cables and exposed insulation at ends of cables. Connect ends of both conductors of the circuit together and to high-voltage terminals of test equipment, and test voltage applied as specified in the following tabulation between conductors and ground for a period of 5 minutes.

Test Voltage, DC		
	First Test on New Circuits	Test on Existing Circuits
High Intensity Series Lighting Circuits (5,000 volt leads, 500 and 200 watt transformers)	9000	5000
Medium Intensity Series Lighting Circuits (5,000 volt leads, 30/45 watt transformers)	6000	3000
600-Volt Circuits	900	600

When additions are made to existing circuits, test only new sections in accordance with "First Test on New Circuits" in table above. To ensure reliable operation, test complete circuit at reduced voltages indicated above.

b. Leakage Current: Measure and record insulation leakage current for

each circuit after a 1 minute application of the test voltage. If leakage current exceeds values specified below, sectionalize the circuit and retest, and repair or replace defective parts. Leakage current limits include allowances for the normal number of connectors and splices for each circuit as follows:

(1) . Three microamperes for each 1000 feet of cable.

(2) . Two microamperes for each isolation transformer.

(3) . If measured value of insulation leakage current exceeds calculated value, sectionalize the circuit and test as specified for each section. Repair or replace defective components until repeated tests indicate an acceptable value of leakage current for the entire circuit.

c. Resistance Values versus Cable Length

An alternate test procedure for circuit validation is to use a megohmeter. Use 5000V test for new circuits and 3000V test for existing circuits. If new work is tied into existing circuits, perform two tests, one for the new portion, and another for the existing portion. Only existing circuits affected by new work shall be tested. If the minimum resistance values are not achieved then use the leakage current test indicated above.

Circuit Length in Feet Meters	Minimum Resistance to Ground (Megohms)
10,000	50
10,000-20,000	40
>20,000	30

3.11 CLOSEOUT ACTIVITIES

3.11.1 Demonstration

After completion of installations and the above tests, circuits, control equipment, and lights covered by the contract must be demonstrated to be in acceptable operating condition. Each switch in the control tower lighting panels must be operated so that each switch position is engaged at least twice. During this process, lights and associated equipment must be observed to determine that each switch properly controls the corresponding circuit. Telephone or radio communication must be provided between the operator and the observer. Tests must be repeated from the alternate control station, from the remote control points, and again from the local control switches on the regulators. Each lighting circuit must be tested by operating the lamps at maximum brightness for not less than 30 minutes. At the beginning and at the end of this test the correct number of lights must be observed to be burning at full brightness. One day and one night operating test must be conducted for the Contracting Officer.

3.11.2 Training

Submit requirements of training four weeks before training is scheduled to begin. Submit information describing training to be provided, training aids to be used, samples of training materials, and schedules; instructions necessary to checkout, troubleshoot, repair, and replace components of the systems, including integrated electrical and mechanical schematics and diagrams and diagnostic techniques necessary to enable operation and troubleshooting after acceptance of the system.

a. Provide two identical training sessions on the proper operation and maintenance procedures for the system. Submit a list of special tools and test equipment required for maintenance and testing of the products supplied by the Contractor.

b. Submit six copies and an electronic PDF copyof operation for the equipment furnished. One complete set must be furnished prior to performance testing and the remainder must be furnished upon acceptance. Operating manuals must detail the step-by-step procedures required for system startup, operation, and shutdown. Operating manuals must include the manufacturer's name, model number, parts list, and brief description of all equipment and their basic operating features.

c. Submit six copies and an electronic PFDF copy of maintenance manuals listing routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guides. Maintenance manuals must include conduit and equipment layout and simplified wiring and control diagrams of the system as installed.

3.11.3 As-Built Drawings

Submit a hard and electronic copy of as-built drawings that provide current factual information including deviations from, and amendments to the drawings and changes in the work, concealed and visible, as instructed. The as-built drawings must show installations with respect to fixed installations not associated with the systems specified herein. Cable and wire must be accurately identified as to direct-burial or in conduit and must locate the connection and routing to and away from bases, housings, and boxes.

3.11.4 Posted Instructions

Submit a hard and electronic copy of the proposed posted instructions showing wiring, control diagrams, complete layout and operating instructions explaining preventive maintenance procedures, methods of checking the system for normal safe operation, and procedures for safely starting and stopping the system.

3.12 MAINTENANCE

3.12.1 List of Parts

A list of parts and components for the system by manufacturer's name, part number, nomenclature, and stock level required for maintenance and repair necessary to ensure continued operation with minimal delays.

3.12.2 Maintenance and Repair Instructions

Instructions necessary to check out, troubleshoot, repair, and replace components of the systems, as specified.

3.12.3 Posted Operations and Maintenance Instructions

Submit proposed diagrams, instructions, and other sheets prior to posting.

-- End of Section --

SECTION 31 00 00

EARTHWORK
08/08

PART 1 GENERAL

1.1 CRITERIA FOR BIDDING

Base bids on the following criteria:

a. Surface elevations are as indicated.

b. Pipes or other artificial obstructions, except those indicated, will not be encountered.

c. Ground water elevations indicated by the boring log were those existing at the time subsurface investigations were made and do not necessarily represent ground water elevation at the time of construction.

d. Material character is indicated by the boring logs.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 180	(2017) Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop
AASHTO T 224	(2010) Standard Method of Test for Correction for Coarse Particles in the Soil Compaction Test

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C600	(2017) Installation of Ductile-Iron Mains and Their Appurtenances

ASTM INTERNATIONAL (ASTM)

ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D1140	(2017) Standard Test Methods for Determining the Amount of Material Finer

	than 75-µm (No. 200) Sieve in Soils by Washing
ASTM D1556/D1556M	(2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D2487	(2017; E 2020) Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D2937	(2017; E 2017; E 2018) Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method
ASTM D4318	(2017; E 2018) Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D6938	(2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)

EPA 600/4-79/020	(1983) Methods for Chemical Analysis of Water and Wastes
EPA SW-846.3-3	(1999, Third Edition, Update III-A) Test Methods for Evaluating Solid Waste: Physical/Chemical Methods

1.3 DEFINITIONS

1.3.1 Satisfactory Materials

Satisfactory materials comprise any materials classified by ASTM D2487 as GW, GP, GM, GP-GM, GW-GM, GC, GP-GC, GM-GC, SW, SP, SM, SW-SM, SC, SW-SC, SP-SM, SP-SC and CL. Satisfactory materials for grading comprise stones less than 4 inches, except for fill material for pavements which comprise stones less than 1 inches in any dimension.

1.3.2 Unsatisfactory Materials

Materials which do not comply with the requirements for satisfactory materials are unsatisfactory. Unsatisfactory materials also include man-made fills; trash; refuse; backfills from previous construction; and material classified as satisfactory which contains root and other organic matter or frozen material. Notify the Contracting Officer when encountering any contaminated materials.

1.3.3 Cohesionless and Cohesive Materials

Cohesionless materials include materials classified in ASTM D2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic. Perform testing, required for classifying materials, in accordance with ASTM D4318, ASTM C136/C136M and ASTM D1140.

1.3.4 Degree of Compaction

Degree of compaction required, except as noted in the second sentence, is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D1557 abbreviated as a percent of laboratory maximum density. Since ASTM D1557 applies only to soils that have 30 percent or less by weight of their particles retained on the 3/4 inch sieve, express the degree of compaction for material having more than 30 percent by weight of their particles retained on the 3/4 inch sieve as a percentage of the maximum density in accordance with AASHTO T 180 and corrected with AASHTO T 224. To maintain the same percentage of coarse material, use the "remove and replace" procedure as described in NOTE 8 of Paragraph 7.2 in AASHTO T 180.

1.3.5 Topsoil

Conform to the requirements of 32 92 19 SEEDING.

1.3.6 Hard/Unyielding Materials

Hard/Unyielding materials comprise weathered rock, dense consolidated deposits, or conglomerate materials which are not included in the definition of "rock" with stones greater than 12 inch in any dimension. These materials usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.

1.3.7 Unstable Material

Unstable materials are too wet to properly support the utility pipe, conduit, or appurtenant structure.

1.3.8 Select Granular Material

1.3.8.1 General Requirements

Select granular material consist of materials classified as GW, GP, SW,or SP by ASTM D2487 where indicated. The liquid limit of such material must not exceed 35percent when tested in accordance with ASTM D4318. The plasticity index must not be greater than 12percent when tested in accordance with ASTM D4318, and not more than 15percent by weight may be finer than No. 200 sieve when tested in accordance with ASTM D1140.

1.3.9 Initial Backfill Material

Initial backfill consists of select granular material or satisfactory materials free from rocks 3 inches or larger in any dimension.

1.4 SYSTEM DESCRIPTION

Subsurface soil boring logs are shown on the drawings. These data

represent the best subsurface information available; however, variations may exist in the subsurface between boring locations.

1.4.1 Classification of Excavation

No consideration will be given to the nature of the materials, and all excavation will be designated as unclassified excavation.

1.4.2 Blasting

Blasting will not be permitted.

1.4.3 Dewatering Work Plan

Submit procedures for accomplishing dewatering work. The submittal must be reviewed and approved by the Government before dewatering shall commence. The dewatering system must be designed by a professionally licensed geotechnical engineer.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Shoring; G, RO
Dewatering Work Plan; G, RO

SD-03 Product Data

Utilization of Excavated Materials; G, DO

Shoulder Construction

SD-06 Test Reports

Testing

Borrow Site Testing

Within 24 hours of conclusion of physical tests, submit 3 copies of test results, including calibration curves and results of calibration tests.

SD-07 Certificates

Testing

PART 2 PRODUCTS

2.1 REQUIREMENTS FOR OFFSITE SOILS

Test offsite soils brought in for use as backfill for Total Petroleum

Hydrocarbons (TPH), Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and full Toxicity Characteristic Leaching Procedure (TCLP) including ignitability, corrosivity and reactivity. Backfill shall contain a maximum of 100 parts per million (ppm) of total petroleum hydrocarbons (TPH) and a maximum of 10 ppm of the sum of Benzene, Toluene, Ethyl Benzene, and Xylene (BTEX) and shall pass the TCPL test. Determine TPH concentrations by using EPA 600/4-79/020 Method 418.1. Determine BTEX concentrations by using EPA SW-846.3-3 Method 5030/8020. Perform TCLP in accordance with EPA SW-846.3-3 Method 1311. Provide Borrow Site Testing for TPH, BTEX and TCLP from a composite sample of material from the borrow site, with at least one test from each borrow site. Do not bring material onsite until tests have been approved by the Contracting Officer.

2.2 BURIED WARNING AND IDENTIFICATION TAPE

Provide polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for warning and identification of buried utility lines. Provide tape on rolls, 3 inches minimum width, color coded as specified below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Provide permanent color and printing, unaffected by moisture or soil.

Warning Tape Color Codes	
Red	Electric
Yellow	Gas, Oil; Dangerous Materials
Orange	Telephone and Other Communications
Blue	Water Systems
Green	Sewer Systems
White	Steam Systems
Gray	Compressed Air

2.2.1 Warning Tape for Metallic Piping

Provide acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.003 inch and a minimum strength of 1500 psi lengthwise, and 1250 psi crosswise, with a maximum 350 percent elongation.

2.2.2 Detectable Warning Tape for Non-Metallic Piping

Provide polyethylene plastic tape conforming to the width, color, and printing requirements specified above, with a minimum thickness of 0.004 inch, and a minimum strength of 1500 psi lengthwise and 1250 psi crosswise. Manufacture tape with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 3 feet deep. Encase metallic element of the tape in a protective jacket

or provide with other means of corrosion protection.

2.3 DETECTION WIRE FOR NON-METALLIC PIPING

Insulate a single strand, solid copper detection wire with a minimum of 12 AWG.

PART 3 EXECUTION

3.1 STRIPPING OF TOPSOIL

Strip topsoil to a depth of 4inches. Spread topsoil on areas already graded and prepared for topsoil, or transported and deposited in stockpiles convenient to areas that are to receive application of the topsoil later, or at locations indicated or specified. Keep topsoil separate from other excavated materials, brush, litter, objectionable weeds, roots, stones larger than 1 in diameter, and other materials that would interfere with planting and maintenance operations.

3.2 GENERAL EXCAVATION

Perform excavation of every type of material encountered within the limits of the project to the lines, grades, and elevations indicated and as specified. Perform the grading in accordance with the typical sections shown and the tolerances specified in paragraph FINISHING. Transport satisfactory excavated materials and place in fill within the limits of the work. Excavate unsatisfactory materials encountered within the limits of the work below grade and replace with satisfactory materials as directed. Include such excavated material and the satisfactory material ordered as replacement in excavation. Dispose surplus satisfactory excavated material not required for fill in areas approved for surplus material storage or designated waste areas. Dispose unsatisfactory excavated material in designated waste or spoil areas. During construction, perform excavation and fill in a manner and sequence that will provide proper drainage at all times. Excavate material required for fill in excess of that produced by excavation within the grading limits from other approved areas selected by the Contractor as specified.

3.2.1 Ditches, Gutters, and Channel Changes

Finish excavation of ditches, gutters, and channel changes by cutting accurately to the cross sections, grades, and elevations shown on the drawings. Do not excavate ditches and gutters below grades shown. Backfill the excessive open ditch or gutter excavation with satisfactory, thoroughly compacted, material or with suitable stone or cobble to grades shown. Dispose excavated material as shown or as directed, except in no case allow material be deposited a maximum 4 feet from edge of a ditch. Maintain excavations free from detrimental quantities of leaves, brush, sticks, trash, and other debris until final acceptance of the work.

3.2.2 Structures

Make excavations to the lines, grades, and elevations shown, or as directed. Provide trenches and foundation pits of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Clean rock or other hard foundation material of loose debris and cut to a firm, level, stepped, or serrated surface. Remove loose disintegrated rock and thin strata. Do not disturb the bottom of the excavation when concrete or masonry is to be

placed in an excavated area. Do not excavate to the final grade level until just before the concrete or masonry is to be placed.

3.2.3 Drainage

Provide for the collection and disposal of surface and subsurface water encountered during construction. Completely drain construction site during periods of construction to keep soil materials sufficiently dry. Throughout construction grade the construction area to provide positive surface water runoff away from the construction activity and provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. It is the responsibility of the Contractor to assess the soil and ground water conditions presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

3.2.4 Dewatering

Control groundwater flowing toward or into excavations to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. Do not permit French drains, sumps, ditches or trenches within 3 feet of the foundation of any structure, except with specific written approval from the Contracting Officer, and after specific contractual provisions for restoration of the foundation area have been made. Take control measures by the time the excavation reaches the water level in order to maintain the integrity of the in situ material. While the excavation is open, maintain the water level continuously, at least 2 feet below the bottom of the excavation. Operate dewatering system continuously until construction work below existing water levels is complete. Submit performance records weekly.

3.2.5 Trench Excavation Requirements

Excavate the trench as recommended by the manufacturer of the pipe to be installed. Slope trench walls below the top of the pipe, or make vertical, and of such width as recommended in the manufacturer's printed installation manual. Provide vertical trench walls where no manufacturer's printed installation manual is available. Shore trench walls more than 4 feet high, cut back to a stable slope, or provide with equivalent means of protection for employees who may be exposed to moving ground or cave in. Shore vertical trench walls more than 4 feet high. Excavate trench walls which are cut back to at least the angle of repose of the soil. Give special attention to slopes which may be adversely affected by weather or moisture content. Do not exceed the trench width below the pipe top of 24 inches plus pipe outside diameter (O.D.) for pipes of less than 24 inches inside diameter, and do not exceed 36 inches plus pipe outside diameter for sizes larger than 24 inches inside diameter. Where recommended trench widths are exceeded, provide redesign, stronger pipe, or special installation procedures by the Contractor. The Contractor is responsible for the cost of redesign, stronger pipe, or special installation procedures without any additional cost to the Government.

3.2.5.1 Bottom Preparation

Grade the bottoms of trenches accurately to provide uniform bearing and support for the bottom quadrant of each section of the pipe. Excavate bell holes to the necessary size at each joint or coupling to eliminate point bearing. To avoid point bearing, remove stones such that the maximum rock size is 1 inch, or as recommended by the pipe manufacturer, whichever is smaller, for coated or wrapped pipes. For uncoated or unwrapped pipes up to 24 inches in diameter, the maximum rock size shall be 1.5 inches, or as recommended by the pipe manufacturer, whichever is smaller.

3.2.5.2 Removal of Unyielding Material

Where unyielding material is encountered in the bottom of the trench, remove such material 6 inches below the required grade and replaced with suitable materials as provided in paragraph BACKFILLING AND COMPACTION.

3.2.5.3 Removal of Unstable Material

Where unstable material is encountered in the bottom of the trench, remove such material to the depth directed and replace it to the proper grade with select granular material as provided in paragraph BACKFILLING AND COMPACTION. When removal of unstable material is required due to the Contractor's fault or neglect in performing the work, the Contractor is responsible for excavating the resulting material and replacing it without additional cost to the Government.

3.2.5.4 Excavation for Appurtenances

Provide excavation for manholes, catch-basins, inlets, or similar structures sufficient to leave at least 12 inches clear between the outer structure surfaces and the face of the excavation or support members. Clean rock or loose debris and cut to a firm surface either level, stepped, or serrated, as shown or as directed. Remove loose disintegrated rock and thin strata. Specify removal of unstable material. When concrete or masonry is to be placed in an excavated area, take special care not to disturb the bottom of the excavation. Do not excavate to the final grade level until just before the concrete or masonry is to be placed.

3.2.6 Underground Utilities

The Contractor is responsible for movement of construction machinery and equipment over pipes and utilities during construction. Report damage to utility lines or subsurface construction immediately to the Contracting Officer.

3.2.7 Structural Excavation

Ensure that footing subgrades have been inspected and approved by the Contracting Officer prior to concrete placement.

3.3 SELECTION OF BORROW MATERIAL

Select borrow material to meet the requirements and conditions of the particular fill for which it is to be used. Obtain borrow material from approved private sources.

3.4 SHORING

3.4.1 General Requirements

Submit a Shoring and Sheeting plan for approval 15 days prior to starting work. Submit drawings and calculations, certified by a registered professional engineer, describing the methods for shoring and sheeting of excavations. Finish shoring, including sheet piling, and install as necessary to protect workmen, banks, adjacent paving, structures, and utilities. Remove shoring, bracing, and sheeting as excavations are backfilled, in a manner to prevent caving.

3.5 GRADING AREAS

Where indicated, divide work into grading areas within which satisfactory excavated material will be placed in embankments, fills, and required backfills. Do not haul satisfactory material excavated in one grading area to another grading area except when so directed in writing. Place and grade stockpiles of satisfactory, unsatisfactory,and wasted materials as specified. Keep stockpiles in a neat and well drained condition, giving due consideration to drainage at all times. Clear, grub, and seal by rubber-tired equipment, the ground surface at stockpile locations; separately stockpile excavated satisfactory and unsatisfactory materials. Protect stockpiles of satisfactory materials from contamination which may destroy the quality and fitness of the stockpiled material. If the Contractor fails to protect the stockpiles, and any material becomes unsatisfactory, remove and replace such material with satisfactory material from approved sources.

3.6 FINAL GRADE OF SURFACES TO SUPPORT CONCRETE

Do not excavate to final grade until just before concrete is to be placed. Roughen the level surfaces, and cut the sloped surfaces, as indicated, into rough steps or benches to provide a satisfactory bond. Protect all surfaces from erosion resulting from ponding or water flow.

3.7 GROUND SURFACE PREPARATION

3.7.1 General Requirements

Remove and replace unsatisfactory material with satisfactory materials, as directed by the Contracting Officer, in surfaces to receive fill or in excavated areas. Scarify the surface to a depth of 6 inches before the fill is started. Plow, step, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that the fill material will bond with the existing material. When subgrades are less than the specified density, break up the ground surface to a minimum depth of 6 inches, pulverizing, and compacting to the specified density. When the subgrade is part fill and part excavation or natural ground, scarify the excavated or natural ground portion to a depth of 12 inches and compact it as specified for the adjacent fill.

3.7.2 Frozen Material

Do not place material on surfaces that are muddy, frozen, or contain frost.

3.8 UTILIZATION OF EXCAVATED MATERIALS

Dispose unsatisfactory materials removing from excavations into designated waste disposal or spoil areas if available, else dispose of outside the limits of Government-controlled property. Use satisfactory material removed from excavations, insofar as practicable, in the construction of fills, embankments, subgrades, shoulders, bedding (as backfill), and for similar purposes. Submit procedure and location for disposal of unused satisfactory material. Submit proposed source of borrow material to the designer-of-record for approval.. Do not waste any satisfactory excavated material without specific written authorization. Dispose of satisfactory material, authorized to be wasted, in designated areas approved for surplus material storage or designated waste areas as directed. Clear and grub newly designated waste areas on Government-controlled land before disposal of waste material thereon. Stockpile and use coarse rock from excavations for constructing slopes or embankments adjacent to streams, or sides and bottoms of channels and for protecting against erosion. Do not dispose excavated material to obstruct the flow of any stream, endanger a partly finished structure, impair the efficiency or appearance of any structure, or be detrimental to the completed work in any way.

3.9 BURIED TAPE AND DETECTION WIRE

3.9.1 Buried Warning and Identification Tape

Provide buried utility lines with utility identification tape. Bury tape 12 inches below finished grade; under pavements and slabs, bury tape 6 inches below top of subgrade.

3.9.2 Buried Detection Wire

Bury detection wire directly above non-metallic piping at a distance not to exceed 12 inches above the top of pipe. Extend the wire continuously and unbroken, from manhole to manhole. Terminate the ends of the wire inside the manholes at each end of the pipe, with a minimum of 3 feet of wire, coiled, remaining accessible in each manhole. Furnish insulated wire over its entire length. Install wires at manholes between the top of the corbel and the frame, and extend up through the chimney seal between the frame and the chimney seal. For force mains, terminate the wire in the valve pit at the pump station end of the pipe.

3.10 BACKFILLING AND COMPACTION

Place satisfactory material backfill adjacent to any and all types of structures, in successive horizontal layers of loose materia not more than 8 inches in depth. Compact to at least 90 percent laboratory maximum dry density for cohesive materials or 95 percent laboratory maximum dry density for cohesionless materials per ASTM D1557, to prevent wedging action or eccentric loading upon or against the structure. Backfill material must be within the range of -2 to +2 percent of optimum moisture content at the time of compaction.

Prepare ground surface on which backfill is to be placed and provide compaction requirements for backfill materials in conformance with the applicable portions of paragraphs GROUND SURFACE PREPARATION. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment.

3.10.1 Trench Backfill

Backfill trenches to the grade shown.

3.10.1.1 Replacement of Unyielding Material

Replace unyielding material removed from the bottom of the trench with select granular material or initial backfill material.

3.10.1.2 Replacement of Unstable Material

Replace unstable material removed from the bottom of the trench or excavation with select granular material placed in layers not exceeding 6 inches loose thickness.

3.10.1.3 Bedding and Initial Backfill

Provide bedding of the type and thickness shown. Place initial backfill material and compact it with approved tampers to a height of at least one foot above the utility pipe or conduit. Bring up the backfill evenly on both sides of the pipe for the full length of the pipe. Take care to ensure thorough compaction of the fill under the haunches of the pipe. Except as specified otherwise in the individual piping section, provide bedding for buried piping in accordance with AWWA C600, Type 4, except as specified herein. Compact backfill to top of pipe to 95 percent of ASTM D1557 maximum density. Provide plastic piping with bedding to spring line of pipe. Provide materials as follows:

3.10.1.3.1 Class I

Angular, 0.25 to 1.5 inch, graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.

3.10.1.3.2 Class II

Coarse sands and gravels with maximum particle size of 1.5 inch, including various graded sands and gravels containing small percentages of fines, generally granular and noncohesive, either wet or dry. Soil Types GW, GP, SW, and SP are included in this class as specified in ASTM D2487.

3.10.1.4 Final Backfill

Fill the remainder of the trench, except for special materials for roadways, railroads and airfields, with satisfactory material. Place satisfactory material backfill material and compact as follows:

3.10.1.4.1 Roadways and Airfields

Place satisfactory material backfill up to the required elevation as specified. Do not permit water flooding or jetting methods of compaction.

3.10.1.4.2 Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas

Deposit backfill in layers of a maximum of 12 inches loose thickness, and compact it to 85 percent maximum density for cohesive soils and 90 percent maximum density for cohesionless soils. Do not permit compaction by water flooding or jetting. Apply this requirement to all other areas not specifically designated above.

3.10.2 Backfill for Appurtenances

After the manhole, catchbasin, inlet, or similar structure has been constructed and the concrete has been allowed to cure for 7 days, place satisfactory material backfill in such a manner that the structure is not be damaged by the shock of falling earth. Deposit the backfill material, compact it as specified for final backfill, and bring up the backfill evenly on all sides of the structure to prevent eccentric loading and excessive stress.

3.11 SPECIAL REQUIREMENTS

Special requirements for both excavation and backfill relating to the specific utilities are as follows:

3.11.1 Water Lines

Excavate trenches to a depth that provides a minimum cover of 4.5 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe.

3.11.2 Electrical Distribution System

Provide a minimum cover of 24 inches from the finished grade to direct burial cable and conduit or duct line, unless otherwise indicated.

3.12 FILL

Construct fill from satisfactory materials free of organic or frozen material and rocks with any dimension greater than 3 inches. Place the material in successive horizontal layers of loose material not more than 8 inches in depth. Spread each layer uniformly on a soil surface that has been moistened or aerated as necessary, and scarified or otherwise broken up so that the fill will bond with the surface on which it is placed. After spreading, plow, disk, or otherwise break up each layer; moisten or aerate as necessary; thoroughly mix; and compact to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials. Backfill material must be within the range of -2 to +2 percent of optimum moisture content at the time of compaction.

3.13 SUBGRADE PREPARATION

3.13.1 Proof Rolling

Proof roll only on non-stabilized subgrades. Finish proof rolling on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade. Proof roll the existing subgrade with six passes of a dump truck loaded with 4 cubic yards of soil or a 15 ton, pneumatic-tired roller. Operate the truck or roller in a systematic manner to ensure the number of passes over all areas, and at speeds between 2-1/2 to 3-1/2 mph. When proof rolling, provide one-half of the passes made with the roller in a direction perpendicular to the other passes. Notify the Contracting Officer a minimum of 3 days prior to proof rolling. Perform proof rolling in the presence of the Contracting Officer. Undercut rutting or pumping of material as directed by the Contracting Officer and replace with select granular material.

3.13.2 Construction

Shape subgrade to line, grade, and cross section, and compact as specified. Include plowing, disking, and any moistening or aerating required to obtain specified compaction for this operation. Remove soft or otherwise unsatisfactory material and replace with satisfactory excavated material or other approved material as directed. Excavate rock encountered in the cut section to a depth of 6 inches below finished grade for the subgrade. Bring up low areas resulting from removal of unsatisfactory material or excavation of rock to required grade with satisfactory materials, and shape the entire subgrade to line, grade, and cross section and compact as specified. After rolling, do not show deviations for the surface of the subgrade for airfields greater than 1/4 inch when tested with a 12 foot straightedge applied both parallel and at right angles to the centerline of the area. Do not vary the elevation of the finish subgrade more than 0.05 foot from the established grade and cross section.

3.13.3 Compaction

Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, other approved equipment, or by methods indicated in Section 32 11 33.13 if subgrade is stabilized. Except for paved areas, compact each layer of fill to at least 90 percent of ASTM D1557 laboratory maximum density.

3.13.3.1 Subgrade for Road Pavements

Compact subgrade for road pavements to at least 95 percent of the laboratory maximum density for the depth below the surface of the pavement shown. When more than one soil classification is present in the subgrade, thoroughly blend, reshape, and compact the top 12 inches of subgrade.

3.13.3.2 Subgrade for Shoulders

Reference Section 32 11 33.13 for shoulder subgrade compaction requirements.

3.13.3.3 Subgrade for Airfield Pavements

Reference Section 32 11 33.13 for airfield pavement subgrade compaction requirements.

3.14 SHOULDER CONSTRUCTION

Construct shoulders of satisfactory excavated or borrow material or as otherwise shown or specified. Submit advanced notice on shoulder construction for rigid pavements. Construct shoulders immediately after adjacent paving is complete. In the case of rigid pavements, do not construct shoulders until permission of the Contracting Officer has been obtained. Compact the entire shoulder area to at least the percentage of maximum density as specified in paragraph SUBGRADE PREPARATION above, for specific ranges of depth below the surface of the shoulder. Finish compaction by sheepsfoot rollers, pneumatic-tired rollers, steel-wheeled rollers, vibratory compactors, or other approved equipment. Finish shoulder construction in proper sequence in such a manner that adjacent ditches will be drained effectively and that no damage of any kind is done to the adjacent completed pavement. Align the completed shoulders true to

grade and shaped to drain in conformity with the cross section shown.

3.15 FINISHING

Finish the surface of excavations, embankments, and subgrades to a smooth and compact surface in accordance with the lines, grades, and cross sections or elevations shown. Provide the degree of finish for graded areas within 0.1 foot of the grades and elevations indicated except that the degree of finish for subgrades specified in paragraph SUBGRADE PREPARATION. Finish gutters and ditches in a manner that will result in effective drainage. Finish the surface of areas to be turfed from settlement or washing to a smoothness suitable for the application of turfing materials. Repair graded, topsoiled, or backfilled areas prior to acceptance of the work, and re-established grades to the required elevations and slopes.

3.15.1 Subgrade and Embankments

During construction, keep embankments and excavations shaped and drained. Maintain ditches and drains along subgrade to drain effectively at all times. Do not disturb the finished subgrade by traffic or other operation. Protect and maintain the finished subgrade in a satisfactory condition until ballast, subbase, base, or pavement is placed. Do not permit the storage or stockpiling of materials on the finished subgrade. Do not lay subbase, base course, ballast, or pavement until the subgrade has been checked and approved by the Contracting Officer's Representative, and in no case place subbase, base, surfacing, or pavement on a muddy, spongy, or frozen subgrade.

3.15.2 Grading Around Structures

Construct areas within 5 feet outside of each structure line true-to-grade, shape to drain, and maintain free of trash and debris until final inspection has been completed and the work has been accepted.

3.16 PLACING TOPSOIL

As specified in 32 92 19 SEEDING.

3.17 TESTING

Perform testing by a Corps validated commercial testing laboratory or the Contractor's validated testing facility. Submit qualifications of the Corps validated commercial testing laboratory or the Contractor's validated testing facilities. If the Contractor elects to establish testing facilities, do not permit work requiring testing until the Contractor's facilities have been inspected, Corps validated and approved by the Contracting Officer.

a. Determine field in-place density in accordance with ASTM D1556/D1556M and ASTM D6938. When ASTM D6938 is used, check the calibration curves and adjust using only the sand cone method as described in ASTM D1556/D1556M. ASTM D6938 results in a wet unit weight of soil in determining the moisture content of the soil when using this method.

b. Check the calibration curves furnished with the moisture gauges along with density calibration checks as described in ASTM D6938; check the calibration of both the density and moisture gauges at the beginning of a job on each different type of material encountered and at

intervals as directed by the Contracting Officer. ASTM D2937 shall be used only for soft, fine-grained, cohesive soils. When test results indicate, as determined by the Contracting Officer, that compaction is not as specified, remove the material, replace and recompact to meet specification requirements.

c. Perform tests on recompacted areas to determine conformance with specification requirements. Appoint a registered professional civil engineer to certify inspections and test results. Testing and observations shall be done by an approved special inspector under the supervision of a registered professional civil engineer. These certifications shall state that the tests and observations were performed by or under the direct supervision of the engineer and that the results are representative of the materials or conditions being certified by the tests. The following number of tests, if performed at the appropriate time, will be the minimum acceptable for each type operation.

3.17.1 Fill and Backfill Material Gradation

One test per 1,000 cubic yards stockpiled or in-place source material. Determine gradation of fill and backfill material in accordance with ASTM C136/C136M and ASTM D1140.

3.17.2 In-Place Densities

a. One test per 2,500 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by other than hand-operated machines.

b. One test per 500 square feet, or fraction thereof, of each lift of fill or backfill areas compacted by hand-operated machines.

3.17.3 Check Tests on In-Place Densities

If ASTM D6938 is used, check in-place densities by ASTM D1556/D1556M as follows:

a. One check test per lift for each 25,000 square feet, or fraction thereof, of each lift of fill or backfill compacted by other than hand-operated machines.

b. One check test per lift for each 5,000 square feet, of fill or backfill areas compacted by hand-operated machines.

3.17.4 Moisture Contents

In the stockpile, excavation, or borrow areas, perform a minimum of two tests per day per type of material or source of material being placed during stable weather conditions. During unstable weather, perform tests as dictated by local conditions and approved by the Contracting Officer.

3.17.5 Optimum Moisture and Laboratory Maximum Density

Perform tests for each type material or source of material including borrow material to determine the optimum moisture and laboratory maximum density values. One representative test per 500 cubic yards of fill and backfill, or when any change in material occurs which may affect the optimum moisture content or laboratory maximum density.

3.17.6 Tolerance Tests for Subgrades

Perform continuous checks on the degree of finish specified in paragraph SUBGRADE PREPARATION during construction of the subgrades.

3.18 DISPOSITION OF SURPLUS MATERIAL

Remove surplus material or other soil material not required or suitable for filling or backfilling, and brush, refuse, stumps, roots, and timber from Government property.

-- End of Section --

SECTION 32 01 16.71

COLD MILLING ASPHALT PAVING
02/17

PART 1 GENERAL

1.1 EQUIPMENT, TOOLS, AND MACHINES

Maintain in a satisfactory working condition equipment, tools, and machines used in the performance of the work.

1.1.1 Cold-Milling Machine

Provide a cold-milling machine which is self-propelled, capable of milling the pavement to a specified depth and smoothness and of establishing grade control; with means of controlling transverse slope and dust produced during the pavement milling operation. Machine will have capability of adding water in front of equipment to minimize dust during milling operation. The machine will have the ability to remove the millings or cuttings from the pavement and load them into a truck. The milling machine will not damage any part of the pavement structure that is not to be removed.

1.1.2 Cleaning Equiment

Provide cleaning equipment suitable for removing and cleaning loose material from the pavement surface.

1.1.3 Straightedge

Furnish and maintain at the site, in good condition, one 12 foot straightedge or other suitable device for each milling machine, for testing the finished surface. Make straightedge available for Government use. Use straightedges constructed of aluminum or other lightweight metal, with blades of box or box-girder cross section with flat bottom reinforced to insure rigidity and accuracy. Use straightedges with handles to facilitate movement on the pavement.

1.2 ENVIRONMENTAL REQUIREMENTS

Do not perform milling when there is accumulation of snow or ice on the pavement surface.

PART 2 PRODUCTS

Not Used

PART 3 EXECUTION

3.1 MILLING OPERATION

A minimum of seven days notice is required, prior to start work, for the Contracting Officer to coordinate the milling operation with other activities at the site. Make sufficient passes so that the designated area is milled to the grades and cross sections indicated. Mill the pavement in depth increments that will not damage the pavement below the

designated finished grade. If scabbing occurs, the surface will not meet smoothness requirements. Take steps to modify the process as needed to prevent scabbing from occuring. Repair or replace, as directed, items damaged during milling such as manholes, valve boxes, utility lines, pavement that is torn, cracked, gouged, broken, or undercut. Remove the milled material from the pavement and load into trucks.

3.2 GRADE AND SURFACE-SMOOTHNESS TESTING

3.2.1 Grade-Conformance Tests

Test the finished milled surface of the pavement for conformance with the plan-grade requirements and for acceptance by the Contracting Officer by running lines of levels at intervals of 25 feet longitudinally and 25 feet transversely to determine the elevation of the completed pavement. Correct variations from the designated grade line and elevation in excess of the plan-grade requirements as directed. Skin patching for correcting low areas will not be permitted. Remove and replace the deficient low area. Remove sufficient material to allow at least 1 inch of asphalt concrete to be placed.

3.2.2 Surface-Smoothness Tests

After completion of the final milling, the finished milled surface will be tested by the Government with a straightedge. Other approved devices may be used, provided that when satisfactorily and properly operated, such devices reveal all surface irregularities exceeding the tolerances specified. Correct surface irregularities that depart from the testing edge by more than 1/4 inch. Skin patching for correcting low areas will not be permitted. Remove and replace the deficient low area. Remove sufficient material to allow at least 1 inch of asphalt concrete to be placed.

3.3 REMOVAL OF MILLED MATERIAL

Material that is removed will become the property of the Contractor and removed from the site.

-- End of Section --

SECTION 32 01 19.61

SEALING OF JOINTS IN RIGID PAVEMENT
11/19

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C1016	(2014) Standard Test Method for Determination of Water Absorption of Sealant Backing (Joint Filler) Material
ASTM D789	(2015) Determination of Relative Viscosity and Moisture Content of Polyamide (PA)
ASTM D5249	(2010; R 2016) Standard Specification for Backer Material for Use with Cold-and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints
ASTM D5893/D5893M	(2016) Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Sealants; G, RO

Submit catalog cuts, specifications, Safety Data Sheets and other information documenting conformance to Contract requirements.

Manufacturer's Recommendations

Blocking Media/Backup MaterialsBacker RodBond Breaking Tapes

SD-06 Test Reports

Sealants

SD-07 Certificates

Equipment List

SD-08 Manufacturer's Instructions

Sealants

Provide instructions that include, but not limited to: storage requirements, ambient temperature and humidity ranges, and moisture condition of joints for successful installation; requirements for preparation of joints; safe heating temperature; mixing instructions; installation equipment and procedures; application and disposal requirements; compatibility of sealant with filler material; curing requirements; and restrictions to be adhered to in order to reduce hazards to personnel or to the environment. Submit instructions at least 30 days prior to use.

1.3 QUALITY ASSURANCE

1.3.1 Test Requirements

Test the sealant and backup or separating material for conformance with the referenced material specification. Perform testing of the materials in an approved independent laboratory and submit certified copies of the test reports for approval 60 days prior to the use of the materials at the job site. Submit samples to be retained by the Government for possible future testing if the materials appear defective during or after application. Conformance with the requirements of the laboratory tests specified does not constitute final acceptance of the materials. Base final acceptance on the performance of the in-place materials.

1.3.2 Trial Joint Sealant Installation

Prior to cleaning and sealing the joints for the entire project, prepare a test section at least 200 ft long using the specified materials and approved equipment, so as to demonstrate the proposed joint preparation and sealing of the types of joints in the project. Following the completion of the test section and before any other joint is sealed, inspect the test section to determine that the materials and installation meet the requirements specified. Inspect joint seal test section. Provide written notice of deficiencies and required corrections or adjustments in the joint seal installation procedures. Correct deficiencies and obtain approval of test section prior to installing joint seals. If it is determined that the materials or installation do not meet the requirements, remove the materials, and reclean and reseal the joints at no cost to the Government. Permit the test section meeting the requirements to be incorporated into the permanent work and paid for at the Contract unit price per linear foot for sealing items scheduled. Prepare and seal other joints in the manner approved for sealing the test section. Notify the Contracting Officer upon completion of the test section.

1.4 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to the site for visible damage, and unload and store with a minimum of handling. Deliver joint materials in original sealed containers and protect from freezing or overheating. Provide jobsite storage facilities capable of maintaining temperature ranges within manufacturers recommendations.

1.5 ENVIRONMENTAL REQUIREMENTS

Do not proceed with work when weather conditions detrimentally affect the quality of cleaning joints or applying sealants. Proceed with joint preparation and sealing only when weather conditions are in accordance with manufacturer's instructions. Install joint sealant to dry surfaces and protect sealant and bond breakers from moisture.

1.6 TRAFFIC CONTROL

Do not permit vehicular or heavy equipment traffic on the pavement in the area of the joints being sealed during the protection and curing period of the sealant. Permit traffic on the pavement at the end of the curing period.

PART 2 PRODUCTS

2.1 SEALANTS

Use materials for sealing joints in accordance with ASTM D5893/D5893M, non-sag.

2.2 PRIMERS

Use primers in accordance with the recommendation of the manufacturer.

2.3 BOND BREAKERS

2.3.1 Blocking Media/Backup Materials

Provide backup (joint filler) material that is a compressible, nonshrinking, nonstaining, nonabsorbing, nonreactive material with the sealant. Use backup material compliant with ASTM D5249. Use material with a melting point at least 5 degrees F greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D789. Use material with a water absorption of not more than 5 percent of the sample weight when tested in accordance with ASTM C1016. Use backup (joint filler) material that is 25 plus or minus 5 percent larger in diameter than the nominal width of the crack. Use blocking media consistent with the sealant manufacturer's installation instructions.

2.3.2 Bond Breaking Tapes

Provide a bond breaking tape or separating material that is a flexible, nonshrinkable, nonabsorbing, nonstaining, and nonreacting adhesive-backed tape. Use material with a melting point at least 5 degrees F greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D789. Use bond breaker tape approximately 1/8 in wider than the nominal width of the joint and that does not bond to the sealant. Use bond breaking tape shall be consistent with the sealant manufacturer's installation instructions.

PART 3 EXECUTION

3.1 EXECUTING EQUIPMENT

Submit equipment list and description of the equipment to be used and a statement from the supplier of the sealant that the proposed equipment is acceptable for installing the specified sealant. Use equipment for

heating, mixing, and installing seals in accordance with the instructions provided by the sealant manufacturer. Provide equipment, tools, and accessories necessary to clean joints and install liquid joint sealants. Maintain machines, tools, and other equipment in proper working condition. Submit a list of proposed equipment to be used in performance of construction work including descriptive data, 60 days prior to use on the project.

3.1.1 Joint Cleaning Equipment

3.1.1.1 Tractor-Mounted Routing and Plowing Tool

Use routing tools for removing old sealant from the joints, of such shape and dimensions and so mounted on the tractor that do not damage the sides of the joints. Use tools designed to be adjusted to remove the old material to varying depths and widths as required. Use equipment capable of maintaining accurate cutting depth and width control. Use a joint plow equipped with a spring or hydraulic mechanism to release pressure on the tool prior to spalling the concrete. Do not permit the use of V-shaped tools or rotary impact routing devices. Permit the use of hand-operated spindle routing devices to clean and enlarge random cracks.

3.1.1.2 Concrete Saw

Provide a self-propelled power saw, with water-cooled diamond or abrasive saw blades, for cutting joints to the depths and widths specified, for refacing joints, cleaning sawed joints where waterblasting does not provide a clean joint. Permit single or gang type blades with one or more blades mounted in tandem for fast cutting. Select saw adequately powered and sized to cut specified opening with not more than two passes of the saw through the joint. Reference specification 32 13 14.13 CONCRETE PAVING FOR AIRFIELDS AND OTHER HEAVY DUTY PAVEMENTS for specific joint sawing equipment and methods requirements for airfield pavements.

3.1.1.3 Waterblasting Equipment

Include with the waterblasting equipment a trailer-mounted water tank, pumps, high-pressure hose, wand with safety release cutoff control, nozzle, and auxiliary water resupply equipment. Provide water tank and auxiliary resupply equipment of sufficient capacity to permit continuous operations. Use a nozzle with an adjustable guide that holds the nozzle aligned with the joint approximately 1 in above the pavement surface. Adjust the height, angle of inclination and the size of the nozzle to obtain satisfactory results. Use a pressure gauge mounted at the pump that shows the pressure in psi at which the equipment is operating.

3.1.1.4 Air Compressor

Use a portable air compressor capable of blowing out debris, water, dust adhering to sidewalls of concrete, and other objectionable materials from the joints. Use a compressor that provides air at a pressure not less than 90 psi and a minimum rate of 150 cubic ft of air per minute at the nozzles and free of oil.

3.1.1.5 Vacuum Sweeper

Use a self-propelled, vacuum pickup sweeper capable of completely removing loose sand, water, joint material, and debris from pavement surface.

3.1.1.6 Hand Tools

Permit the use of hand tools, such as brooms and chisels, when approved, for removing defective sealant from a crack and repairing or cleaning the crack faces.

3.1.2 Sealing Equipment

Use joint sealing equipment of a type required by the sealant manufacturer's installation instructions. Use equipment capable of installing sealant to the depths, widths and tolerances indicated. Do not proceed with joint sealing when malfunctions are noted until the malfunctions are corrected.

3.1.2.1 Cold-Applied, Single-Component Sealing Equipment

Use equipment for installing ASTM D5893/D5893M single component joint sealants that consists of an extrusion pump, air compressor, following plate, hoses, and nozzle for transferring the sealant from the storage container into the joint opening. Use a nozzle with dimensions that allows the tip of the nozzle to extend into the joint to allow sealing from the bottom of the joint to the top. Maintain the initially approved equipment in good working condition, serviced in accordance with the supplier's instructions, and unaltered in any way without obtaining prior approval. Use lined hoses and seals to prevent moisture penetration and withstand pumping pressures. Use equipment free of contamination from previously used or other type sealant. Permit use of small hand-held air-powered equipment (i.e., caulking guns) for small applications.

3.2 PREPARATION OF JOINTS

Unless otherwise indicated, remove existing material, saw, clean and reseal joints. Do not proceed with final cleaning operations by more than one working day in advance of sealant. Clean joints by removing existing joint sealing compound, bond-breakers, dirt, laitance, curing compound, filler, and protrusions of hardened concrete from the sides and upper edges of the joint space to be sealed and other foreign material with the equipment. Do not permit cleaning procedures that damage joints or previously repaired patches by chipping or spalling. Remove existing sealant to the required depth. Precise shape and size of existing joints vary, and conditions of joint walls and edges vary and include but are not limited to rounding, square edges, sloping, chips, voids, depressions, and projections.

3.2.1 Existing Sealant Removal

Cut loose the in-place sealant from both joint faces and to the required depth, using the tractor-mounted routing equipment or concrete saw as specified in paragraph EQUIPMENT. Provide a depth sufficient to accommodate blocking media and bond breakers that are required to maintain the depth of new sealant to be installed. For expansion joints, remove existing sealant to a depth of not less than 1 in. When existing preformed expansion-joint material is more than 1 in below the surface of the pavement, remove existing sealant to the top of the preformed joint filler. Prior to further cleaning operations, remove loose old sealant remaining in the joint opening by blowing with compressed air. Permit use of hand tools to remove sealant from random cracks. Do not permit chipping, spalling, or other damage to the concrete. Clean pavement surface with vacuum sweeper. Protect previously cleaned joints from being

contaminated by subsequent cleaning operations.

3.2.2 Sawing

3.2.2.1 Refacing and Facing of Joints

Accomplish refacing and facing of joints using a concrete saw as specified in paragraph EQUIPMENT to remove residual old sealant and a minimum of concrete from the joint face to provide exposure of newly cleaned concrete, and, if required, to enlarge the joint opening to the width and depth shown on the drawings. Provide exposure of newly clean concrete through removal. Remove burrs and irregularities from sides of joint faces. Stiffen the blade with a sufficient number of dummy (used) blades or washers. Clean, immediately following the sawing operation, the joint opening using a water jet to remove saw cuttings and debris and adjacent concrete surface. Protect adjacent previously cleaned joint spaces from receiving water and debris during the cleaning operation.

3.2.2.2 Refacing of Random Cracks

Accomplish sawing of the cracks using a power-driven concrete saw as specified in paragraph EQUIPMENT. Use a saw blade 6 in or less in diameter to enable the saw to follow the trace of the crack. Stiffen the blade with dummy (or used) blades or washers. Immediately following the sawing operation, clean the crack opening using a water jet to remove saw cuttings and debris.

3.2.3 Final Cleaning of Joints

3.2.4 Bond Breaker

At the time the joints receive the final cleaning and are dry, install bond breaker material as indicated with a steel wheel or other approved device.

3.2.4.1 Blocking Media (Backer Rod) (Except for Expansion Joints)

When the joint opening is of a greater depth than indicated for the sealant depth, plug or seal off the lower portion of the joint opening using a blocking media/back-up material to prevent the entrance of the sealant below the specified depth. Take care to ensure that the blocking media/backup material is placed at the specified depth and is not stretched or twisted during installation.

3.2.4.2 Bond Breaking Tape

Where inserts or filler materials contain bitumen, or the depth of the joint opening does not allow for the use of a backup material, insert a bond breaker separating tape to prevent incompatibility with the filler materials and three-sided adhesion of the sealant. Bond the tape to the bottom of the joint opening to prevent it from floating up into the new sealant.

3.2.5 Rate of Progress of Joint Preparation

Limit the stages of joint preparation, air pressure cleaning and placing of the back-up material to only that lineal footage that can be sealed

during the same day.

3.2.6 Disposal of Debris

Sweep pavement surface to remove excess joint material, dirt, water, sand, and other debris by vacuum sweepers or hand brooms. Remove the debris immediately to a point off base..

3.3 PREPARATION OF SEALANT

3.3.1 Single-Component, Cold-Applied Sealants

Inspect the ASTM D5893/D5893M sealant and containers prior to use. Reject materials that contain water, hard caking of any separated constituents, nonreversible jell, or materials that are otherwise unsatisfactory. Do not reject sealants that exhibit settlement of constituents in a soft mass that can be readily and uniformly remixed in the field with simple tools.

3.4 INSTALLATION OF SEALANT

3.4.1 Time of Application

After approval of the test section, seal joints immediately following final cleaning and placing of bond breakers. Commence sealing joints when walls are dust free and dry, and when weather conditions meet sealant manufacturer's instructions. If the above conditions cannot be met, or when rain interrupts sealing operations, reclean and permit the joints to dry prior to installing the sealant.

3.4.2 Sealing Joints

Do not install joint sealant until joints to be sealed have been inspected and approved. Install bond breaker just prior to pouring sealant. Fill the joints with sealant from bottom up until joints are uniformly filled solid from bottom to top using the specified equipment for the type of sealant required. Fill joints to 3/16 in plus or minus 1/16 in below top of pavement, and without formation of voids or entrapped air. Do not permit gravity methods or pouring pots to be used to install the sealant material. Except as otherwise permitted, tool the sealant immediately after application to provide firm contact with the joint walls and to form the indicated sealant profile below the pavement surface. Remove excess sealant that has been inadvertently spilled on the pavement surface. Do not permit traffic over newly sealed pavement until authorized. When a primer is recommended by the manufacturer, apply it evenly to the joint faces in accordance with the manufacturer's recommendations. Check sealed joints frequently to ensure that newly installed sealant is cured to a tack-free condition within the specified time. Protect new sealant from rain during curing period.

3.5 INSPECTION/FIELD QUALITY CONTROL

3.5.1 Joint Cleaning

Inspect joints during the cleaning process to correct improper equipment and cleaning techniques that damage the concrete pavement in any manner. Approve cleaned joints prior to installation of the separating or back-up material and joint sealant.

3.5.2 Sampling Sealant

Obtain a one gal sample of each type of sealant on the project from material used for each 10,000 linear ft or less of joints sealed. Store samples according to sealant manufacturer's instructions. Retain samples until final acceptance of the work.

3.5.3 Sealant Application Equipment

Inspect the application equipment to ensure conformance to temperature requirements, proper proportioning and mixing (if two-component sealant) and proper installation. Suspend operations if there is evidences of bubbling, improper installation, or failure to cure or set until causes of the deficiencies are determined and corrected.

3.5.4 Joint Sealant

Inspect the joint sealant for proper rate of cure and set, bonding to the joint walls, cohesive separation within the sealant, reversion to liquid, entrapped air and voids. Remove sealants exhibiting these deficiencies prior to the final acceptance of the project from the joint, wasted, and replace at no additional cost to the Government. Obtain approval for each joint seal installation.

3.6 ACCEPTANCE

Reject sealer that fails to cure properly, or fails to bond to joint walls, or reverts to the uncured state, or fails in cohesion, or shows excessive air voids, blisters, surface defects, swelling, or other deficiencies, or is not properly recessed within indicated tolerances. Remove rejected sealer and reclean and reseal joints. Perform removal and reseal work promptly by and at the expense of the Contractor.

3.7 CLEAN-UP

Upon completion of the project, remove unused materials from the site and leave the pavement in a clean condition.

-- End of Section --

Certified Rapid Setting Repair Material Matrix

Current Repair Material Information						Temporary Repairs			Permanent Airfield Repairs							
						Crater Repairs			Primary Runways and Taxiways				Secondary Runways, Secondary Taxiways, and Parking Aprons			
Material Classification	Product Name	Manufacturer	Previous Names	Last Tested	Currently Produced?[A]	Small Patch	Large Patch	Expeditionary Spall Repairs	Spall	Small Patch	Large Patch	Full Slab	Spall	Small Patch	Large Patch	Full Slab
Polymeric	ART DOD/DOT 30 MR	A.R.T. Concrete Solutions		2019	Yes			X	X				X			
Cementitious	CTS Cement All	CTS Cement Manufacturing Corp.		2020	Yes			X	X				X			
Cementitious	Euco Speed MP	Euclid Chemical Co.		2018	Yes			X	X				X			
Cementitious	Fast Trac 246 Concrete	Western Material and Design, LLC		2016	Yes			X	X	X			X	X		
Cemenitious	HD-50	Dayton Superior Corp		2015	Yes			X	X	X			X	X		
Polymeric	Jetcon JC400	Jetcon Korea Company LTD		2020	Yes	X	X	X	X	X	X	X	X	X	X	X
Polymeric	MasterEmaco S6000	BASF	Degadeck	2016	Yes			X	X				X			
Cementitious	MasterEmaco T545	BASF	Set 45	2017	Yes			X	X	X	X		X	X	X	
Cementitious	MasterEmaco T545HT	BASF	Set 45 HW	2017	Yes			X	X	X	X		X	X	X	
Cementitious	ProSpec Premium Patch 200	H.B. Fuller Construction Products Inc.		2015	Yes			X	X	X			X	X		
Cementitious-MALP	Phoscrete HC	Phoscrete Corporation		2021	Yes			X	X	X			X	X		
Cementitious	Rapid Set Concrete Mix	CTS Cement Corp.		2017	Yes	X	X	X	X	X	X	X	X	X	X	X

Cementitious	Rapid Set DOT Repair Mix	CTS Cement Corp.		2017	Yes			X								
Cementitious	Rapid Set Mortar Mix	CTS Cement Copr.		2015	Yes			X	X	X			X	X		
Cementitious	SikaQuick 2500	Sika Corp		2018	Yes			X	X	X			X	X		
Polymeric	Silikal R17	Silikal America		2018	Yes			X	X				X			
Cementitious	Ulti-Pave 3	Buzzi-Unicem USA, Inc.		2014	Yes	X	X	X	X	X	X	X	X	X	X	X

SECTION 32 11 20

SUBBASE COURSE
08/17

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 88	(2013) Standard Method of Test for Particle Size Analysis of Soils

ASTM INTERNATIONAL (ASTM)

ASTM C117	(2017) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C131/C131M	(2020) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D1556/D1556M	(2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D4318	(2017; E 2018) Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D6938	(2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D75/D75M	(2019) Standard Practice for Sampling Aggregates
ASTM E11	(2020) Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

1.2 DEGREE OF COMPACTION

Degree of compaction required is expressed as a percentage of the maximum laboratory dry density obtained by the test procedure presented in ASTM D1557 abbreviated as a percent of laboratory maximum dry density. If more than 30 percent by weight is retained on and above the 3/4 inch sieve, notify the Government of the need for a test section to determine the number of compaction coverages and equipment type.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Plant, Equipment, and Tools; G, RO

SD-06 Test Reports

Initial Tests; G, DO

In-Place Tests; G, RO

1.4 EQUIPMENT, TOOLS, AND MACHINES

All plant, equipment, and tools used in the performance of the work will be subject to approval by the Contracting Officer before the work is started. Maintain all plant, equipment, and tools in satisfactory working condition at all times. Submit a list of proposed equipment, including descriptive data. Use equipment capable of minimizing segregation, producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

1.5 QUALITY ASSURANCE

Sampling and testing are the responsibility of the Contractor. Perform sampling and testing using a laboratory approved in accordance with Section 01 45 00 QUALITY CONTROL. Work requiring testing will not be permitted until the testing laboratory has been inspected and approved. Test the materials to establish compliance with the specified requirements and perform testing at the specified frequency. The Contracting Officer may specify the time and location of the tests. Furnish copies of test results to the Contracting Officer within 24 hours of completion of the tests.

1.5.1 Sampling

Take samples for laboratory testing in conformance with ASTM D75/D75M. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.5.2 Tests

1.5.2.1 Sieve Analysis

Perform sieve analysis in conformance with ASTM C117 and ASTM C136/C136M using sieves conforming to ASTM E11. Perform particle-size analysis of the soils in conformance with AASHTO T 88.

1.5.2.2 Liquid Limit and Plasticity Index

Determine liquid limit and plasticity index in accordance with ASTM D4318.

1.5.2.3 Moisture-Density Determinations

Determine the laboratory maximum dry density and optimum moisture in accordance with paragraph DEGREE OF COMPACTION.

1.5.2.4 Field Density Tests

Measure field density in accordance with ASTM D1556/D1556M, or ASTM D6938. For the method presented in ASTM D1556/D1556M, use the base plate, as shown in the drawing. For the method presented in ASTM D6938, check the calibration curves and adjust them, if necessary, using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with ASTM D6938 result in a wet unit weight of soil and ASTM D6938 will be used to determine the moisture content of the soil. Also check the calibration curves furnished with the moisture gauges along with density calibration checks as described in ASTM D6938. Make the calibration checks of both the density and moisture gauges using the prepared containers of material method, as described in paragraph Calibration, in ASTM D6938, on each different type of material to be tested at the beginning of a job and at intervals as directed by the Contracting Officer. Submit calibration curves and related test results prior to using the device or equipment being calibrated.

1.5.2.5 Wear Test

Perform wear tests on subbase course material in conformance with ASTM C131/C131M.

1.6 ENVIRONMENTAL REQUIREMENTS

Perform construction when the atmospheric temperature is above 35 degrees F. When the temperature falls below 35 degrees F, protect all completed areas by approved methods against detrimental effects of freezing. Correct completed areas damaged by freezing, rainfall, or other weather conditions to meet specified requirements.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Subbase Course

Provide aggregates consisting of crushed stone, gravel, sand, or other sound, durable, approved materials processed and blended or naturally combined. Provide aggregates which are free from lumps and balls of clay, organic matter, objectionable coatings, and other foreign material. The percentage of loss of material retained on the No. 4 sieve must not exceed 50 percent after 500 revolutions when tested in accordance with ASTM C131/C131M. Provide aggregate that is reasonably uniform in density and quality. Provide aggregates with a maximum size of 1-1/2 inch and within the limits specified as follows:

Maximum Allowable Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	No. 1
No. 10	50
No. 200	8

Particles having diameters less than 0.02 mm must not be in excess of 3 percent by weight of the total sample tested as determined in accordance with AASHTO T 88. The portion of any blended component and of the completed course passing the No. 40 sieve must be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

2.2 TESTS, INSPECTIONS, AND VERIFICATIONS

2.2.1 Initial Tests

Perform one of each of the following tests on the proposed material prior to commencing construction to demonstrate that the proposed material meets all specified requirements prior to installation. Complete this testing for each source if materials from more than one source are proposed.

a. Sieve Analysis including 0.02 mm size material.

b. Liquid limit and plasticity index.

c. Moisture-density relationship.

d. Wear.

Submit certified copies of test results for approval not less than 30 days before material is required for the work.

2.2.2 Approval of Material

Tentative approval of material will be based on initial test results.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Provide adequate drainage during the entire period of construction to prevent water from collecting or standing on the working area.

3.2 OPERATION OF AGGREGATE SOURCES

Condition aggregate sources on private lands in accordance with local laws and authorities.

3.3 STOCKPILING MATERIAL

Clear and level storage sites prior to stockpiling of material. Stockpile all materials, including approved material available from excavation and grading, in the manner and at the locations designated. Stockpile aggregates on the cleared and leveled areas designated by the Contracting Officer to prevent segregation. Stockpile materials obtained from different sources separately.

3.4 PREPARATION OF UNDERLYING COURSE OR SUBGRADE

Clean the underlying course or subgrade of all foreign substances prior to constructing the subbase. Do not construct subbase course on underlying subgrade that is frozen. Construct the surface of the underlying subgrade to meet specified compaction and surface tolerances. Underlying subgrade shall meet the requirements of specification section 32 11 33.13 PORTLAND CEMENT-STABILIZED SUBGRADE. Do not allow traffic or other operations to disturb the finished subgrade and maintain in a satisfactory condition until the overlying course is placed.

3.5 GRADE CONTROL

Provide a finished and completed subbase course conforming to the lines, grades, and cross sections shown. Place line and grade stakes as necessary for control.

3.6 MIXING AND PLACING MATERIALS

Mix and place the materials to obtain uniformity of the material at the water content specified. Make such adjustments in mixing or placing procedures or in equipment as may be directed to obtain the true grades, to minimize segregation and degradation, to reduce or accelerate loss or increase of water, and to insure a satisfactory subbase course.

3.7 LAYER THICKNESS

Compact the completed course to the thickness indicated. No individual layer may be thicker than 6 inches nor be thinner than 3 inches in compacted thickness. Compact the course(s) to a total thickness that is within 1/2 inch of the thickness indicated. Where the measured thickness is more than 1/2 inch deficient, correct such areas by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 1/2 inch thicker than indicated, the course will be considered as conforming to the specified thickness requirements. The average job thickness will be the average of all thickness measurements taken for the job and must be within 1/4 inch of the thickness indicated. Measure the total thickness of the course(s)

at intervals of one measurement for each 500 square yards of completed course. Measure total thickness using 3 inch diameter test holes penetrating the completed course.

3.8 COMPACTION

Compact each layer of the material, as specified, with approved compaction equipment. Maintain water content during the compaction procedure to within plus or minus 2 percent of optimum water content determined from laboratory tests as specified in this Section. Begin rolling at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Slightly vary the length of alternate trips of the roller. Adjust speed of the roller as needed so that displacement of the aggregate does not occur. Compact mixture with hand-operated power tampers in all places not accessible to the rollers. Continue compaction of the subbase until each layer is compacted through the full depth to at least 100 percent of laboratory maximum density. Make such adjustments in compacting or finishing procedures as may be directed by the Contracting Officer to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory subbase course. Remove any materials that are found to be unsatisfactory and replace with satisfactory material or rework, as directed, to meet the requirements of this specification.

3.9 EDGES OF SUBBASE

Place approved material along the outer edges of the subbase course in sufficient quantity to compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, simultaneously roll and compact at least a 2 foot width of this shoulder material with the rolling and compacting of each layer of the subbase course, as directed.

3.10 SMOOTHNESS TEST

Construct the top layer so that the surface shows no deviations in excess of 3/8 inch when tested with a 12 foot straightedge. Take measurements in successive positions parallel to the centerline of the area to be paved. Also take measurements perpendicular to the centerline at 50 foot intervals. Correct deviations exceeding this amount by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

3.11 FIELD QUALITY CONTROL

3.11.1 In-Place Tests

Perform one of each of the following tests on samples taken from the placed and compacted subbase course. Take samples and test at the rates indicated.

a. Perform density tests on every lift of material placed and at a frequency of one set of tests for every 500 square yards, or portion thereof, of completed area.

b. Perform sieve analysis including 0.02 mm size material on every lift of material placed and at a frequency of one sieve analysis for every 2,000 square yards, or portion thereof, of material placed.

c. Perform liquid limit and plasticity index tests at the same frequency as the sieve analysis.

d. Measure the thickness of each course at intervals providing at least one measurement for each 500 square yards or part thereof. Measure the thickness using test holes, at least 3 inches in diameter through the course.

3.11.2 Approval of Material

Final approval of the materials will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and fully compacted course(s).

3.12 TRAFFIC

Do not allow traffic on the completed subbase course.

3.13 MAINTENANCE

Maintain the completed course in a satisfactory condition until the full pavement section is completed and accepted. Immediately repair any defects and repeat repairs as often as necessary to keep the area intact. Retest any course that was not paved over prior to the onset of winter to verify that it still complies with the requirements of this specification. Rework or replace any area that is damaged as necessary to comply with this specification.

3.14 DISPOSAL OF UNSATISFACTORY MATERIALS

Dispose of any unsuitable materials that have been removed outside the limits of Government-controlled land. No additional payments will be made for materials that have to be replaced.

-- End of Section --

SECTION 32 11 23

AGGREGATE BASE COURSES
08/17

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 88	(2013) Standard Method of Test for Particle Size Analysis of Soils

ASTM INTERNATIONAL (ASTM)

ASTM C117	(2017) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C127	(2015) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
ASTM C128	(2015) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
ASTM C131/C131M	(2020) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D1556/D1556M	(2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D4318	(2017; E 2018) Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D5821	(2013; R 2017) Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate

ASTM D6938	(2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM D75/D75M	(2019) Standard Practice for Sampling Aggregates
ASTM E11	(2020) Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

1.2 DEFINITIONS

For the purposes of this specification, the following definitions apply.

1.2.1 Aggregate Base Course

Aggregate base course (ABC) is well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction.

1.2.2 Degree of Compaction

Degree of compaction required is expressed as a percentage of the maximum laboratory dry density obtained by the test procedure presented in ASTM D1557 abbreviated as a percent of laboratory maximum dry density. If more than 30 percent by weight is retained on and above the 3/4 inch sieve, notify the Government of the need for a test section to determine the number of compaction coverages and equipment type.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Plant, Equipment, and Tools; G, RO

SD-06 Test Reports

Initial Tests; G, RO
In-Place Tests; G, RO

1.4 EQUIPMENT, TOOLS, AND MACHINES

All plant, equipment, and tools used in the performance of the work will be subject to approval by the Contracting Officer before the work is started. Maintain all plant, equipment, and tools in satisfactory working condition at all times. Submit a list of proposed equipment, including descriptive data. Use equipment capable of minimizing segregation, producing the required compaction, meeting grade controls, thickness control, and smoothness requirements as set forth herein.

1.5 QUALITY ASSURANCE

Sampling and testing are the responsibility of the Contractor. Perform sampling and testing using a laboratory approved in accordance with Section 01 45 00 QUALITY CONTROL. Work requiring testing will not be permitted until the testing laboratory has been inspected and approved. Test the materials to establish compliance with the specified requirements and perform testing at the specified frequency. The Contracting Officer may specify the time and location of the tests. Furnish copies of test results to the Contracting Officer within 24 hours of completion of the tests.

1.5.1 Sampling

Take samples for laboratory testing in conformance with ASTM D75/D75M. When deemed necessary, the sampling will be observed by the Contracting Officer.

1.5.2 Tests

1.5.2.1 Sieve Analysis

Perform sieve analysis in conformance with ASTM C117 and ASTM C136/C136M using sieves conforming to ASTM E11. Perform particle-size analysis of the soils in conformance with AASHTO T 88.

1.5.2.2 Liquid Limit and Plasticity Index

Determine liquid limit and plasticity index in accordance with ASTM D4318.

1.5.2.3 Moisture-Density Determinations

Determine the laboratory maximum dry density and optimum moisture content in accordance with paragraph DEGREE OF COMPACTION.

1.5.2.4 Field Density Tests

Measure field density in accordance with ASTM D1556/D1556M or ASTM D6938. For the method presented in ASTM D6938 check the calibration curves and adjust them, if necessary, using only the sand cone method as described in paragraph Calibration, of the ASTM publication. Tests performed in accordance with ASTM D6938 result in a wet unit weight of soil and ASTM D6938 will be used to determine the moisture content of the soil. Also check the calibration curves furnished with the moisture gauges along with density calibration checks as described in ASTM D6938. Make the calibration checks of both the density and moisture gauges using the prepared containers of material method, as described in paragraph Calibration of ASTM D6938, on each different type of material being tested at the beginning of a job and at intervals as directed. Submit calibration curves and related test results prior to using the device or equipment being calibrated.

1.5.2.5 Wear Test

Perform wear tests on ABC course material in conformance with ASTM C131/C131M.

1.6 ENVIRONMENTAL REQUIREMENTS

Perform construction when the atmospheric temperature is above 35 degrees F. When the temperature falls below 35 degrees F, protect all completed areas by approved methods against detrimental effects of freezing. Correct completed areas damaged by freezing, rainfall, or other weather conditions to meet specified requirements.

PART 2 PRODUCTS

2.1 AGGREGATES

Provide ABC consisting of clean, sound, durable particles of crushed stone, crushed gravel, angular sand, or other approved material. Provide ABC that is free of lumps of clay, organic matter, and other objectionable materials or coatings. The portion retained on the No. 4 sieve is known as coarse aggregate; that portion passing the No. 4 sieve is known as fine aggregate. When the coarse and fine aggregate is supplied form more than one source, provide aggregate from each source that meets the specified requirements.

2.1.1 Coarse Aggregate

Provide coarse aggregates with angular particles of uniform density. Separately stockpile coarse aggregate supplied from more than one source.

a. Crushed Gravel: Provide crushed gravel that has been manufactured by crushing gravels and that meets all the requirements specified below.

b. Crushed Stone: Provide crushed stone consisting of freshly mined quarry rock, meeting all the requirements specified below.

2.1.1.1 Aggregate Base Course

The percentage of loss of ABC coarse aggregate must not exceed 50 percent when tested in accordance with ASTM C131/C131M. Provide aggregate that contains no more than 30 percent flat and elongated particles. A flat particle is one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3. In the portion retained on each sieve specified, the crushed aggregates must contain at least 50 percent by weight of crushed pieces having two or more freshly fractured faces determined in accordance with ASTM D5821. When two fractures are contiguous, the angle between planes of the fractures must be at least 30 degrees in order to count as two fractured faces. Manufacture crushed gravel from gravel particles 50 percent of which, by weight, are retained on the maximum size sieve listed in TABLE 1.

2.1.2 Fine Aggregate

Provide fine aggregates consisting of angular particles of uniform density.

2.1.2.1 Aggregate Base Course

Provide ABC fine aggregate that consists of screenings, angular sand, crushed recycled concrete fines, or other finely divided mineral matter processed or naturally combined with the coarse aggregate.

2.1.3 Gradation Requirements

Apply the specified gradation requirements to the completed base course. The Contractor shall choose either gradation No.1 or No.2 for the entire project. Provide aggregates that are continuously well graded within the limits specified in TABLE 1. Use sieves that conform to ASTM E11.

TABLE 1. GRADATION OF AGGREGATES

Percentage by Weight Passing Square-Mesh Sieve

Sieve Designation	No. 1	No. 2
2 inch	100	----
1-1/2 inch	70-100	100
1 inch	45-80	60-100
1/2 inch	30-60	30-65
No. 4	20-50	20-50
No. 10	15-40	15-40
No. 40	5-25	5-25
No. 200	0-8	0-8

NOTE 1: Particles having diameters less than 0.02 mm must not be in excess of 3 percent by weight of the total sample tested as determined in accordance with AASHTO T 88.

NOTE 2: The values are based on aggregates of uniform specific gravity. If materials from different sources are used for the coarse and fine aggregates, test the materials in accordance with ASTM C127 and ASTM C128 to determine their specific gravities. Correct the percentages passing the various sieves as directed by the Contracting Officer if the specific gravities vary by more than 10 percent.

2.2 LIQUID LIMIT AND PLASTICITY INDEX

Apply liquid limit and plasticity index requirements to the completed course and to any component that is blended to meet the required gradation. The portion of any component or of the completed course passing the No. 40 sieve must be either nonplastic or have a liquid limit not greater than 25 and a plasticity index not greater than 5.

2.3 TESTS, INSPECTIONS, AND VERIFICATIONS

2.3.1 Initial Tests

Perform one of each of the following tests, on the proposed material prior to commencing construction, to demonstrate that the proposed material meets all specified requirements when furnished. Complete this testing for each source if materials from more than one source are proposed.

a. Sieve Analysis including 0.02 mm material.

b. Liquid limit and plasticity index.

c. Moisture-density relationship.

d. Wear.

Submit certified copies of test results for approval not less than 30 days before material is required for the work.

2.3.2 Approval of Material

Tentative approval of material will be based on initial test results.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

When the ABC is constructed in more than one layer, clean the previously constructed layer of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Provide adequate drainage during the entire period of construction to prevent water from collecting or standing on the working area.

3.2 OPERATION OF AGGREGATE SOURCES

Condition aggregate sources on private lands in accordance with local laws or authorities.

3.3 STOCKPILING MATERIAL

Clear and level storage sites prior to stockpiling of material. Stockpile all materials, including approved material available from excavation and grading, in the manner and at the locations designated. Stockpile aggregates on the cleared and leveled areas designated by the Contracting Officer to prevent segregation. Stockpile materials obtained from different sources separately.

3.4 PREPARATION OF UNDERLYING COURSE

Clean the underlying course of all foreign substances prior to constructing the base course. Do not construct base course on underlying course or subgrade that is frozen. Construct the surface of the underlying course to meet specified compaction and surface tolerances. Underlying subbase shall meet the requirements of specification section 32 11 20 SUBBASE COURSE. Do not allow traffic or other operations to disturb the finished underlying course and maintain in a satisfactory condition until the base course is placed.

3.5 GRADE CONTROL

Provide a finished and completed base course conforming to the lines, grades, and cross sections shown. Place line and grade stakes as necessary for control.

3.6 MIXING AND PLACING MATERIALS

Mix the coarse and fine aggregates in a stationary plant. Make adjustments in mixing procedures or in equipment, as directed, to obtain true grades, to minimize segregation or degradation, to obtain the required water content, and to insure a satisfactory base course meeting all requirements of this specification. Place the mixed material on the prepared subbase in layers of uniform thickness with an approved spreader. Place the layers so that when compacted they will be true to the grades or levels required with the least possible surface disturbance. Where the base course is placed in more than one layer, clean the previously constructed layers of loose and foreign matter by sweeping with power sweepers, power brooms, or hand brooms, as directed. Make adjustments in placing procedures or equipment as may be directed by the Contracting Officer to obtain true grades, to minimize segregation and degradation, to adjust the water content, and to insure an acceptable base course.

3.7 LAYER THICKNESS

Compact the completed base course to the thickness indicated. No individual layer may be thicker than 6 inches nor be thinner than 3 inches in compacted thickness. Compact the base course(s) to a total thickness that is within 1/2 inch of the thickness indicated. Where the measured thickness is more than 1/2 inch deficient, correct such areas by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 1/2 inch thicker than indicated, the course will be considered as conforming to the specified thickness requirements. The average job thickness will be the average of all thickness measurements taken for the job and must be within 1/4 inch of the thickness indicated. Measure the total thickness of the base course at intervals of one measurement for each 500 square yards of base course. Measure total thickness using 3 inch diameter test holes penetrating the base course.

3.8 COMPACTION

Compact each layer of the base course, as specified, with approved compaction equipment. Maintain water content during the compaction procedure to within plus or minus 2 percent of the optimum water content determined from laboratory tests as specified in this Section. Begin rolling at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Slightly vary the length of alternate trips of the roller. Adjust speed of the roller as needed so that displacement of the aggregate does not occur. Compact mixture with hand-operated power tampers in all places not accessible to the rollers. Continue compaction until each layer is compacted through the full depth to at least 100 percent of laboratory maximum density. Make such adjustments in compacting or finishing procedures as may be directed by the Contracting Officer to obtain true grades, to minimize segregation and degradation, to reduce or increase water content, and to ensure a satisfactory base course. Remove any materials found to be unsatisfactory and replace with satisfactory material or rework, as directed, to meet the requirements of this specification.

3.9 EDGES OF BASE COURSE

Place approved material along the outer edges of the base course in

sufficient quantity to compact to the thickness of the course being constructed. When the course is being constructed in two or more layers, simultaneously roll and compact at least a 2 foot width of this shoulder material with the rolling and compacting of each layer of the base course, as directed.

3.10 FINISHING

Finish the surface of the top layer of base course after final compaction by cutting any overbuild to grade and rolling with a steel-wheeled roller. Do not add thin layers of material to the top layer of base course to meet grade. If the elevation of the top layer of base course is 1/2 inch or more below grade, scarify the top layer to a depth of at least 3 inches and blend new material in and compact to bring to grade. Make adjustments to rolling and finishing procedures as directed by the Contracting Officer to minimize segregation and degradation, obtain grades, maintain moisture content, and insure an acceptable base course. Should the surface become rough, corrugated, uneven in texture, or traffic marked prior to completion, scarify the unsatisfactory portion and rework and recompact it or replace as directed.

3.11 SMOOTHNESS TEST

Construct the top layer so that the surface shows no deviations in excess of 3/8 inch when tested with a 12 foot straightedge. Take measurements in successive positions parallel to the centerline of the area to be paved. Also take measurements perpendicular to the centerline at 50 foot intervals. Correct deviations exceeding this amount by removing material and replacing with new material, or by reworking existing material and compacting it to meet these specifications.

3.12 FIELD QUALITY CONTROL

3.12.1 In-Place Tests

Perform each of the following tests on samples taken from the placed and compacted ABC. Take samples and test at the rates indicated.

a. Perform density tests on every lift of material placed and at a frequency of one set of tests for every 500 square yards, or portion thereof, of completed area.

b. Perform sieve analysis including 0.02 mm size material on every lift of material placed and at a frequency of one sieve analysis for every 2000 square yards, or portion thereof, of material placed.

c. Perform liquid limit and plasticity index tests at the same frequency as the sieve analysis.

d. Measure the thickness of the base course at intervals providing at least one measurement for each 500 square yards of base course or part thereof. Measure the thickness using test holes, at least 3 inch in diameter through the base course.

3.12.2 Approval of Material

Final approval of the materials will be based on tests for gradation, liquid limit, and plasticity index performed on samples taken from the completed and fully compacted course.

3.13 TRAFFIC

Do not allow traffic on the completed base course.

3.14 MAINTENANCE

Maintain the base course in a satisfactory condition until the full pavement section is completed and accepted. Immediately repair any defects and repeat repairs as often as necessary to keep the area intact. Retest any base course that was not paved over prior to the onset of winter to verify that it still complies with the requirements of this specification. Rework or replace any area of base course that is damaged as necessary to comply with this specification.

3.15 DISPOSAL OF UNSATISFACTORY MATERIALS

Dispose of any unsuitable materials that have been removed outside the limits of Government-controlled land. No additional payments will be made for materials that have to be replaced.

-- End of Section --

SECTION 32 11 33.13

PORTLAND CEMENT-STABILIZED SUBGRADE
05/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C117	(2017) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C150/C150M	(2020) Standard Specification for Portland Cement
ASTM C309	(2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C1077	(2017) Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1602/C1602M	(2018) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete
ASTM D558/D558M	(2019) Standard Test Methods for Moisture-Density (Unit Weight) Relations of Soil-Cement Mixtures
ASTM D559	(2003) Wetting and Drying Compacted Soil-Cement Mixtures
ASTM D1556/D1556M	(2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D1632	(2007) Standard Practice for Making and Curing Soil-Cement Compression and Flexure Test Specimens in the Laboratory

ASTM D1633	(2000; R 2007) Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders
ASTM D4318	(2017; E 2018) Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D6938	(2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.2 DEFINITION

Cement-stabilized mixture, as used herein, is a mixture of Portland cement and in-place or select borrow material uniformly blended and compacted as specified to produce a pavement subgrade which meets the criteria set forth in the drawings and specifications.

1.3 SUBMITTALS

Government approval is required for all submittals. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-05 Design Data

Mix Design; G, DO

Submit a contractor-furnished mix design prior to commencement of work. After receiving approval of the mix design, submit a job-mix formula.

SD-06 Test Reports

Compressive Strength Of Modified Subgrade Material; G, DO

Soil-Cement Weight Loss; G, DO

Optimum Moisture Content And Maximum Density; G, DO

Submit results of ASTM C136/C136M sieve analysis and ASTM D1633 compressive strength testing.

SD-07 Certificates

Portland Cement; G, DO

Curing Materials; G, DO

Methods Of Installation; G, DO

Equipment; G, DO

1.4 QUALITY CONTROL

1.4.1 Qualifications

Perform sampling and testing using an approved commercial testing

laboratory or on-site facilities that is accredited in accordance with ASTM C1077. Do not start work requiring testing until the facilities have been inspected and approved. The Government will inspect all laboratories requiring validation for equipment and test procedures prior to the start of any stabilization operations for conformance to ASTM C1077. Schedule and provide payment for laboratory inspections. Additional payment or a time extension due to failure to acquire the required laboratory validation is not allowed. Maintain this certification for the duration of the project.

1.4.2 Test Results

Verify that materials comply with the specification. When a material source is changed, test the new material for compliance. When deficiencies are found, repeat the initial analysis and retest the material already placed to determine the extent of unacceptable material. Replace or repair all in-place unacceptable material to conform to the contract requirements. Perform tests in sufficient numbers, and as specified, to ensure that materials and compaction meet specified requirements. Furnish copies of the test results within 24 hours of completion of tests.

1.5 ENVIRONMENTAL REQUIREMENTS

Do not apply cement when the atmospheric temperature is less than 40 degrees F or to soils that are frozen or contain frost, or when the underlying material is frozen. If the temperature falls below 35 degrees F, protect completed cement-stabilized mixture against detrimental effects of freezing. Bring any areas of completed cement-stabilized mixture that are damaged by freezing, rainfall, or other weather conditions to a satisfactory condition in conformance with this specification.

1.6 ACCEPTANCE

1.6.1 Tolerances

Acceptance of cement-stabilized mixture is based on compliance with the tolerances presented in Table 1. Remove and replace cement-stabilized mixture represented by the failing tests or submit plan for approval.

TABLE 1

Measurement	Tolerance
Grade	plus/minus 0.05 foot
Smoothness	plus/minus 3/8 inch
Thickness (individual measurement)	plus/minus 1/2 inch
Thickness (average)	plus/minus 1/4 inch
Field Density	95 percent minimum

TABLE 1	
Compressive Strength	minus 50 psi below specified strength

1.6.2 Test Section

Place a test section of at least 8 by 100 feet, utilizing the equipment and procedures proposed for use, to demonstrate that cement stabilized mixture conforming to this specification can be produced. Acceptance of the test section is based on compliance with the tolerances listed in Table 1.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Cementitious Materials

2.1.1.1 Portland Cement

Provide cement conforming to ASTM C150/C150M, Type II low alkali.

2.1.2 Material to be Stabilized

2.1.2.1 Subgrade Soil

The subgrade may consist of any combination of gravel, stone, sand, silt, and clay. The subgrade soils shall not contain roots, topsoil, or any material deleterious to its reaction with cement. Soils suitable for cement stabilization comprise of materials classified as GW, GP, GM, GP-GM, GC, GP-GC, GM-GC, SW, SP, SM, SW-SM, SC, SW-SC, SP-SM, SP-SC, and CL. The soils shall have at least 100 percent by weight passing the 1.5-inch sieve and 45 percent by weight passing the No. 4 sieve in accordance with ASTM C117 and ASTM C136/C136M.

2.1.3 Water

Provide water which is clean, fresh, and free from injurious amounts of oil, acid, salt, alkali, organic matter, and other substances deleterious to the hardening of the cement-stabilized mixture, and subject to approval. Test non-potable water sources for conformance with ASTM C1602/C1602M.

2.1.4 Curing Materials

2.1.4.1 Curing Compound

White-pigmented, liquid membrane-forming compound conforming to ASTM C309, Type 2, Class A or Class B (wax-based) for curing cement-stabilized mixture placed as a base course under Portland cement concrete pavement.

2.2 MIX DESIGN

Submit proposed mix design prior to start of stabilization work. Develop the mix using the subgrade soil material to be stabilized. Design mix for a minimum 7-day compressive strength of 250 psi when tested in accordance with ASTM D1633. Limit Soil-Cement Weight Loss to 11 percent or less for

granular soil with PI < 10, 8 percent or less for silt or granular soil with PI > 10, and 6 percent or less for clays after 12 cycles of the durability test in accordance with ASTM D559.

2.2.1 Laboratory Density

Conduct moisture-density tests in accordance with the procedure contained in ASTM D558/D558M and determine optimum moisture content and maximum density. Use the apparatus and procedures outlined in ASTM D1557 to compact the cement-stabilized mixture.

2.2.2 Unconfined Compression

Conduct three unconfined compression tests, in accordance with ASTM D1633, for each mix design tested. Prepare specimens to be used for unconfined compression tests in accordance with ASTM D1632. Use a 4 inch diameter by 8 inch high mold to prepare specimens when more than 35 percent of the material is retained on the No. 4 sieve. Cure samples at a constant moisture content and temperature for 7 days.

2.2.3 Durability

Conduct wet-dry tests in accordance with ASTM D559. Test three specimens for each mix design.

2.2.4 Mix Design Report

Perform trial design batches, mixture proportioning studies, testing, and include results demonstrating that the proposed mixture proportions produce cement-stabilized mixture of the qualities indicated. Submit test results in a mix design report to include:

a. Soil classification including sieve analyses and Atterberg Limits.
b. Durability test results.
c. Mill certificates for cement and supplemental cementitious materials.
d. Recommended proportions and volumes for proposed mixture.
e. Moisture-density curve for selected cement content.
f. Individual compressive strength test results.
g. Narrative discussing methodology on how the mix design was developed.

2.3 EQUIPMENT

Plant, equipment, machines, and tools used in the work are subject to approval. Maintain in a satisfactory working condition at all times. Submit proposed equipment list prior to start of stabilization work. Provide equipment with the capability of producing the mixing and compaction requirements, meeting grade controls, thickness control, and smoothness requirements specified.

2.3.1 Mechanical Spreader

Provide a steerable, self propelled, mechanical spreader having variable speeds forward and reverse. Mount the spreader on tracks, rubber tires, or drum-type steel rollers that will not disturb the underlying material. Provide a spreader containing a hopper, an adjustable screed, and outboard bumper rolls; designed to have a uniform, steady flow of material from the hopper; and capable of laying material without segregation, across the full width of the lane, to a uniform thickness and to a uniform loose density so

that when compacted, the layer or layers conform to thickness and grade requirements indicated.

2.3.2 Pulvimixer

Provide self-propelled, four-wheel drive pulverizing and mixing equipment, capable of pulverizing the soil in a single pass for the full depth to be stabilized and providing a mixing action capable of uniformly blending and mixing the required cement content with the subgrade soil material. Equip with a rotor capable of up or down cutting.

2.3.3 Traveling Plant

Provide a traveling plant capable of moving at a uniform rate of speed and accomplishing thorough mixing of the materials in one pass. Deliver water and cement from supply trucks or bins at a predetermined rate. Construct windrows of prepared cement stabilized mixture to cover a predetermined width to the indicated compacted thickness.

2.3.4 Rollers

Compact the cement stabilized mixture using one or a combination of the following pieces of equipment: tamping or grid roller; steel-wheeled roller; vibratory roller; pneumatic-tire roller, and/or vibrating plate compactor (for areas inaccessible to rollers). Compact the cement stabilized mixture to the required density using the number, type, and weight of rollers and/or compactors sufficient to compact the mixture to the required density.

2.3.5 Straightedge

Furnish and maintain at the site, in good condition, one 12 foot straightedge for use in the testing of the finished surface. Make straightedges available for Government use. Construct straightedges of aluminum or other lightweight metal with blades of box or box-girder cross section with flat bottom reinforced to insure rigidity and accuracy. Provide handles on straightedges to facilitate movement on pavement.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Do not apply cement if the soil moisture content exceeds optimum moisture content specified for the cement-stabilized mixture. When the stabilized course is constructed in more than 1 layer, clean the previously constructed layer of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Provide adequate drainage during the entire construction period to prevent water from collecting or standing on the areas to be stabilized or on pulverized, mixed, or partially mixed material. Provide line and grade stakes as necessary for control. Place grade stakes in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

3.2 STOCKPILING MATERIALS

Stockpile select material, including approved material available from excavation and grading, in the manner and at the locations designated. Before stockpiling of material, clear, drain and level the storage sites.

Separately stockpile materials obtained from different sources.

3.3 PREPARATION OF AREA TO BE STABILIZED

Clean debris from area to be stabilized. Dispose of debris and removed unsatisfactory in-place material as specified.

3.3.1 In-Place Material to be Stabilized

Grade the entire area to be stabilized and shape to conform to the lines, grades, and cross sections shown in the plans, prior to being processed.

3.3.2 Dewatering

Shallow groundwater may create difficulties with cement-stabilization due to excess moisture in the subgrade soils. The Contractor shall dewater areas where shallow groundwater will prevent proper mixing or compaction of a stabilized subgrade. The Contractor shall maintain the water level so that proper moisture content and compaction of the subgrade can be achieved. A dewatering work plan shall be submitted as required in SECTION 31 00 00.

3.4 Methods Of Installation

3.4.1 Mixed-in-Place Method

3.4.1.1 Scarifying and Pulverizing of Soil

Prior to the application of cement, scarify and pulverize the soil to the depth shown. Carefully control scarification so that the layer beneath the layer to be stabilized is not disturbed. Do not pulverize to a depth exceeding the depth of scarification. Unless otherwise permitted, do not scarify and pulverize an area greater than can be completed in 2 working days.

3.4.1.2 Application of Cement

Approximately shape pulverized material to the cross section indicated. Apply cement so that when uniformly mixed with the soil, the specified cement content is obtained, and a sufficient quantity of cement-treated soil is produced to construct a compacted cement-stabilized mixture conforming to the lines, grades, and cross section indicated. Do not pass over the freshly spread cement-stabilized mixture, except for equipment used in spreading and mixing operations.

3.4.1.3 Water Application and Moist Mixing

Determine moisture content of the cement stabilized mixture immediately after completion of mixing of the soil and cement. Provide water-supply and pressure distributing equipment that will permit the continuous application within 3 hours of all water required on the section being processed. Incorporate water in the mix so that concentration of water near the surface does not occur. After all the mixing water has been added, continue mixing until the water is uniformly distributed throughout the full depth of the mixture, with no portion of the mixture remaining undisturbed during mixing for more than 30 minutes. Dispose of any portion of the cement stabilized mixture remaining undisturbed more than 30 minutes during mixing.

3.4.2 Traveling-Plant Method

Move traveling plant at a uniform rate of speed to accomplish thorough mixing of the materials. Deliver water and cement from supply trucks or bins at a predetermined rate. Construct windrows of prepared cement stabilized mixture of sufficient size to cover a predetermined width to the indicated compacted thickness.

3.4.3 Layer Thickness

Compact thickness of the cement-stabilized mixture as indicated. Do not compact layers in excess of 8 inches nor less than 4 inches in compacted thickness.

3.4.4 Compaction

As a continuation of the mixing operation, thoroughly loosen the mixture to the full depth before compaction operations are started. At the beginning of compaction, process the mixture to provide a uniform blend with 100 percent passing the specified maximum subgrade soil size. Start compaction immediately after mixing is completed. Compact the cement stabilized mixture to at least 95 percent of the maximum density obtained from the laboratory samples prepared and tested in accordance with paragraph: LABORATORY DENSITY. Uniformly and continuously compact the loose mixture until the entire depth and width of the area are compacted to the density specified. Maintain the moisture content at the surface near optimum at all times through the rolling, but less than that quantity which will cause the cement stabilized mixture to become unstable during compaction. Begin rolling at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Use slightly different lengths on alternate trips of the roller. Do not permit displacement of the cement stabilized mixture due to the speed of the roller. Compact areas inaccessible to rollers with mechanical tampers.

3.5 FINISHING

Moisten the surface, if necessary, and shape to the required lines, grades, and cross section. Lightly scarify the surface, if necessary, to eliminate any imprints made by the compacting or shaping equipment. Thoroughly compact the surface to the specified density with rubber-tired rollers and smooth-wheel tandem rollers to the extent necessary to provide a smooth, dense, uniform surface that is free of surface checking, ridges, or loose material, and that conforms to the crown, grade, and line indicated. Complete these finishing operations within 2 hours after completion of mixing operations. In places not accessible to finishing and shaping equipment, compact the cement-stabilized mixture with mechanical tampers to the density specified and shape and finish by hand methods. Correct, as specified below, any portion of the compacted mix that has density less than that specified, that has not properly hardened, or that is improperly finished.

3.6 CONSTRUCTION JOINTS

At the end of each day's construction, form a straight transverse construction joint by cutting back into the completed work to form a true vertical face free of loose or shattered material. Remove material along construction joints not properly compacted and replace with cement stabilized mixture mixed, moistened, and compacted as specified.

3.7 CURING AND PROTECTION

Protect the finished surface against rapid drying for 7 days by one of the methods specified.

3.7.1 Liquid Membrane Forming Curing Compound

Uniformly spray the surface of the cement treated subgrade with the curing compound at the rate of one gallon/100 square feet to obtain a uniform cover over the surface. Provide spraying equipment of the fully atomizing type equipped with a tank agitator. Thoroughly and uniformly mix the curing compound with the pigment in the storage tank. During application, stir the compound continuously by mechanical means. Hand spray odd widths or shapes and surfaces.

3.8 FIELD QUALITY CONTROL

3.8.1 Grade Control

Excavate underlying material to sufficient depth for the required stabilized-course thickness. Provide a finished stabilized course with the subsequent surface course meeting the fixed grade. Conform finished and completed stabilized area to the lines, grades, cross section, and dimensions indicated and the tolerances of Table 1. Correct deviations exceeding the tolerances by removing and replacing the cement-stabilized mixture. Do not permit skin patching of deficient areas.

3.8.2 Smoothness Test

Take measurements for deviation from grade and cross section in successive positions parallel to the placement lane with a straightedge. Also take measurements perpendicular to the placement lane at 50 foot intervals. Correct deviations exceeding the tolerances of Table 1 by removing and replacing the cement-stabilized mixture. Do not permit skin patching of deficient areas.

3.8.3 Thickness Control

Measure the thickness of the cement stabilized mixture at intervals which ensure one measurement for each 500 square yards of cement stabilized mixture. Make measurements in 3 inch diameter test holes penetrating the cement stabilized mixture. Where the measured thickness exceeds the tolerances of Table 1, correct such areas by removing and replacing the cement-stabilized material. Where the measured thickness is more than 1/2 inch thicker than indicated, the course will be considered as conforming with the specified thickness requirements. Calculate the average job thickness as the average of all thickness measurements taken for the job, but within the tolerances of Table 1.

3.8.4 Field Density

Perform field density tests in accordance with ASTM D1556/D1556M or ASTM D6938. Use ASTM D6938 to determine the moisture content of the soil. ASTM D6938 results in a wet unit weight of soil. Check calibration curves furnished along with the density gauge described in ASTM D6938. Make calibration checks of the density gauge at the beginning of a job on each type of material encountered. If ASTM D6938 is used, check in-place densities by ASTM D1556/D1556M at least once per lift for each 1000

square yards of stabilized material. Perform at least 1 field density test for each 250 square yards of each layer of cement-stabilized mixture.

3.8.5 Compressive Strength Of Modified Subgrade Material

Test composite sample of cement stabilized mixture for compressive strength. Fabricate three test cylinders for each set of tests in accordance with ASTM D558/D558M, Method A or B (as appropriate), cure and test according to ASTM D1632 and ASTM D1633. Test specimens for compressive strength at 7 days, and submit results. If the average of the three compressive strengths is less than 50 psi below the required strength, stop operations and adjust the mix design. If the average of the three compressive strengths is more than 50 psi below the required strength, remove and replace the area represented by the failing tests, as directed. Take samples not less than once a day, nor less than once for each 500 cubic yards of cement stabilized mixture.

3.8.6 Sieve Analysis

Perform a minimum of one analysis for each 1000 tons of material to be stabilized, with a minimum of 3 analyses for each day's run until the course is completed. When the source of materials is changed or deficiencies are found, repeat the analysis and retest the material already placed to determine the extent of unacceptable cement-stabilized mixture. Replace all in-place unacceptable cement-stabilized mixture.

3.8.7 Liquid Limit and Plasticity Index

Perform one liquid limit and plasticity index for each sieve analysis. Test for liquid limit and plasticity index in accordance with ASTM D4318.

3.8.8 Maintenance

Maintain the cement-stabilized mixture in a satisfactory condition until the completed work is accepted. Perform immediate repairs to any defects and repeat as often as necessary to keep the area intact. Repair defects as specified.

3.8.9 Traffic

Completed portions of the cement stabilized mixture may be opened immediately to light traffic provided the curing is not impaired. After the curing period has elapsed, completed areas may be opened to all traffic provided that the cement-stabilized mixture has hardened sufficiently to prevent marring or distorting of the surface by equipment or traffic. Heavy equipment will not be permitted on the area during the curing period. Cement and water may be hauled over the area with pneumatic-tired equipment as approved. Protect finished portions of cement-stabilized mixture that are traveled on by equipment used in constructing an adjoining section in a manner that prevents equipment from marring or damaging the completed work.

3.9 DISPOSAL OF UNSATISFACTORY MATERIALS

Dispose of removed in-place materials that are unsuitable for stabilization, material that is removed for the required correction of defective areas, waste material, and debris as directed.

-- End of Section --

SECTION 32 11 33

CEMENT-TREATED BASE COURSES
05/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C88	(2018) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117	(2017) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C131/C131M	(2020) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C142/C142M	(2017) Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM C150/C150M	(2020) Standard Specification for Portland Cement
ASTM C309	(2011) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C595/C595M	(2020) Standard Specification for Blended Hydraulic Cements
ASTM C1077	(2017) Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1260	(2014) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1602/C1602M	(2018) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete

ASTM D75/D75M	(2019) Standard Practice for Sampling Aggregates
ASTM D558/D558M	(2019) Standard Test Methods for Moisture-Density (Unit Weight) Relations of Soil-Cement Mixtures
ASTM D559	(2003) Wetting and Drying Compacted Soil-Cement Mixtures
ASTM D560	(2003) Freezing and Thawing Compacted Soil-Cement Mixtures
ASTM D1556/D1556M	(2015; E 2016) Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method
ASTM D1557	(2012; E 2015) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)
ASTM D1632	(2007) Standard Practice for Making and Curing Soil-Cement Compression and Flexure Test Specimens in the Laboratory
ASTM D1633	(2000; R 2007) Standard Test Methods for Compressive Strength of Molded Soil-Cement Cylinders
ASTM D4318	(2017; E 2018) Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D4791	(2019) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D6938	(2017a) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
ASTM E11	(2020) Standard Specification for Woven Wire Test Sieve Cloth and Test Sieves

1.2 DEFINITION

Cement-stabilized mixture, as used herein, is a mixture of Portland cement and select borrow material uniformly blended and compacted as specified to produce a pavement base course or subbase which meets the criteria set forth in the drawings and specifications.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Mix Design; G, DO

Aggregate; G, DO

SD-06 Test Reports

Aggregate; G, DO

Compressive Strength; G, DO

1.4 QUALITY CONTROL

1.4.1 Qualifications

Perform sampling and testing using an approved commercial testing laboratory or on-site facilities that is accredited in accordance with ASTM C1077. Do not start work requiring testing until the facilities have been inspected and approved. The Government will inspect all laboratories requiring validation for equipment and test procedures prior to the start of any stabilization operations for conformance to ASTM C1077. Schedule and provide payment for laboratory inspections. Additional payment or a time extension due to failure to acquire the required laboratory validation is not allowed. Maintain this certification for the duration of the project.

1.4.2 Test Results

Verify that materials comply with the specification. When a material source is changed, test the new material for compliance. When deficiencies are found, repeat the initial analysis and retest the material already placed to determine the extent of unacceptable material. Replace or repair all in-place unacceptable material to conform to the contract requirements. Perform tests in sufficient numbers, and as specified, to ensure that materials and compaction meet specified requirements. Furnish copies of the test results within 24 hours of completion of tests.

1.4.3 Aggregate

Submit notification of sources from which aggregates are to be obtained, within 15 days after the award of contract. Perform tests for determining the suitability of aggregate including, but not limited to: sieve analysis in accordance with ASTM C136/C136M using sieves conforming to ASTM E11 and liquid limits and plasticity index in accordance with ASTM D4318. Take aggregate samples for laboratory tests in accordance with ASTM D75/D75M. Submit certified copies of aggregate test results, not less than 30 days before the material is required in the work.

1.5 ENVIRONMENTAL REQUIREMENTS

Do not apply cement when the atmospheric temperature is less than 40 degrees F or to soils that are frozen or contain frost, or when the underlying material is frozen. If the temperature falls below 35 degrees F,

protect completed cement-stabilized mixture against detrimental effects of freezing. Bring any areas of completed cement-stabilized mixture that are damaged by freezing, rainfall, or other weather conditions to a satisfactory condition in conformance with this specification.

1.6 ACCEPTANCE

1.6.1 Tolerances

Acceptance of cement-stabilized mixture is based on compliance with the tolerances presented in Table 1. Remove and replace cement-stabilized mixture represented by the failing tests or submit plan for approval.

TABLE 1

Measurement	Tolerance
Grade	plus/minus 0.05 foot
Smoothness	plus/minus 3/8 inch
Thickness (individual measurement)	plus/minus 1/2 inch
Thickness (average)	plus/minus 1/4 inch
Field Density	98 percent minimum
Compressive Strength	minus 50 psi below specified strength

1.6.2 Test Section

Place a test section of at least 8 by 100 feet, utilizing the equipment and procedures proposed for use, to demonstrate that cement stabilized mixture conforming to this specification can be produced. Acceptance of the test section is based on compliance with the tolerances listed in Table 1..

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Cementitious Materials

2.1.1.1 Portland Cement

Provide cement conforming to ASTM C150/C150M, Type I, IA, II, or IIA low alkali or ASTM C595/C595M, Type IS or IS(A).

2.1.2 Material to be Stabilized

2.1.2.1 Aggregate for Cement Treated Base

Provide aggregate consisting of crushed or uncrushed gravel and/or stone, free of roots, sod, and weeds, meeting the requirements below:
a. Plasticity index of less than 6 and liquid limit less than 25 in

accordance with ASTM D4318.

b. Percentage of wear less than 40 percent in accordance with ASTM C131/C131M.

c. Soundness loss after 5 cycles of 10 percent maximum using Sodium Sulfate or 15 percent maximum using Magnesium Sulfate in accordance with ASTM C88.

d. Flat, elongated or flat and elongated particles 10 percent maximum, by weight, for fraction retained on the 1/2 inch sieve and 20 percent maximum, by weight, for the fraction passing the 1/2 inch sieve in accordance with ASTM D4791.

e. Clay lumps and friable particles less than or equal to 3 percent in accordance with ASTM C142/C142M

f. Test virgin crushed stone or gravel sources for alkali-aggregate reactivity in accordance with ASTM C1260, and reject materials having a measured expansion greater than 0.10 percent in 16 days.

g. Gradation meeting the limits of Table 2, in accordance with ASTM C117 and ASTM C136/C136M.

TABLE 2

Sieve Designation	Percent Passing By Weight
2 inch	100
1 inch	100
No.4	45-95
No. 10	37-80
No. 40	15-50
No. 200	0-15
Note: For Cement Treated Base under concrete surfacing, limit the 1 inch size to 100 percent passing.	

2.1.3 Water

Provide water which is clean, fresh, and free from injurious amounts of oil, acid, salt, alkali, organic matter, and other substances deleterious to the hardening of the cement-stabilized mixture, and subject to approval. Test non-potable water sources for conformance with ASTM C1602/C1602M.

2.1.4 Curing Materials

2.1.4.1 Curing Compound

White-pigmented, liquid membrane-forming compound conforming to ASTM C309, Type 2, Class A or Class B (wax-based) for curing cement-stabilized mixture placed as a base course under Portland cement concrete pavement.

2.2 MIX DESIGN

Submit proposed mix design, prior to start of stabilization work. Develop the mix using the aggregate or soil-aggregate material to be stabilized. Design mix for a minimum 7-day compressive strength between 500 psi and 800 psi for base under Portland cement concrete pavement. Avoid higher strength due to potential to cause shrinkage and reflective cracks. Limit weight loss to 14 percent or less after 12 cycles of the durability test.

2.2.1 Laboratory Density

Conduct moisture-density tests in accordance with the procedure contained in ASTM D558/D558M. Use the apparatus and procedures outlined in ASTM D1557 to compact the cement-stabilized mixture.

2.2.2 Unconfined Compression

Conduct three unconfined compression tests, in accordance with ASTM D1633, for each mix design tested. Prepare specimens to be used for unconfined compression tests in accordance with ASTM D1632. Use a 4 inch diameter by 8 inch high mold to prepare specimens when more than 35 percent of the material is retained on the No. 4 sieve. Cure samples at a constant moisture content and temperature for 7 days.

2.2.3 Durability

Conduct wet-dry tests in accordance with ASTM D559. Conduct freeze-thaw tests in accordance with ASTM D560. Test three specimens for each mix design.

2.2.4 Mix Design Report

Perform trial design batches, mixture proportioning studies, testing, and include results demonstrating that the proposed mixture proportions produce cement-stabilized mixture of the qualities indicated. Submit test results in a mix design report to include:

a. Coarse and fine aggregate gradations and plots.
b. Coarse aggregate quality test results, include deleterious materials.
c. Fine aggregate quality test results.
d. Durability test results.
e. Mill certificates for cement and supplemental cementitious materials.
f. Recommended proportions and volumes for proposed mixture.
g. Moisture-density curve for selected cement content.
h. Individual compressive strength test results.
i. Narrative discussing methodology on how the mix design was developed.

2.3 EQUIPMENT

Plant, equipment, machines, and tools used in the work are subject to approval. Maintain in a satisfactory working condition at all times. Provide equipment with the capability of producing the required compaction, meeting grade controls, thickness control and smoothness requirements specified.

2.3.1 Central Plant

Provide a batch or continuous flow type central plant capable of producing a uniform cement stabilized mixture at the required cement and moisture

contents. Equip the mixer with calibrated metering and feeding devices that introduce the aggregate, cement, water, and cementitious additives (if used) into the mixer in the specified quantities. If necessary, use a screening device to remove oversized material from the raw aggregate feed prior to mixing.

2.3.2 Mechanical Spreader

Provide a steerable, self propelled, mechanical spreader having variable speeds forward and reverse. Mount the spreader on tracks, rubber tires, or drum-type steel rollers that will not disturb the underlying material. Provide a spreader containing a hopper, an adjustable screed, and outboard bumper rolls; designed to have a uniform, steady flow of material from the hopper; and capable of laying material without segregation, across the full width of the lane, to a uniform thickness and to a uniform loose density so that when compacted, the layer or layers conform to thickness and grade requirements indicated.

2.3.3 Rollers

Compact the cement stabilized mixture using one or a combination of the following pieces of equipment: tamping or grid roller; steel-wheeled roller; vibratory roller; pneumatic-tire roller, and/or vibrating plate compactor (for areas inaccessible to rollers). Compact the cement stabilized mixture to the required density using the number, type, and weight of rollers and/or compactors sufficient to compact the mixture to the required density.

2.3.4 Straightedge

Furnish and maintain at the site, in good condition, one 12 foot straightedge for use in the testing of the finished surface. Make straightedges available for Government use. Construct straightedges of aluminum or other lightweight metal with blades of box or box-girder cross section with flat bottom reinforced to insure rigidity and accuracy. Provide handles on straightedges to facilitate movement on pavement.

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

Do not apply cement if the soil moisture content exceeds optimum moisture content specified for the cement-stabilized mixture. When the stabilized course is constructed in more than 1 layer, clean the previously constructed layer of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Provide adequate drainage during the entire construction period to prevent water from collecting or standing on the areas to be stabilized or on pulverized, mixed, or partially mixed material. Provide line and grade stakes as necessary for control. Place grade stakes in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

3.2 PREPARATION OF AREA TO BE STABILIZED

3.2.1 In-Place Materials to Receive Stabilized Course

Conform Subgrade to Section 32 11 33.13 PORTLAND CEMENT-STABILIZED SUBGRADE.

3.3 INSTALLATION

3.3.1 Edges of Stabilized Course

Placed approved material along the edges of the cement-stabilized mixture in such quantity as will compact to the thickness of the course being constructed, or to the thickness of each layer in a multiple-layer course, allowing at least a 1 foot width of the shoulder to be rolled and compacted simultaneously with the rolling and compacting of each layer of the cement-stabilized mixture.

3.3.2 Central-Plant Method

Haul the cement stabilized mixture to the job in trucks equipped with protective covers. Thoroughly moisten the underlying course and deposit the material on the prepared area in a quantity that will produce a compacted base of uniform density to the required grade and cross section. Operate spreading or spreading-trimming equipment to produce a layer of material which is uniform in thickness and surface contour and free from irregularities in density. Use spreading or spreading-trimming equipment in sufficient numbers and in staggered formation to obtain full-width spreading in one construction operation. Start the compaction of the treated layer within 60 minutes after the start of the moist mixing. Place cement stabilized mixture in adjacent lanes within 30 minutes.

3.3.3 Layer Thickness

Compact thickness of the cement-stabilized mixture as indicated. Do not compact layers in excess of 8 inches nor less than 4 inches in compacted thickness.

3.3.4 Compaction

As a continuation of the mixing operation, thoroughly loosen the mixture to the full depth before compaction operations are started. At the beginning of compaction, process the mixture to provide a uniform blend with 100 percent passing the specified maximum aggregate size. Start compaction immediately after mixing is completed. Compact the cement stabilized mixture to at least 98 percent of the maximum density obtained from the laboratory samples prepared and tested in accordance with paragraph: LABORATORY DENSITY. Uniformly and continuously compact the loose mixture until the entire depth and width of the area are compacted to the density specified. Maintain the moisture content at the surface near optimum at all times through the rolling, but less than that quantity which will cause the cement stabilized mixture to become unstable during compaction. Begin rolling at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Use slightly different lengths on alternate trips of the roller. Do not permit displacement of the cement stabilized mixture due

to the speed of the roller. Compact areas inaccessible to rollers with mechanical tampers.

3.4 FINISHING

Moisten the surface, if necessary, and shape to the required lines, grades, and cross section. Lightly scarify the surface, if necessary, to eliminate any imprints made by the compacting or shaping equipment. Thoroughly compact the surface to the specified density with rubber-tired rollers and smooth-wheel tandem rollers to the extent necessary to provide a smooth, dense, uniform surface that is free of surface checking, ridges, or loose material, and that conforms to the crown, grade, and line indicated. Complete these finishing operations within 2 hours after completion of mixing operations. In places not accessible to finishing and shaping equipment, compact the cement-stabilized mixture with mechanical tampers to the density specified and shape and finish by hand methods. Correct, as specified below, any portion of the compacted mix that has density less than that specified, that has not properly hardened, or that is improperly finished.

3.5 CONSTRUCTION JOINTS

At the end of each day's construction, form a straight transverse construction joint by cutting back into the completed work to form a true vertical face free of loose or shattered material. Remove material along construction joints not properly compacted and replace with cement stabilized mixture mixed, moistened, and compacted as specified.

3.6 CURING AND PROTECTION

Protect the finished surface against rapid drying for 7 days by one of the methods specified.

3.6.1 Liquid Membrane Forming Curing Compound

Uniformly spray the surface of the cement treated base course with the curing compound at the rate of one gallon/100 square feet to obtain a uniform cover over the surface. Provide spraying equipment of the fully atomizing type equipped with a tank agitator. Thoroughly and uniformly mix the curing compound with the pigment in the storage tank. During application, stir the compound continuously by mechanical means. Hand spray odd widths or shapes and surfaces.

3.6.2 Bond Breaker

Within 8 to 24 hours before concrete pavement placement, coat the surface of the cement treated base course with an additional application of wax-based liquid membrane forming curing compound applied in a quality sufficient to prevent bonding of the concrete pavement to the base course.

3.7 FIELD QUALITY CONTROL

3.7.1 Grade Control

Excavate underlying material to sufficient depth for the required stabilized-course thickness. Provide a finished stabilized course with the subsequent surface course meeting the fixed grade. Conform finished and completed stabilized area to the lines, grades, cross section, and dimensions indicated and the tolerances of Table 1. Correct deviations

exceeding the tolerances by removing and replacing the cement-stabilized mixture. Do not permit skin patching of deficient areas.

3.7.2 Smoothness Test

Take measurements for deviation from grade and cross section in successive positions parallel to the apron/taxiway centerline with a straightedge. Also take measurements perpendicular to the apron/taxiway centerline at 50 foot intervals. Correct deviations exceeding the tolerances of Table 1 by removing and replacing the cement-stabilized mixture. Do not permit skin patching of deficient areas.

3.7.3 Thickness Control

Measure the thickness of the cement stabilized mixture at intervals which ensure one measurement for each 500 square yards of cement stabilized mixture. Make measurements in 3 inch diameter test holes penetrating the cement stabilized mixture. Where the measured thickness exceeds the tolerances of Table 1, correct such areasby removing and replacing the cement-stabilized material. Where the measured thickness is more than 1/2 inch thicker than indicated, the course will be considered as conforming with the specified thickness requirements. Calculate the average job thickness as the average of all thickness measurements taken for the job, but within the tolerances of Table 1.

3.7.4 Field Density

Perform field density tests in accordance with ASTM D1556/D1556M or ASTM D6938. Use ASTM D6938 to determine the moisture content of the soil. ASTM D6938 results in a wet unit weight of soil. Check calibration curves furnished along with the density gauge described in ASTM D6938. Make calibration checks of the density gauge at the beginning of a job on each type of material encountered. If ASTM D6938 is used, check in-place densities by ASTM D1556/D1556M at least once per lift for each 1000 square yards of stabilized material. Perform at least 1 field density test for each 250 square yards of each layer of cement-stabilized mixture.

3.7.5 Compressive Strength

Test composite sample of cement stabilized mixture for compressive strength. Fabricate three test cylinders for each set of tests in accordance with ASTM D558/D558M, Method A or B (as appropriate), cure and test according to ASTM D1632 and ASTM D1633. Test specimens for compressive strength at 7 days, and submit results. If the average of the three compressive strengths is less than 50 psi below the required strength, stop operations and adjust the mix design. If the average of the three compressive strengths is more than 50 psi below the required strength, remove and replace the area represented by the failing tests, as directed. Take samples not less than once a day, nor less than once for each 500 cubic yards of cement stabilized mixture.

3.7.6 Sieve Analysis

Perform a minimum of one analysis for each 1000 tons of material to be stabilized, with a minimum of 3 analyses for each day's run until the course is completed. Replace all in-place unacceptable cement-stabilized mixture.

3.7.7 Liquid Limit and Plasticity Index

Perform one liquid limit and plasticity index for each sieve analysis. Test for liquid limit and plasticity index in accordance with ASTM D4318.

3.7.8 Maintenance

Maintain the cement-stabilized mixture in a satisfactory condition until the completed work is accepted. Perform immediate repairs to any defects and repeat as often as necessary to keep the area intact. Repair defects as specified.

3.7.9 Traffic

Completed portions of the cement stabilized mixture may be opened immediately to light traffic provided the curing is not impaired. After the curing period has elapsed, completed areas may be opened to all traffic provided that the cement-stabilized mixture has hardened sufficiently to prevent marring or distorting of the surface by equipment or traffic. Heavy equipment will not be permitted on the area during the curing period. Cement and water may be hauled over the area with pneumatic-tired equipment as approved. Protect finished portions of cement-stabilized mixture that are traveled on by equipment used in constructing an adjoining section in a manner that prevents equipment from marring or damaging the completed work.

3.8 DISPOSAL OF UNSATISFACTORY MATERIALS

Dispose of removed in-place materials that are unsuitable for stabilization, material that is removed for the required correction of defective areas, waste material, and debris off of Government-controlled lands.

-- End of Section --

SECTION 32 12 13

BITUMINOUS TACK AND PRIME COATS
05/17

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 102	(2009; R 2013) Standard Method of Test for Spot Test of Asphaltic Materials

ASTM INTERNATIONAL (ASTM)

ASTM D140/D140M	(2016) Standard Practice for Sampling Asphalt Materials
ASTM D2397/D2397M	(2019a) Standard Specification for Cationic Emulsified Asphalt
ASTM D2995	(1999; R 2009) Determining Application Rate of Bituminous Distributors
ASTM D977	(2019a; E 2019) Standard Specification for Emulsified Asphalt

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-06 Test Reports

Sampling and Testing

1.3 QUALITY ASSURANCE

Certificates of compliance for asphalt materials delivered will be obtained and checked to ensure that specification requirements are met. Quantities of applied material will be determined. Payment will be for amount of residual asphalt applied. Tack coat materials will not be diluted. Prime coat materials when emulsions are used can be diluted on site with potable water up to 1 part emulsion to 1 part water.

1.4 DELIVERY, STORAGE, AND HANDLING

Inspect the materials delivered to the site for contamination and damage.

Unload and store the materials with a minimum of handling.

1.5 EQUIPMENT, TOOLS AND MACHINES

1.5.1 General Requirements

Equipment, tools and machines used in the work are subject to approval. Maintain in a satisfactory working condition at all times. Calibrate equipment such as asphalt distributors, scales, batching equipment, spreaders and similar equipment within 12 months of there use. If the calibration expires during project, recalibrate the equipment before work can continue.

1.5.2 Bituminous Distributor

Provide a self propelled distributor with pneumatic tires of such size and number to prevent rutting, shoving or otherwise damaging the surface being sprayed. Calibrate the distributer in accordance with ASTM D2995. Design and equip the distributor to spray the bituminous material in a uniform coverage at the specified temperature, at readily determined and controlled total liquid rates from 0.03 to 1.0 gallons per square yard, with a pressure range of 25 to 75 psi and with an allowable variation from the specified rate of not more than plus or minus 5 percent, and at variable widths. Include with the distributor equipment a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gauges, volume-measuring devices, adequate heaters for heating of materials to the proper application temperature, a thermometer for reading the temperature of tank contents, and a hand hose attachment suitable for applying bituminous material manually to areas inaccessible to the distributor. The distributor will be capable of circulating and agitating the bituminous material during the heating process.

1.5.3 Heating Equipment for Storage Tanks

Use steam, electric, or hot oil heaters for heating the bituminous material. Provide steam heaters consisting of steam coils and equipment for producing steam, so designed that the steam cannot come in contact with the bituminous material. Fix an armored thermometer to the tank with a temperature range from 40 to 400 degrees F so that the temperature of the bituminous material may be determined at all times.

1.5.4 Power Brooms and Power Blowers

Use power brooms and power blowers suitable for cleaning the surfaces to which the bituminous coat is to be applied.

1.6 ENVIRONMENTAL REQUIREMENTS

Apply bituminous coat only when the surface to receive the bituminous coat is dry. A limited amount of moisture (approximately 0.03 gallon/square yard) can be sprayed on the surface of unbound material when prime coat is used to improve coverage and penetration of asphalt material. Apply bituminous coat only when the atmospheric temperature in the shade is 50 degrees F or above and when the temperature has not been below 35 degrees F for the 12 hours prior to application, unless otherwise directed.

PART 2 PRODUCTS

2.1 PRIME COAT

Provide asphalt conforming to one of the following grades:

2.1.1 Emulsified Asphalt

Provide emulsified asphalt conforming to ASTM D977, Type SS-1 or SS1h; or ASTM D2397/D2397M, Type CSS-1 or CSS-1h. Asphalt emulsion can be diluted up to 1 part water to 1 part emulsion for prime coat use. Do not dilute asphalt emulsion for tack coat use.

2.2 TACK COAT

2.2.1 Emulsified Asphalt

Provide emulsified asphalt conforming to ASTM D977, Type SS-1 or SS1h; or ASTM D2397/D2397M, Type CSS-1 or CSS-1h. For prime coats the emulsified asphalt can be diluted with up to 1 part emulsion to 1 part water. No dilution is allowed for tack coat applications. The base asphalt used to manufacture the emulsion is required to show a negative spot when tested in accordance with AASHTO T 102 using standard naphtha.

PART 3 EXECUTION

3.1 PREPARATION OF SURFACE

Immediately before applying the bituminous coat, remove all loose material, dirt, clay, or other objectionable material from the surface to be treated by means of a power broom or blower supplemented with hand brooms. Apply treatment only when the surface is dry and clean.

3.2 APPLICATION RATE

The exact quantities within the range specified, which may be varied to suit field conditions, will be determined by the Contracting Officer.

3.2.1 Tack Coat

Apply bituminous material for the tack coat in quantities of not less than 0.03 gallons nor more than 0.10 gallons per square yard of residual asphalt onto the pavement surface as approved by the Contracting Officer. Do not dilute asphalt emulsion when used as a tack coat.

3.2.2 Prime Coat

Apply bituminous material for the prime coat in quantities of not less than 0.05 gallons nor more than 0.12 gallons per square yard of residual asphalt for asphalt emulsion up to a 1 to 1 dilution rate or for residual asphalt for cutback asphalt.

3.3 APPLICATION TEMPERATURE

3.3.1 Viscosity Relationship

Apply asphalt at a temperature that will provide a viscosity between 10 and 60 seconds, Saybolt Furol, or between 20 and 120 centistokes, kinematic. Furnish the temperature viscosity relation to the Contracting

Officer.

3.3.2 Temperature Ranges

The viscosity requirements determine the application temperature to be used. The following is a normal range of application temperatures:

Asphalt Emulsion	
All Grades	70-160 degrees F

Some of these temperatures for rapid cure cutbacks are above the flash point of the material and care should be taken in their heating.

3.4 APPLICATION

3.4.1 General

Following preparation and subsequent inspection of the surface, apply the bituminous prime or tack coat with the bituminous distributor at the specified rate with uniform distribution over the surface to be treated. Properly treat all areas and spots, not capable of being sprayed with the distributor, with the hand spray. Until the succeeding layer of pavement is placed, maintain the surface by protecting the surface against damage and by repairing deficient areas at no additional cost to the Government. If required, spread clean dry sand to effectively blot up any excess bituminous material. No smoking, fires, or flames other than those from the heaters that are a part of the equipment are permitted within 25 feet of heating, distributing, and transferring operations of cutback materials. Prevent all traffic, except for paving equipment used in constructing the surfacing, from using the underlying material, whether primed or not, until the surfacing is completed. The bituminous coat requirements are described herein.

3.4.2 Prime Coat

Apply a prime coat at locations shown on the Drawings. Apply the bituminous material uniformly over the surface to be treated at a pressure range of 25 to 75 psi; the rate will be as specified above in paragraph APPLICATION RATE. To obtain uniform application of the prime coat on the surface treated at the junction of previous and subsequent applications, spread building paper on the surface for a sufficient distance back from the ends of each application to start and stop the prime coat on the paper and to ensure that all sprayers will operate at full force on the surface to be treated. Immediately after application remove and destroy the building paper.

3.4.3 Tack Coat

Apply tack coat between successive compacted lifts of asphalt paving and at the locations shown on the drawings. A tack coat should be applied to every bound surface (asphalt or concrete pavement) that is being overlaid with asphalt mixture and at transverse and longitudinal joints. Apply the tack coat when the surface to be treated is clean and dry. Immediately following the preparation of the surface for treatment, apply the bituminous material by means of the bituminous distributor, within the limits of temperature specified herein and at a rate as specified above in paragraph APPLICATION RATE. Apply the bituminous material so that uniform

distribution is obtained over the entire surface to be treated. Treat lightly coated areas and spots missed by the distributor by spraying with a hand wand or using other approved method. Following the application of bituminous material, allow the surface to cure without being disturbed for period of time necessary to permit setting of the tack coat. Apply the bituminous tack coat only as far in advance of the placing of the overlying layer as required for that day's operation. Maintain and protect the treated surface from damage until the succeeding course of pavement is placed.

3.5 CURING PERIOD

Following application of the bituminous material and prior to application of the succeeding layer of asphalt mixture allow the bituminous coat to cure and water or volatiles to evaporate prior to overlaying. Maintain the tacked surface in good condition until the succeeding layer of pavement is placed, by protecting the surface against damage and by repairing and recoating deficient areas. Allow the prime coat to cure without being disturbed for a period of at least 48 hours or longer, as may be necessary to attain penetration into the treated course. Furnish and spread enough sand to effectively blot up excess bituminous material.

3.6 FIELD QUALITY CONTROL

Obtain certificates of compliance for all asphalt material delivered to the project. Obtain samples of the bituminous material for both the prime coat and tack coat under the supervision of the Contracting Officer. The sample may be retained and tested by the Government at no cost to the Contractor.

3.7 SAMPLING AND TESTING

Furnish certified copies of the manufacturer's test reports indicating compliance with applicable specified requirements, not less than 5 days before the material is required in the work.

3.7.1 Sampling

Unless otherwise specified, sample bituminous material in accordance with ASTM D140/D140M.

3.7.2 Calibration Test

Furnish all equipment, materials, and labor necessary to calibrate the bituminous distributor. Calibrate using the approved job material and prior to applying the bituminous coat material to the prepared surface. Calibrate the bituminous distributor in accordance with ASTM D2995.

3.7.3 Trial Applications

Before applying the spray application of tack or prime coat, apply three lengths of at least 100 feet for the full width of the distributor bar to evaluate the amount of bituminous material that can be satisfactorily applied.

3.7.3.1 Tack Coat Trial Application Rate

Unless otherwise authorized, apply the trial application rate of bituminous tack coat materials in the amount of 0.05 gallons per square

yard. Make other trial applications using various amounts of material as may be deemed necessary.

3.7.3.2 Prime Coat Trial Application Rate

Unless otherwise authorized, apply the trial application rate of bituminous materials in the amount of 0.15 gallon per square yard. Make other trial applications using various amounts of material as may be deemed necessary.

3.7.4 Sampling and Testing During Construction

Perform quality control sampling and testing as required in paragraph FIELD QUALITY CONTROL.

3.8 TRAFFIC CONTROLS

Keep traffic off surfaces freshly treated with bituminous material. Provide sufficient warning signs and barricades so that traffic will not travel over freshly treated surfaces.

-- End of Section --

SECTION 32 12 15.13

ASPHALT PAVING FOR AIRFIELDS
11/20, CHG 1: 05/22

PART 1 GENERAL

1.1 FULL PAYMENT

1.1.1 Method of Measurement

Utilize the quantity of hot-mix asphalt pavement, per ton placed and accepted, for the purposes of assessing the pay factors stipulated below.

1.1.2 Basis of Payment

The measured quantity of hot-mix asphalt pavement will be paid for and included in the lump sum contract price. If less than 100 percent payment is due based on the pay factors stipulated in paragraph PERCENT PAYMENT and ACCEPTANCE, a unit price of 200 per ton will be used for purposes of calculating the payment reduction.

1.2 PERCENT PAYMENT

When a pavement lot of material fails to meet the specification requirements for 100 percent pay as outlined in the following paragraphs, remove and replace the lot, or accept at a reduced price which will be computed by multiplying the unit price per ton by the lot's pay factor. The lot pay factor is determined by taking the lowest computed pay factor based on either laboratory air voids, in-place density, grade or smoothness (each discussed below). At the end of the project, an average of all lot pay factors will be calculated. If this average lot pay factor exceeds 95.0 percent and no individual lot has a pay factor less than 75.0 percent, then the percent payment for the entire project will be 100 percent of the unit bid price. If the average lot pay factor is less than 95.0 percent, then each lot will be paid for at the unit price multiplied by the lot's pay factor. For any lots which are less than 2000 tons, a weighted lot pay factor will be used to calculate the average lot pay factor. When work on a lot is required to be terminated before all sublots are completed, the results from the completed sublots will be analyzed to determine the percent payment for the lot following the same procedures and requirements for full lots but with fewer test results.

1.2.1 Mat and Joint Densities

The average in-place mat and joint densities are expressed as a percentage of the average theoretical maximum density (TMD) for the lot. The average TMD for each lot will be determined as the average TMD of the four random samples per lot. The average in-place mat density and joint density for a lot are determined and compared with Table 1 to calculate a single pay factor per lot based on in-place density, as described below. All density results for a lot will be completed and reported within 24 hours after the construction of that lot. Use the following process to determine the single pay factor for in-place density:

a. Step 1: Determine the pay factors for mat density and joint density using Table 1.

b. Step 2: Determine ratio of joint area to mat area. The area associated with the joint is considered to be 10 feet wide times the length of completed longitudinal construction joint in the lot. This joint area will not exceed the total lot size. The length of joint to be considered will be that length where a new lane has been placed against an adjacent lane of asphalt pavement, either any cold joint against another lot or any other existing asphalt paved previously. The area associated with the joint is expressed as a percentage of the total lot.

c. Step 3: Compute the weighted pay factor for the joint using the formula in the example shown in paragraph PAY FACTOR BASED ON IN-PLACE DENSITY.

d. Step 4: Where freshly placed asphalt pavement abuts old (not in contract) asphalt pavement, determine density at the tie-in longitudinal joint by taking one core per sublot at a random location for each lot of material placed adjacent to the joint. If Step 4 is not applicable, move to Step 5. The size of joint area is 10 feet wide by the length of the joint being paved. Locate the center of each of the four cores 6 inches from the edge of the existing pavement. Take each core at a random location along the length of the joint. The requirements for joint density for this lot, adjacent to the existing asphalt joint, are the same as that for the mat density specified in Table 1. For the interface of new asphalt pavement abutting existing asphalt (not in contract) joints at taxiways abutting runways, aprons, or other taxiways, take two additional randomly located cores along each taxiway intersection.

e. Step 5: Compare weighted pay factor for joint density to pay factor for mat density and select the lowest. This selected pay factor is the pay factor based on density for the lot. When the TMD on both sides of a longitudinal joint is different, the average of these two TMD values will be used as the TMD needed to calculate the percent joint density.

When 0 percent payment is determined for mat density, remove and replace the rejected lot at least 4 inches into the cold lane adjacent to the longitudinal joint. Evaluate this as a new lot per paragraph MAT AND JOINT DENSITIES.

When 0 percent payment is determined for joint density, remove and replace the rejected longitudinal joint with a 10 feet wide paving lane that is centered over the joint. This 10 feet wide placement will be evaluated as a new lot. When removing and replacing a joint that fails to meet the project requirements, the result will be two additional longitudinal joints. Determine a pay factor for these longitudinal joints by randomly selecting two cores per lot centered on the joint each side of the lot. This will result in four total cores for joint density evaluation. Take the average of the joint density of the four cores to develop a pay factor for joint density determination. Average the new lot TMD values with the adjacent lot TMD values to determine a final average for joint density evaluation. In this case do not use a weighted pay factor. Evaluate the mat density for this lot per paragraph MAT AND JOINT DENSITIES.

Table 1

Pay Factor Based on In-place Density

Average Mat Density (4 cores) (Percent of TMD)	Pay Factor, percent	Average Joint Density (4 cores)(Percent of TMD)
94.0 - 96.0	100.0	Above 92.5
93.9	100.0	92.4
93.8 or 96.1	99.9	92.3
93.7	99.8	92.2
93.6 or 96.2	99.6	92.1
93.5	99.4	92.0
93.4 or 96.3	99.1	91.9
93.3	98.7	91.8
93.2 or 96.4	98.3	91.7
93.1	97.8	91.6
93.0 or 96.5	97.3	91.5
92.9	96.3	91.4
92.8 or 96.6	94.1	91.3
92.7	92.2	91.2
92.6 or 96.7	90.3	91.1
92.5	87.9	91.0
92.4 or 96.8	85.7	90.9
92.3	83.3	90.8
92.2 or 96.9	80.6	90.7
92.1	78.0	90.6
92.0 or 97.0	75.0	90.5
below 92.0, above 97.0	0.0 (reject)	below 90.5

1.2.2 Pay Factor Based on In-place Density

An example of the computation of a pay factor (in I-P units only) based on in-place density, is as follows: Assume the following test results for field density made on the lot: (1) Average mat density = 93.2 percent (of lab TMD). (2) Average joint density = 91.5 percent (of lab TMD). (3) Total area of lot = 30,000 square feet. (4) Length of completed longitudinal construction joint = 2,000 feet.

a. Step 1: Determine pay factor based on mat density and on joint density, using Table 1:

(1) Mat density of 93.2 percent = 98.3 pay factor.

(2) Joint density of 91.5 percent = 97.3 pay factor.

b. Step 2: Determine ratio of joint area (length of longitudinal joint x 10 feet) to mat area (total paved area in the lot): Multiply the length of completed longitudinal construction joint by the specified 10 feet width and divide by the mat area (total paved area in the lot).

(1) ,000 feet x 10 feet)/30000 square feet = 0.6667 ratio of joint area to mat area (ratio).

c. Step 3: Weighted pay factor (wpf) for joint is determined as indicated below:

(1) wpf = joint pay factor + (100 - joint pay factor) (1 - ratio) wpf = 97.3 + (100-97.3) (1-0.6667) = 98.2 percent

d. Step 4: Compare weighted pay factor for joint density to pay factor for mat density and select the smaller:

(1) Pay factor for mat density: 98.3 percent. Weighted pay factor for joint density: 98.2 percent

(2) Select the smaller of the two values as pay factor based on density: 98.2 percent

1.2.3 Payment Adjustment for Smoothness (Final Wearing Surface Only)

1.2.4 Laboratory Air Voids and Theoretical Maximum Density

Laboratory air voids will be calculated in accordance with ASTM D3203/D3203M by determining the density of each lab compacted specimen using the laboratory-prepared, thoroughly dry method in ASTM D2726/D2726M and determining the theoretical maximum density (TMD) of four of the sublots using ASTM D2041/D2041M. Laboratory air void calculations for each lot will use the average TMD values obtained for the lot. The mean absolute deviation of the four laboratory air void contents (one from each sublot) from the JMF air void content will be evaluated and a pay factor determined from Table 3. All laboratory air void tests will be completed and reported within 24 hours after completion of construction of each lot. The TMD is also used for computation of in-place density, as required in paragraph MAT AND JOINT DENSITIES above.

1.2.4.1 Mean Absolute Deviation

An example of the computation of mean absolute deviation for laboratory air voids is as follows: Assume that the laboratory air voids are determined from 4 random samples of a lot (where 3 specimens were compacted from each sample). The average laboratory air voids for each sublot sample are determined to be 3.5, 3.0, 4.0, and 3.7. Assume that the target air voids from the JMF is 4.0. The mean absolute deviation is then:

Mean Absolute Deviation = (|3.5 - 4.0| + |3.0 - 4.0| + |4.0 - 4.0| + |3.7 - 4.0|)/4

= (0.5 + 1.0 + 0.0 + 0.3)/4 = (1.8)/4 = 0.45

The mean absolute deviation for laboratory air voids is determined to be 0.45. It can be seen from Table 3 that the lot's pay factor based on laboratory air voids, is 100 percent.

Table 3	
Pay Factor Based on Laboratory Air Voids	
Mean Absolute Deviation of Lab Air Voids from JMF	Pay Factor, Percent
0.60 or less	100
0.61 - 0.80	98
0.81 - 1.00	95
1.01 - 1.20	90
Above 1.20	reject (0)

1.2.5 Pay Factor Based on Plan Grade

Evaluate plan grade per paragraph PLAN GRADE. Use Table 4 for determining Pay Factor for Plan Grade. Evaluate plan grade on a lot basis.

Table 4	
Pay Factor for Plan Grade	
Percent of All Measurements Outside Tolerance	Pay Factor, percent
Less than 5	100
Greater than or equal to 5 but less than 10	90
Greater than or equal to 10 but less than 15	75
Greater than or equal to 15	Remove and replace the surface lift

1.3 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 156 (2013; R 2025) Standard Specification for Requirements for Mixing Plants for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures

AASHTO T 329 (2015) Standard Test Method for Moisture Content of Hot Mix Asphalt (HMA) by Oven Method

ASPHALT INSTITUTE (AI)

AI MS-2 (2015) Asphalt Mix Design Methods

ASTM INTERNATIONAL (ASTM)

ASTM C88	(2018) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117	(2023) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C127	(2025) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate
ASTM C128	(2025) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
ASTM C131/C131M	(2020) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136/C136M	(2025) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C142/C142M	(2017; R 2023) Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM C566	(2025) Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying
ASTM C1252	(2017) Standard Test Methods for Uncompacted Void Content of Fine Aggregate (as Influenced by Particle Shape, Surface Texture, and Grading)
ASTM D75/D75M	(2019) Standard Practice for Sampling Aggregates
ASTM D242/D242M	(2009; R 2014) Mineral Filler for Bituminous Paving Mixtures
ASTM D979/D979M	(2015) Sampling Bituminous Paving Mixtures
ASTM D2041/D2041M	(2011) Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures
ASTM D2172/D2172M	(2017; E 2018) Standard Test Methods for Quantitative Extraction of Asphalt Binder from Asphalt Mixtures
ASTM D2419	(2014) Sand Equivalent Value of Soils and Fine Aggregate
ASTM D2489/D2489M	(2016) Standard Test Method for Estimating

	Degree of Particle Coating of Asphalt Mixtures
ASTM D2726/D2726M	(2019) Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures
ASTM D3203/D3203M	(2017) Standard Test Method for Percent Air Voids in Compacted Asphalt Mixtures
ASTM D3665	(2012; R 2017) Standard Practice for Random Sampling of Construction Materials
ASTM D3666	(2016) Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
ASTM D4125/D4125M	(2010) Asphalt Content of Bituminous Mixtures by the Nuclear Method
ASTM D4791	(2019) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D4867/D4867M	(2009; R 2014) Effect of Moisture on Asphalt Concrete Paving Mixtures
ASTM D5361/D5361M	(2016) Standard Practice for Sampling Compacted Asphalt Mixtures for Laboratory Testing
ASTM D5444	(2015) Mechanical Size Analysis of Extracted Aggregate
ASTM D5821	(2013; R 2017) Standard Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate
ASTM D6084/D6084M	(2018) Standard Test Method for Elastic Recovery of Asphalt Materials by Ductilometer
ASTM D6307	(2019) Standard Test Method for Asphalt Content of Asphalt Mixture by Ignition Method
ASTM D6373	(2023) Standard Specification for Performance Graded Asphalt Binder
ASTM D6925	(2014) Standard Test Method for Preparation and Determination of the Relative Density of Hot Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S"

classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Equipment; G, RO

SD-02 Shop Drawings

Placement Plan; G, DO

SD-03 Product Data

Diamond Grinding Plan; G, DO

Mix Design; G, DO

Contractor Quality Control; G, DO

SD-04 Samples

Aggregates

Asphalt Binder

SD-06 Test Reports

Aggregates; G, DO

QC Monitoring

Pavement Lots; G, DO

SD-07 Certificates

Asphalt Binder; G, DO

Testing Laboratory; G, DO

Airfield Asphalt Pavement QC Manager; G, DO

Airfield Asphalt Pavement Inspector; G, DO

Airfield Asphalt Pavement Laboratory Technician; G, DO

1.5 CONTRACTOR QUALITY CONTROL STAFF

Reference Section 01 45 00QUALITY CONTROL for Contractor personnel qualification requirements along with the information included below. The Airfield Asphalt Pavement QC Manager is a separate person and is in addition to the CQC System Manager identified in Section 01 45 00 QUALITY CONTROL. The Airfield Asphalt Pavement QC Manager will report to and assist the project CQC System Manager. Submit certifications for Contractor Quality Control Staff in the following areas:

a. Airfield Asphalt Pavement QC Manager(1): The QC manager will oversee all QC testing and inspection, review asphalt pavement transmittals

prior to submission to the Government, be responsible for making mix design adjustments, and in charge of all other activities related to performance. The QC manager will also ensure that daily reports and necessary transmittals arrive for Government review as specified.

b. Airfield Asphalt Pavement Inspector[1]: The Inspector will be available on the project during all paving operations. The Inspector is responsible for identifying observed paving issues and ensuring these issues are addressed by the Contractor Quality Control staff.

c. Airfield Asphalt Pavement Laboratory Technician[1]: The Technician will be responsible for conducting laboratory tests. The Airfield Asphalt Pavement Technician will be present in the laboratory anytime laboratory testing is underway.

[1]: Registration for the Airfield Asphalt Pavement Certification Program can be found at www.airfieldasphaltcert.com.

1.6 ACCEPTANCE

1.6.1 Acceptability of Work

Acquire the services of an independent commercial laboratory to perform acceptance testing. Acceptance of the plant produced mix and in-place requirements will be on a lot to lot basis. The materials and the pavement itself will be accepted on the basis of production testing. The Government may make check tests from split samples to validate the results of the production testing. Testing performed by the Government does not reduce the required testing of the independent commercial laboratory. Split samples will be taken for Government testing to reduce the variability between the independent commercial laboratory and the Government's test results. When the difference between the independent commercial laboratory and the Government's test results for split samples exceed the acceptable range of two results for multi-laboratory precision for the appropriate test method (i.e. ASTM) then at least one of the laboratories is determined to be in error. An evaluation of procedures and equipment in both laboratories will be made to determine the cause(s) for the differences. Develop steps to correct procedures and equipment to bring multi-laboratory precision to within acceptable limits.

1.6.2 Acceptance Requirements

Provide all sampling and testing required for acceptance and payment adjustment. Where appropriate, adjustments in payment for individual lots of asphalt pavement will be made based on laboratory air voids, in-place density, smoothness, and grade in accordance with the following paragraphs. Surface smoothness and grade determinations will be made on the lot as a whole. Exceptions or adjustments to this will be made in situations where the mix within one lot is placed as part of both the intermediate and surface courses, thus smoothness and grade measurements for the entire lot cannot be made.

1.6.3 Pavement Lots

A standard lot for all requirements is equal to one day's production or 2,000 tons, whichever is smaller. Divide each lot into four equal sublots in order to evaluate laboratory air voids and in-place density. When

operational conditions cause a lot to be terminated before the specified four sublots have been completed, use the following procedure to adjust the lot size and number of tests for the lot. Where three sublots have been completed, they constitute a lot. Where one or two sublots have been completed, incorporate them into the next lot and the total number of sublots (i.e. 5 or 6 sublots) is used for acceptance criteria. Maintain 4 sublots when possible. Include partial lots at the end of asphalt production into the previous lot. When more than one plant is simultaneously producing asphalt for the project, apply the lot size separately for each plant. Complete and report all asphalt testing including but not limited to aggregate gradation, asphalt content, theoretical maximum density, laboratory air voids, and in-place density testing within 24 hours, unless otherwise stated, after construction of each lot.

1.6.4 Sublot Sampling

Obtain one random mixture sample from each sublot in accordance with ASTM D979/D979M from a loaded truck or another approved location for determining laboratory air voids, theoretical maximum density, Contractor Quality Control, and for any additional testing as directed the Government. Representative samples will be selected from random trucks, using commonly recognized methods of assuring randomness conforming to ASTM D3665 and employing tables of random numbers or computer programs. Laboratory air voids will be determined from three laboratory compacted specimens of each sublot sample in accordance with ASTM D3203/D3203M. The specimens will be compacted within 2 hours of the time the mixture was loaded into trucks at the asphalt plant. Samples will not be reheated prior to compaction and insulated containers will be used as necessary to maintain the temperature.

1.6.5 Additional Sampling and Testing

The Government reserves the right to direct additional samples and tests for any area which appears to deviate from the specification requirements. The cost of any additional testing will be paid for by the Contractor. Testing in these areas will be treated as a separate lot. Payment will be made for the quantity of asphalt pavement represented by these tests in accordance with the provisions of this section.

1.6.6 Theoretical Maximum Density (TMD)

Measure theoretical maximum density one time for each sublot in accordance with ASTM D2041/D2041M for purposes of calculating laboratory air voids and determining in-place density. The average TMD for each lot will be determined as the average TMD of the random sublot samples. When the TMD on both sides of a longitudinal joint is different, the average of these two TMD values will be used as the TMD needed to calculate the percent joint density.

1.6.7 Laboratory Air Voids

Prepare one set of laboratory compacted specimens for each sublot in accordance with ASTM D6925 using the Superpave gyratory compactor. Provide three test specimens prepared from the same sample for each set of laboratory compacted specimens. Compact the specimens within 2 hours of the time the mixture was loaded into trucks at the asphalt plant. Do not reheat samples prior to compaction. Provide insulated containers as necessary to maintain the sample temperature. Measure the bulk density of

laboratory compacted specimens in accordance with ASTM D2726/D2726M. Determine laboratory air voids from one set (three laboratory compacted specimens) for each sublot sample in accordance with ASTM D3203/D3203M.

1.6.8 In-place Density

Obtain one random 6 inch diameter core from the mat and joint of each sublot in accordance with ASTM D5361/D5361M for determining in-place density. Where different job mix formulas are required as part of the same project, and are adjacent to one another, follow the same joint density sampling and joint density testing instructions of this specification. Cut samples neatly with a diamond core drill bit. Obtain random cores that are the full thickness of the layer being placed. Select core locations randomly using the procedures contained in ASTM D3665. Locate cores for mat density no closer than 12 inches from a transverse or longitudinal joint. Center all cores for joint density on the joint. Discard samples that are clearly defective as a result of sampling and take an additional random core. When the random core is less than 1 inch thick, it will not be included in the analysis. In this case, obtain another random core sample. Clean and tack coat dry core holes before filling with asphalt mixture. Fill all core holes with asphalt mixture and compact using a manual (hand-held) Marshall hammer to the density specified. Provide all tools, labor, and materials for cutting samples, cleaning, and filling the cored pavement. Measure in-place density in accordance with ASTM D2726/D2726M using each core obtained from the mat and joint.

1.6.9 Surface Smoothness

After the final rolling, but not later than 24 hours after placement, test the surface of the pavement in each entire lot by use of a straightedge to reveal surface irregularities exceeding the tolerances specified. Straightedge is used for all lifts. If any pavement areas are diamond ground, retest these areas immediately after diamond grinding and submit results to the Government for evaluation. At a minimum, provide enough information to determine exact location of grinding (station and offset from centerline), smoothness results, and the associated lot(s) pay factor for smoothness. Follow requirements of paragraph DIAMOND GRINDING if diamond grinding is required to correct smoothness. Where drawings show required deviations from a plane surface (for instance crowns, drainage inlets), finish the surface to meet the approval of the Government.

1.6.9.1 Straightedge Testing

Provide finished surfaces of the pavements within the tolerances specified in Table 5 when checked with an approved 12 foot straightedge. Start longitudinal and transverse straightedge testing with one-half the length of the straightedge at the edge of pavement section being tested and then moved ahead one-half the length of the straightedge for each successive measurements. Perform continuous tests across all joints. Determine the amount of surface irregularity by placing the freestanding (unleveled) straightedge on the pavement surface and allowing it to rest upon the two highest spots covered by its length, and measuring the maximum gap between the straightedge and the pavement surface in the area between these two high points. Use the straightedge to also measure abrupt changes in surface smoothness. Abrupt changes in the surface can be visually observed where the surface exhibits irregularities or discontinuities. Surface areas with obvious smoothness defects will be tested with the straightedge to determine the limits of the surface not meeting the tolerance requirements in Table 5. Do not perform straightedge measurements across

grade changes or cross slope transitions.

Perform transverse measurements perpendicular to centerline every 50 feet or more often as determined by the Government. For longitudinal measurements, test parallel to the centerline of paving; at the center of paving lanes when widths of paving lanes are less than 20 feet; and at the third points of paving lanes when widths of paving lanes are 20 feet or greater. After two full lots have been placed with an average of less than five percent of measurements out, a request can be made to reduce the testing frequency at a rate approved by the Government. Report all individual straightedge measurements coinciding with project stationing in each paving lot report.

Table 5

Straightedge Surface Smoothness

Pavement Category	Direction of Testing	Tolerance, inch
		1/8
		1/4
		1/4
		1/4
		1/8
		1/8
All other airfield pavements	Longitudinal	1/4
	Transverse	1/4

1.6.10 Plan Grade

Within 5 working days after completion of a particular lot incorporating the final wearing course, test the lot for conformance with specified plan grade requirements. Provide a final wearing surface of pavement conforming to the elevations and cross sections and not vary more than 0.03 foot for runways and landing zones or 0.05 foot for taxiways, aprons and shoulders. Deviation from the plan elevations will not be permitted in areas of pavements where closer conformance with planned elevation is required for the proper functioning of drainage and other appurtenant structures involved. The grade will be determined by running lines of levels at intervals of 50 feet, or less, longitudinally that coincides with the project spot elevations and lateral spacing to match the paving lane width (after cut back). In areas where the grade exceeds the tolerance by more than 50 percent, remove the surface lift full depth and replace the lift with asphalt pavement to meet specification requirements, at no additional cost to the Government. Match finished surfaces at juncture with other pavements with finished surfaces of abutting pavements except for where paragraph ASPHALT PAVEMENT-PORTLAND CEMENT CONCRETE JOINTS apply. Diamond grinding can be used to remove high spots to meet grade requirements. Skin patching for correcting low areas or planing or milling for correcting high areas is not permitted. Provide finished

surface grades in record drawing format showing design and constructed elevations which are stamped and signed by a licensed surveyor. Provide a comparison of the as-built grades to the design grades and determine a percentage of individual measurements exceeding the tolerances specified and determine pay factor per paragraph PAY FACTOR BASED ON PLAN GRADE. Submit the survey CAD files to the Government for record purposes. Submit all files including the calculation for percent measurements in each paving lot report.

1.7 Laboratory Accreditation and Validation

Provide laboratories used to develop the Job Mix Formula (JMF), perform acceptance testing, and Contractor Quality Control testing that meet the requirements of ASTM D3666. Perform all required test methods by an accredited and validated laboratory including field standards. Schedule and provide payment for laboratory inspections. Additional payment or a time extension due to failure to acquire the required laboratory accreditation is not allowed. The Government will inspect the laboratory equipment and test procedures prior to the start of asphalt pavement operations for conformance with ASTM D3666. In addition, all testing laboratories performing JMF, acceptance testing and Contractor Quality Control requires USACE validation by the Material Testing Center (MTC) for both parent laboratory and plant testing laboratory. Validation on all laboratories is required to remain current throughout the duration of the paving project. Contact the MTC manager listed at https://mtc.erdc.dren.mil/ for costs and scheduling. Submit a certificate of compliance signed by the manager of the laboratory stating that it meets these requirements to the Government prior to the start of construction. At a minimum, include the following certifications:

a. Qualification(s) and certification(s) of personnel; laboratory manager, supervising technician, and testing technicians.

b. A listing of equipment, with calibration dates, to be used in developing the job mix.

c. A copy of the laboratory's quality control system.

1.8 ENVIRONMENTAL REQUIREMENTS

Do not place asphalt pavement upon a wet surface or when the surface temperature of the underlying course is less than specified in Table 6. The temperature requirements may be waived by the Government, if requested; provided all other requirements, including in-place density, are met.

Table 6

Surface Temperature Limitations of Underlying Course

Mat Thickness, inches	Degrees F
3 or greater	40
Less than 3	45

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

This section is intended to stand alone for construction of asphalt pavement. However, where the construction covered herein interfaces with other sections, construct each interface to conform to the requirements of both this section and the other section, including tolerance for both.

Perform the work consisting of pavement courses composed of mineral aggregate and asphalt material heated and mixed in a central mixing plant and placed on a prepared course. Provide hot-mix asphalt (HMA) pavement designed and constructed in accordance with this section conforming to the lines, grades, thicknesses, and typical cross sections shown on the drawings. Construct each course to the depth, section, or elevation required by the drawings and rolled, finished, and approved before the placement of the next course (adjacent to or above). Submit proposed Placement Plan, indicating lane widths, longitudinal joints, and transverse joints for each course or lift.

2.2 Equipment

Provide product data for all components below.

2.2.1 Asphalt Mixing Plant

Provide plants used for the preparation of asphalt mixture conforming to the requirements of AASHTO M 156, including calibration data.

2.2.1.1 Truck Scales

Weigh the asphalt mixture on approved scales, or on certified public scales at no additional expense to the Government. Inspect and seal scales at least annually by an approved calibration laboratory.

2.2.1.2 Inspection of Plant

Provide access to the Government at all times, to all areas of the plant for checking adequacy of equipment; inspecting operation of the plant; verifying weights, proportions, and material properties; checking the temperatures maintained in the preparation of the mixtures and for taking samples. Provide assistance as requested, for the Government to procure any desired samples.

2.2.1.3 Storage Silos

The asphalt mixture may be stored in non-insulated storage silos for a period of time not exceeding 3 hours. The asphalt mixture may be stored in insulated storage silos for a period of time not exceeding 8 hours. No differences in the mix removed from silos and the mix loaded into trucks are allowed.

2.2.2 Hauling Equipment

Provide trucks used for hauling asphalt mixture that have tight, clean, and smooth metal beds. To prevent the mixture from adhering to them, lightly coat the truck beds with a minimum amount of paraffin oil, lime solution, or other approved material. Do not use petroleum based products as a release agent. Cover the bed of each truck with a tarp or other

suitable cover at all times during transport. When necessary to ensure that the mixture is delivered to the site at the specified temperature, provide insulated or heated truck beds with covers (tarps) that are securely fastened.

2.2.3 Material Transfer Vehicle (MTV)

Provide a self-propelled MTV with a swing conveyor that delivers material to the paver from outside the paving lane and without making contact with the paver. Provide MTV capable to move back and forth between the hauling equipment and the paver providing material transfer to the paver, while allowing the paver to operate at a constant speed. Provide Material Transfer Vehicle with remixing and a minimum onboard storage capability of 13 tons.

2.2.4 Asphalt Pavers

Provide mechanical spreading and finishing equipment consisting of a self-powered paver, capable of spreading and finishing the mixture to the specified line, grade, and cross section. Provide paver with a vibrating screed capable of placing a uniform mixture to meet the specified thickness, smoothness, and grade without physical or temperature segregation, the full width of the material being placed. Provide a screed that effectively produces a finished surface of the required evenness and texture without tearing, shoving, or gouging the mixture. Provide information on the tractor(s) and screed(s) proposed for use.

2.2.4.1 Receiving Hopper

Provide paver with a receiving hopper of sufficient capacity to permit a uniform spreading operation and a distribution system to place the mixture uniformly in front of the screed without segregation.

2.2.4.2 Automatic Grade Controls

If an automatic grade control device is used, provide a paver equipped with a control system capable of automatically maintaining the specified screed elevation that is automatically actuated from either a reference line or through a system of mechanical sensors or sensor-directed mechanisms or devices which maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. Provide transverse slope controller capable of maintaining the screed at the desired slope within plus or minus 0.1 percent. Do not use the transverse slope controller to control grade. Provide controls capable of working in conjunction with any of the following attachments:

a. Ski-type device of not less than 30 feet in length.

b. Taut stringline set to grade.

c. Short ski or shoe for joint matching.

d. Laser control.

e. GPS control.

2.2.5 Rollers

Provide rollers in good condition and operated at slow speeds to avoid

displacement of the asphalt mixture. Provide sufficient number, type, and weight of rollers to compact the mixture to the required density while it is still in a workable condition. Do not use equipment which causes excessive crushing of the aggregate.

2.2.6 Diamond Grinding

Those performing diamond grinding are required to have a minimum of three years experience in diamond grinding of airfield pavements. In areas not meeting the specified limits for surface smoothness and plan grade, reduce high areas to attain the required smoothness and grade, except as depth is limited below. Reduce high areas by diamond grinding the asphalt pavement with approved equipment after the asphalt pavement is at a minimum age of 14 days. Perform diamond grinding by sawing with saw blades impregnated with an industrial diamond abrasive. Assemble the saw blades in a cutting head mounted on a machine designed specifically for diamond grinding that produces the required texture and smoothness level without damage to the asphalt pavement. Provide diamond grinding equipment with saw blades that are 1/8-inch wide, a minimum of 60 blades per 12 inches of cutting head width, and capable of cutting a path a minimum of 3 feet wide. Diamond grinding equipment that causes raveling, fracturing of aggregate , or disturbance to the underlying material will not be allowed. The maximum area corrected by diamond grinding the surface of the asphalt pavement is 10 percent of the total area of any sublot. The maximum depth of diamond grinding is 1/2 inch. Provide diamond grinding machine equipped to flush and vacuum the pavement surface. Dispose of all debris from diamond grinding operations off Government property. Prior to diamond grinding, submit a Diamond Grinding Plan for review and approval. At a minimum, include the daily reports for the deficient areas, the location and extent of deficiencies, corrective actions, and equipment. Remove and replace all pavement areas requiring plan grade or surface smoothness corrections in excess of the limits specified.

Prior to production diamond grinding operations, perform a test section at the approved location, consisting of a minimum of two adjacent passes with a minimum length of 40 feet to allow evaluation of the finish and transition between adjacent passes. Production diamond grinding operations cannot be performed prior to approval.

2.3 AGGREGATES

Sample aggregates in the presence of a Government Representative. Obtain samples in accordance with ASTM D75/D75M and be representative of the materials to be used for the project. Provide aggregates consisting of crushed stone, crushed gravel, crushed slag, screenings, natural sand and mineral filler, as required. The portion of material retained on the No. 4 sieve is coarse aggregate. The portion of material passing the No. 4 sieve and retained on the No. 200 sieve is fine aggregate. The portion passing the No. 200 sieve is defined as mineral filler. Submit sufficient materials to produce 400 pounds of blended mixture for mix design verification. Submit all aggregate test results and samples to the Government at least 14 days prior to start of construction. Aggregate tests can be no older than 6 months prior to contract award.

2.3.1 Coarse Aggregate

Provide coarse aggregate consisting of sound, tough, durable particles, free from films of material that would prevent thorough coating and bonding with the asphalt material and free from organic matter and other

deleterious substances. Provide coarse aggregate particles meeting the following requirements:

a. The percentage of loss not greater than 40 percent after 500 revolutions when tested in accordance with ASTM C131/C131M.

b. The sodium sulfate soundness loss not exceeding 12 percent, or the magnesium sulfate soundness loss not exceeding 18 percent after five cycles when tested in accordance with ASTM C88.

c. At least 75 percent by weight of coarse aggregate contain at least two or more fractured faces when tested in accordance with ASTM D5821 with fractured faces produced by crushing.

d. The particle shape essentially cubical and the aggregate containing not more than 5 percent, by weight, of flat particles, elongated particles, or flat and elongated particles (5:1 ratio of maximum to minimum) when tested in accordance with ASTM D4791 Method A.

e. Clay lumps and friable particles not exceeding 0.3 percent, by weight, when tested in accordance with ASTM C142/C142M.

2.3.2 Fine Aggregate

Provide fine aggregate consisting of clean, sound, tough, durable particles. Provide aggregate particles that are free from coatings of clay, silt, or any objectionable material, contain no clay balls, and meet the following requirements:

a. Quantity of natural sand (noncrushed material) added to the aggregate blend not exceeding 15 percent by weight of total aggregate.

b. Individual fine aggregate sources with a sand equivalent value greater than 45 when tested in accordance with ASTM D2419.

c. Fine aggregate portion of the blended aggregate with an uncompacted void content greater than 45.0 percent when tested in accordance with ASTM C1252 Method A.

d. Clay lumps and friable particles not exceeding 0.3 percent, by weight, when tested in accordance with ASTM C142/C142M.

2.3.3 Mineral Filler

Provide mineral filler consisting of a nonplastic material meeting the requirements of ASTM D242/D242M.

2.3.4 Aggregate Gradation

Provide a combined aggregate gradation that conforms to gradations specified in Table 7, when tested in accordance with ASTM C136/C136M and ASTM C117, and does not vary from the low limit on one sieve to the high limit on the adjacent sieve or vice versa, but grades uniformly from coarse to fine. Provide a JMF within the specification limits; however, the gradation can exceed the limits when the allowable deviation from the JMF shown in Tables 10 and 11 are applied.

Table 7			
Aggregate Gradations			
		Gradation 2	
Sieve Size, inch		Percent Passing by Mass	
1		---	
3/4		100	
1/2		90-100	
3/8		69-89	
No. 4		53-73	
No. 8		38-60	
No. 16		26-48	
No. 30		18-38	
No. 50		11-27	
No. 100		6-18	
No. 200		3-6	

2.4 ASPHALT BINDER

Provide asphalt binder that conforms to ASTM D6373 for Performance Grade (PG) 64-22. Provide test data indicating grade certification by the supplier at the time of delivery of each load to the mix plant. For modified binders, perform PG Plus test requirements in ASTM D6084/D6084M Procedure B on RTFO aged binder, with a minimum elastic recovery of 30 percent. Submit copies of these certifications to the Government. The supplier is defined as the last source of any modification to the binder. The Government may sample and test the binder at the mix plant at any time before or during mix production.

2.5 MIX DESIGN

Develop the mix design and provide results of the Job Mix formula (JMF) and aggregates testing performed no earlier than 6 months prior to contract award. Provide asphalt mixture composed of well-graded aggregate, mineral filler if required, and asphalt material. Provide aggregate fractions sized, handled in separate size groups, and combined in such proportions that the resulting mixture meets the grading requirements of Table 7. Do not produce asphalt pavement for payment until a JMF has been approved. Design the asphalt mixture using the Superpave gyratory compactor set at 50 gyrations using the procedures contained in AI MS-2 and the criteria shown in Table 8. Prepare samples at various asphalt contents and compacted in accordance with ASTM D6925. Use laboratory compaction temperatures for Polymer Modified Asphalts as

recommended by the asphalt binder supplier. For tensile strength ratio (TSR) testing, adjust the compactive effort, as required, to provide specimens with an air void content of 7 plus or minus 1 percent. If the Tensile Strength Ratio (TSR) of the composite mixture, as determined by ASTM D4867/D4867M is less than 75, reject the aggregates or treat the asphalt mixture with an anti-stripping agent. Add a sufficient amount of anti-stripping agent to produce a TSR of not less than 75. If an antistrip agent is required, provide it at no additional cost to the Government. Provide sufficient materials to produce 400 pounds of blended mixture to the Government for verification of mix design at least 14 days prior to construction of test section.

2.5.1 JMF Requirements

Submit the proposed JMF in writing, for approval, at least 14 days prior to the start of the test section, including as a minimum:

a. Percent passing each sieve size.

b. Optimum asphalt content.

c. Percent of each aggregate and mineral filler to be used.

d. Asphalt viscosity grade, penetration grade, or performance grade and additional test requirements as specified in paragraph ASPHALT BINDER.

e. Number of Superpave gyratory compactor gyrations.

f. Laboratory mixing and compaction temperatures.

g. Supplier-recommended field mixing and compaction temperatures.

h. Temperature-viscosity relationship of the asphalt binder.

i. Plot of the combined gradation on the 0.45 power gradation chart, stating the nominal maximum size.

j. Graphical plots and summary tabulation of air voids, voids in the mineral aggregate, and unit weight versus asphalt content as shown in AI MS-2. Include summary tabulation that includes individual specimen data for each specimen tested.

k. Specific gravity and absorption of each aggregate.

l. Percent natural sand.

m. Percent particles with two or more fractured faces (in coarse aggregate).

n. Fine aggregate angularity.

o. Percent flat or elongated particles (in coarse aggregate).

p. Tensile Strength Ratio and wet/dry specimen test results.

q. Type and amount of antistrip agent (if required).

r. List of all modifiers.

s. Date the JMF was developed. Mix designs that are not dated or which are from a prior construction season may not be accepted.

Table 8	
Superpave Gyratory Compaction Criteria	
Test Property	Value
Air voids, percent	4(1)
Percent Voids in mineral aggregate (minimum)	See Table 9
Dust Proportion(2)	0.8-1.2
TSR, minimum percent	75
TSR Conditioned Strength (minimum psi)	60
(1) Select the JMF asphalt content corresponding to an air void content of 4 percent. Verify the other properties of Table 8 meet the specification requirements at this asphalt content.	
(2) Dust Proportion is calculated as the aggregate content, expressed as a percent of mass, passing the No. 200 sieve, divided by the effective asphalt content, in percent of total mass of the mixture.	

Table 9	
Minimum Percent Voids in Mineral Aggregate (VMA)(1)	
Aggregate (See Table 7)	Minimum VMA, percent
Gradation 2	14.0
(1) Calculate VMA in accordance with AI MS-2, based on ASTM C127 and ASTM C128 bulk specific gravity for the aggregate.	

2.5.2 Adjustments to JMF

The JMF for each mixture is in effect until a new formula is approved in writing by the Government. Should a change in sources of any materials be made, perform a new mix design and a new JMF approved before the new material is used. Make minor adjustments within the specification limits to the JMF to optimize mix volumetric properties. Adjustments to the original JMF are limited to plus or minus 4 percent on the No. 4 and coarser sieves; plus or minus 3 percent on the No. 8 to No. 50 sieves; and plus or minus 1 percent on the No. 100 sieve. Adjustments to the JMF are

limited to plus or minus 1.0 percent on the No. 200 sieve. Asphalt content adjustments are limited to plus or minus 0.40 from the original JMF. If adjustments are needed that exceed these limits, develop a new mix design.

2.6 RECLAIMED ASPHALT PAVEMENT

Reclaimed asphalt is not allowed for the project.

2.7 RECYCLED ASPHALT SHINGLES

Recycled asphalt shingles (RAS) is not allowed for the project.

PART 3 EXECUTION

3.1 CONTRACTOR QUALITY CONTROL

3.1.1 General Quality Control Requirements

Submit the Pavement Quality Control Plan. The Quality Control Plan is specific to this specification and supplements the overall Quality Control Plan required by Section 01 45 00. Do not produce hot-mix asphalt pavement for payment until the quality control plan has been approved. In the quality control plan, address all elements which affect the quality of the pavement including, but not limited to:

a. Mix Design and unique JMF identification code

b. Aggregate Grading

c. Quality of Materials

d. Stockpile Management and procedures to prevent contamination

e. Proportioning

f. Mixing and Transportation

g. Mixture Volumetrics

h. Moisture Content of Mixtures

i. Placing and Finishing

j. Joints

k. Compaction, including Asphalt Pavement-Portland Cement Concrete joints

l. Surface Smoothness

m. Truck bed release agent

3.1.2 Testing Laboratory

Provide a fully equipped asphalt laboratory located at the plant or job site that is equipped with heating and air conditioning units to maintain a temperature of 75 plus or minus 5 degrees F. Provide laboratory

facilities that are kept clean and all equipment maintained in proper working condition. Provide the Government with unrestricted access to inspect the laboratory facility, to witness quality control activities, and to perform any check testing desired. The Government will advise in writing of any noted deficiencies concerning the laboratory facility, equipment, supplies, or testing personnel and procedures. When the deficiencies are serious enough to adversely affect test results, immediately suspend the incorporation of the materials into the work. Incorporation of the materials into the work will not be permitted to resume until the deficiencies are corrected.

3.1.3 Quality Control Testing

Perform all quality control tests applicable to these specifications and as set forth in the Quality Control Program. The quality control (QC) testing is separate and distinct from the acceptance testing in paragraph ACCEPTANCE. Use in-house capabilities or the independent commercial laboratory for quality control testing. Required elements of the testing program include, but are not limited to, tests for the control of asphalt content, aggregate gradation, temperatures, aggregate moisture, moisture in the asphalt mixture, laboratory air voids, in-place density, grade and smoothness. Develop a Quality Control Testing Plan as part of the Quality Control Program.

3.1.3.1 Asphalt Content

Determine asphalt content a minimum of twice per lot (a lot is defined in paragraph PAVEMENT LOTS) by one of the following methods: extraction method in accordance with ASTM D2172/D2172M, Method A or B, the ignition method in accordance with ASTM D6307, or the nuclear method in accordance with ASTM D4125/D4125M, provided each method is calibrated for the specific mix being used. For the extraction method, determine the weight of ash, as described in ASTM D2172/D2172M, as part of the first extraction test performed at the beginning of plant production; and as part of every tenth extraction test performed thereafter, for the duration of plant production. Use the last weight of ash value in the calculation of the asphalt content for the mixture. The asphalt content for the lot will be determined by averaging the test results.

3.1.3.2 Aggregate Properties

Determine aggregate gradations a minimum of twice per lot (a lot is defined in paragraph PAVEMENT LOTS) from mechanical analysis of recovered aggregate in accordance with ASTM D5444, ASTM C136/C136M, and ASTM C117. Determine the specific gravity of each aggregate size grouping for each 20,000 tons in accordance with ASTM C127 or ASTM C128. Determine fractured faces for gravel sources for each 20,000 tons in accordance with ASTM D5821. Determine the uncompacted void content of fine aggregate (including manufactured sand and blending aggregate) for each 20,000 tons in accordance with ASTM C1252 Method A.

3.1.3.3 Temperatures

Check temperatures at least four times per lot, at necessary locations, to determine the temperature at the dryer, the asphalt binder in the storage tank, the asphalt mixture at the plant, and the asphalt mixture at the job site.

3.1.3.4 Moisture Content of Aggregate

Determine the moisture content of aggregate used for production a minimum of once per lot in accordance with ASTM C566.

3.1.3.5 Moisture Content of Mixture

Determine the moisture content of the mixture at least once per lot in accordance with AASHTO T 329.

3.1.3.6 Laboratory Air Voids, TMD, and VMA

Obtain mixture samples at least four times per lot and compacted into specimens, using 50 gyrations of the Superpave gyratory compactor as described in ASTM D6925. After compaction, measure the bulk density of laboratory compacted specimens in accordance with ASTM D2726/D2726M. Determine the laboratory air voids from the set (three laboratory compacted specimens) for each sample in accordance with ASTM D3203/D3203M. Also calculate the VMA of each specimen in accordance with AI MS-2 based on ASTM C127 and ASTM C128 bulk specific gravity for the aggregate. Provide VMA within the limits of Table 9.

3.1.3.7 In-Place Density

Conduct any necessary testing to ensure the specified density is achieved. A nuclear gauge or other non-destructive testing device may be used to monitor pavement density for Contractor Quality Control purposes only.

3.1.3.8 Grade and Smoothness

Conduct the necessary checks to ensure the grade and smoothness requirements are met in accordance with paragraph ACCEPTANCE.

3.1.3.9 Additional Testing

Perform any additional testing, deemed necessary to control the process.

3.1.3.10 QC Monitoring

Submit all QC test results to the Government on a daily basis as the tests are performed. The Government reserves the right to monitor any of the Contractor's quality control testing and to perform duplicate testing as a check to the Contractor's quality control testing.

3.1.4 Sampling

When directed by the Government, sample and test any material which appears inconsistent with similar material being produced, unless such material is voluntarily removed and replaced or deficiencies corrected. Perform all sampling in accordance with standard procedures specified.

3.1.5 Control Charts

For process control, establish and maintain linear control charts on both individual samples and the running average of last four samples for the parameters listed in Table 10, as a minimum. Post the control charts as directed by the Government and maintain current at all times. Identify the following on the control charts, the project number, the test parameter

being plotted, the individual sample numbers, the Action and Suspension Limits listed in Table 10 applicable to the test parameter being plotted, and the test results. Also show target values (JMF) on the control charts as indicators of central tendency for the cumulative percent passing, asphalt content, and laboratory air voids parameters. When the test results exceed either applicable Action Limit, take immediate steps to bring the process back in control. When the test results exceed either applicable Suspension Limit, halt production until the problem is solved. When the Suspension Limit is exceeded for individual values or running average values, the Government has the option to require removal and replacement of the material represented by the samples or to leave in place and base acceptance on mixture volumetric properties and in place density. Use the control charts as part of the process control system for identifying trends so that potential problems can be corrected before they occur. Make decisions concerning mix modifications based on analysis of the results provided in the control charts. In the Quality Control Plan, indicate the appropriate action to be taken to bring the process into control when certain parameters exceed their Action Limits.

Table 10

Action and Suspension Limits for the Parameters to be Plotted on Individual and Running Average Control Charts

	Individual Samples		Running Average of Last Four Samples	
Parameter to be Plotted	Action Limit	Suspension Limit	Action Limit	Suspension Limit
No. 4 sieve, Cumulative Percent Passing, deviation from JMF target; plus or minus values	6	8	4	5
No. 30 sieve, Cumulative Percent Passing, deviation from JMF target; plus or minus values	4	6	3	4
No. 200 sieve, Cumulative Percent Passing, deviation from JMF target; plus or minus values	1.4	2.0	1.1	1.5
Asphalt content, percent deviation from JMF target; plus or minus value	0.4	0.5	0.2	0.3
Laboratory Air Voids, percent deviation from JMF target value	No specific action and suspension limits set since this parameter is used to determine percent payment			
In-place Mat Density, percent of TMD	No specific action and suspension limits set since this parameter is used to determine percent payment			
In-place Joint Density, percent of TMD	No specific action and suspension limits set since this parameter is used to determine percent payment			
VMA, percent deviation from JMF target				
Gradation 1, 2 & 3	-0.5	-1.0	-0.25	-0.5

Table 10

Action and Suspension Limits for the Parameters to be Plotted on Individual and Running Average Control Charts

	Individual Samples		Running Average of Last Four Samples	
Parameter to be Plotted	Action Limit	Suspension Limit	Action Limit	Suspension Limit
$P_{0.075}/P_{be}$ Ratio, deviation from 1.0; plus or minus values	0.7	0.8	0.3	0.4

3.2 PREPARATION OF ASPHALT BINDER MATERIAL

Heat the asphalt binder material while avoiding local overheating and providing a continuous supply of the asphalt material to the mixer at a uniform temperature. Maintain the temperature of unmodified asphalts to no more than 325 degrees F when added to the aggregates. The temperature of modified asphalts is not to exceed 350 degrees F.

3.3 PREPARATION OF MINERAL AGGREGATE

Heat and dry the aggregate for the mixture prior to mixing. No damage to the aggregates due to the maximum temperature and rate of heating used is allowed. Maintain the temperature no lower than is required to obtain complete coating and uniform distribution on the aggregate particles and to provide a mixture of satisfactory workability.

3.4 PREPARATION OF ASPHALT MIXTURE

Weigh or meter the aggregates and the asphalt binder and introduce into the mixer in the amount specified by the JMF. Limit the temperature of the asphalt mixture to 350 degrees F when the asphalt binder is added. Mix the combined materials until the aggregate obtains a thorough and uniform coating of asphalt binder (testing in accordance with ASTM D2489/D2489M may be required by the Contracting Officer) and is thoroughly distributed throughout the mixture. The moisture content of all asphalt mixture upon discharge from the plant is not to exceed 0.5 percent by total weight of mixture as measured by AASHTO T 329.

3.5 PREPARATION OF THE UNDERLYING SURFACE

Immediately before placing asphalt pavement, clean the underlying course of dust and debris. Apply a prime coat and tack coat in accordance with the contract drawings and Section 32 12 13 BITUMINOUS TACK AND PRIME COATS.

3.6 TEST SECTION

Prior to full production, place a test section for each JMF used. Construct a test section 200 feet long and two paver passes wide with a longitudinal cold joint. Do not place the second lane of test section until the temperature of pavement edge is less than 175 degrees F. Construct the test section with the same depth as the course which it represents. Ensure the underlying grade or pavement structure upon which the test section is to be constructed is the same or very similar to the underlying layer for the project. Use the same equipment in construction of the test section as on the remainder of the course represented by the

test section. Construct the test section as part of the project pavement as approved by the Government.

3.6.1 Sampling and Testing for Test Section

Obtain one representative sample from random trucks at the plant, compact triplicate specimens, and test for laboratory air voids. Test a portion of the same sample for theoretical maximum density (TMD), aggregate gradation and asphalt content. Test an additional portion of the sample to determine the TSR. Adjust the compactive effort as required to provide TSR specimens with an air void content of 7 plus or minus 1 percent. Obtain four randomly selected cores from the finished pavement mat, and four from the longitudinal joint, and test for density. Perform random sampling in accordance with procedures contained in ASTM D3665. Construction may continue provided the test results are within the tolerances or exceed the minimum values shown in Table 11. If all test results meet the specified requirements, the test section may remain as part of the project pavement. If test results exceed the tolerances shown, remove and replace the test section and construct another test section at no additional cost to the Government.

Table 11

Test Section Requirements for Material and Mixture Properties

Property	Specification Limit
Aggregate Gradation-Percent Passing (Individual Test Result)	
No. 4 and larger	JMF plus or minus 8
No. 8, No. 16, No. 30, and No. 50	JMF plus or minus 6
No. 100 and No. 200	JMF plus or minus 2.0
Asphalt Content, Percent (Individual Test Result)	JMF plus or minus 0.5
Laboratory Air Voids, Percent (Average of 3 specimens)	JMF plus or minus 1.0
VMA, Percent (Average of 3 specimens)	See Table 9
Tensile Strength Ratio (TSR) (At 7 percent plus/minus 1 percent air void content)	75 percent minimum
Conditioned Strength	60 psi minimum
Mat Density, Percent of TMD (Average of 4 Random Cores)	92.0 - 96.0
Joint Density, Percent of TMD (Average of 4 Random Cores)	90.5 minimum

3.6.2 Additional Test Sections

If the initial test section proves to be unacceptable, make the necessary adjustments to the JMF, plant operation, placing procedures, and rolling procedures before beginning construction of a second test section. Construct and evaluate additional test sections, as required, for conformance to the specifications. Full production paving is not allowed to begin until an acceptable test section has been constructed and accepted.

3.7 TRANSPORTING AND PLACING

3.7.1 Transporting

Transport asphalt mixture from the mixing plant to the site in clean, tight vehicles. Schedule deliveries so that placing and compacting of mixture is uniform with minimum stopping and starting of the paver. Provide adequate artificial lighting for night placements. Hauling over freshly placed material is not permitted until the material has been compacted as specified, and allowed to cool to 140 degrees F.

3.7.2 Placing

Place the mix in lifts of adequate thickness and compacted at a temperature suitable for obtaining density, surface smoothness, and other specified requirements. Place the mixture to the full width by an asphalt paver; strike off in a uniform layer of such depth that, when the work is complete, the required thickness conforms to the grade and contour indicated. Do not broadcast waste mixture onto the mat or recycle it into the paver hopper. Collect waste mixture and dispose off site. Regulate the speed of the paver to eliminate pulling and tearing of the asphalt mat. Begin placement of the mixture along the centerline of a crowned section or on the high side of areas with a one-way slope. Place the mixture in consecutive adjacent strips having a minimum width of 10 feet. Offset the longitudinal joint in one course from the longitudinal joint in the course immediately below by at least 1 foot; however, locate the joint in the surface course at the centerline of the pavement. Offset transverse joints in one course by at least 10 feet from transverse joints in the previous course. Offset transverse joints in adjacent lanes a minimum of 10 feet. On isolated areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread and luted by hand tools. Construct the free edge of shoulder pavements following a guide (e.g. plumb-bob, stringline, etc.) to prevent various widths of the asphalt shoulder. Contractor may elect to cut-back the asphalt edge to maintain consistent shoulder dimensions shown on the plans.

3.8 COMPACTION OF MIXTURE

3.8.1 General

a. After placing, thoroughly and uniformly compact the mixture by rolling. Compact the surface as soon as possible without causing displacement, cracking or shoving. Determine the sequence of rolling operations and the type of rollers used, except as specified in paragraph ASPHALT PAVEMENT-PORTLAND CEMENT CONCRETE JOINTS. Maintain the speed of the roller, at all times, sufficiently slow to avoid displacement of the asphalt mixture and be effective in compaction. Correct at once any displacement occurring as a result of reversing the direction of the roller, or from any other cause.

b. Furnish sufficient rollers to handle the output of the plant. Continue rolling until the surface is of uniform texture, true to grade and cross section, and the required field density is obtained. To prevent adhesion of the mixture to the roller, keep the drums properly moistened, but excessive water is not permitted. In areas not accessible to the roller, thoroughly compact the mixture with hand tampers. Remove the full depth of any mixture that becomes loose and broken, mixed with dirt, contains check-cracking, or is in any way

defective, replace with fresh asphalt mixture and immediately compact to conform to the surrounding area. Perform this work at no expense to the Government. Skin patching is not allowed.

3.8.2 Segregation

The Government can sample and test any material that looks deficient. When the in-place material appears to be segregated, the Government has the option to sample the material and have it tested and compared to the aggregate gradation, asphalt content, and in-place density requirements in Table 11. If the material fails to meet these specification requirements, remove and replace the extent of the segregated material the full depth of the layer of asphalt mixture at no additional cost to the Government. When segregation occurs in the mat, take appropriate action to correct the process so that additional segregation does not occur.

3.9 JOINTS

Construct joints to ensure a continuous bond between the courses and to obtain the required density. Provide all joints with the same texture as other sections of the course and meet the requirements for smoothness and grade.

3.9.1 Transverse Joints

Do not pass the roller over the unprotected end of the freshly laid mixture, except when necessary to form a transverse joint. When necessary to form a transverse joint, construct by means of placing a bulkhead or by tapering the course. Utilize a dry saw cut on the transverse joint full depth and width on a straight line to expose a vertical face prior to placing the adjacent lane. Neither cutting equipment that uses water as a cooling or cutting agent nor milling equipment is permitted. Remove the cutback material and cutting debris from the project. Provide a tack coat in accordance with Section 32 12 13 BITUMINOUS TACK AND PRIME COATS to all contact surfaces before placing any fresh mixture against the joint.

3.9.2 Longitudinal Joints

Cut back longitudinal joints which are irregular, damaged, uncompacted, cold (less than 175 degrees F at the time of placing the adjacent lane), or otherwise defective, a minimum of 3 inches and a maximum of 6 inches from the top edge of the lift with a cutting wheel to expose a clean, sound, near vertical surface for the full depth of the course. Remove all cutback material from the project. Neither cutting equipment that uses water as a cooling or cutting agent nor milling equipment is permitted. Remove the cutback material and cutting debris from the project. Provide tack coat in accordance with Section 32 12 13 BITUMINOUS TACK AND PRIME COATS to all contact surfaces prior to placing any fresh mixture against the joint.

3.9.3 Echelon Paving

If echelon paving is accomplished to minimize longitudinal cold joints, visually inspect the interface between the two paving lanes to ensure that the interface is not segregated or appears to be visually different from other sections of the course. If visual inspection identifies quality concerns, extract 1 randomly selected cores per sublot centered over the interface between the two paving lanes being placed. The requirements for density at the interface between the two echelon paved lanes are the

same as that for the joint density specified in paragraph MAT AND JOINT DENSITIES.

3.9.4 Asphalt Pavement-Portland Cement Concrete Joints

Joints between asphalt pavement and Portland Cement Concrete (PCC) require specific construction procedures for the asphalt pavement. The following criteria are applicable to the first 10 feet or paver width of asphalt pavement adjacent to the PCC.

a. For all lifts, place the asphalt pavement side of the joint in a direction parallel to the joint.

b. For non-surface lifts (e.g. base or intermediate lifts), compact the mixture per paragraph MAT AND JOINT DENSITIES.

c. For the surface lift place the asphalt pavement side sufficiently high so that when fully compacted the asphalt pavement is greater than 1/8 inch but less than 1/4 inch higher than the PCC side of the joint.

d. For the surface lift, compact with steel wheel rollers and at least one rubber tire roller. Compact with a rubber tire roller that weights at least 20 tons with tires inflated to at least 90 psi. Avoid spalling the PCC during placement and compaction of the asphalt pavement. Operate steel wheel rollers in a way that prevents spalling the PCC. Repair any damage to PCC edges or joints as directed by the Government. If damage to the PCC joint or panel edge exceeds a total of 3 feet, remove and replace the PCC panel at no additional expense to the Government.

e. For the surface lift, after compaction is finished, diamond grind a minimum width of 3 feet of the asphalt pavement so that the asphalt pavement side is less than 1/8 inch higher than the PCC side. Perform diamond grinding in accordance with subparagraph DIAMOND GRINDING above. The asphalt pavement immediately adjacent to the joint is not allowed to be lower than the PCC after the grinding operation. Transition the grinding into the asphalt pavement in a way that ensures good smoothness and provides drainage of water. The joint and adjacent materials when completed is required to meet all of the requirements for grade and smoothness. Measure smoothness across the asphalt pavement-PCC joint using a 12 feet straightedge. The acceptable tolerance is 1/8 inch.

f. For all lifts, consider the asphalt pavement next to the PCC as a separate weighted pay factor associated with the lot being placed for evaluation. Lots are based on individual lifts. Do not commingle cores from different lifts for density evaluation purposes. Take four cores for each lot of material placed adjacent to the asphalt pavement-PCC joint. The size of lot is 10 feet wide by the length of the joint being paved. Perform the same computation as displayed in paragraph PAY FACTOR BASED ON IN-PLACE DENSITY above to determine the weighted pay factor. Select the lowest computed pay factor for the lot. Locate the center of each of the four cores 6 inches from the edge of the concrete. Take each core at a random location along the length of the joint. The requirements for joint density, adjacent to the PCC joint, are the same as that for the mat density specified in Table 1. For asphalt pavement-PCC joints at taxiways abutting runways, aprons, or other taxiways, take two additional randomly located cores along each taxiway intersection.

g. All procedures, including repair of damaged PCC, are required to be in accordance with the approved Quality Control Plan.

-- End of Section --

SECTION 32 13 14.13

CONCRETE PAVING FOR AIRFIELDS AND OTHER HEAVY DUTY PAVEMENTS
11/22, CHG 1: 05/24

PART 1 GENERAL

1.1 UNIT PRICES

1.1.1 Measurements

The quantity of concrete will be paid for and included in the lump-sum contract price. Measurement of in place concrete shall only be used to calculate payment reduction if less than 100 percent pavyment is due based on the pay factors herin. The quantity of concrete to be paid for will be the volume of concrete in cubic yards including thickened edges , where required, placed in the completed and accepted pavement. Concrete will be measured in place in the completed and accepted pavement only within the neat line dimensions shown in the plan and cross section. No deductions will be made for rounded or beveled edges or the space occupied by pavement reinforcement, dowel bars, or electrical conduits, nor for any void, or other structure extending into or through the pavement slab, measuring 3 cubic feet or less in volume. No other allowance for concrete will be made unless placed in specified locations in accordance with the approved contract modification. The quantity of other materials specified herein, and used in the construction of the work covered by this section, will not be measured for payment, but will be considered a subsidiary obligation, covered under the price per cubic yard for concrete. Joint sealing materials are covered in Section 32 01 19.61 SEALING OF JOINTS IN RIGID PAVEMENT and 32 13 73.19 COMPRESSION CONCRETE PAVING JOINT SEALANT.

1.1.2 Payments

1.1.2.1 Lump Sum

The quantity of concrete will be paid for and included in the lump-sum contract price. If less than 100 percent payment is due based on the pay factors stipulated below, a unit price of $300 per cubic yard will be used for purposes of calculating the payment reduction. Payment will constitute full compensation for all materials, equipment, plant and tools, and for all labor and other incidentals necessary to complete the concrete pavement, except for other items specified herein for separate payment.

1.1.3 Payment of Lots

When a lot of material fails to meet the specification requirements, that lot will be accepted at a reduced price or be removed and replaced. The lowest computed percent payment determined for any pavement characteristic discussed below (for example, thickness, grade, and surface smoothness) becomes the actual percent payment for that lot. The actual percent payment will be applied to the unit price and the measured quantity of concrete in the lot to determine actual payment. Use results of strength tests to control concreting operations. Strength will be evaluated, but will not be considered for payment adjustment. Remove and replace any sublot not meeting the required 'Concrete Strength for Final Acceptance' at no additional cost to the Government.

1.1.4 Payment Adjustment for Smoothness

1.1.4.1 Straightedge Testing

Record location and deviation from straightedge for all measurements. Determine the computed percent payment for straightedge testing by entering Table 1.

TABLE 1	
PAYMENT ADJUSTMENT FOR SMOOTHNESS USING STRAIGHTEDGE	
Deviation from straightedge for all measurements made within a lot exceed the tolerance specified in paragraph SURFACE SMOOTHNESS by:	Computed Percent Payment
Less than or equal to 5.0 percent	100
More than 5.0 percent but Less than or equal to 10.0 percent, after any reduction of high spots or removal and replacement	95
More than 10.0 percent but Less than or equal to 15.0 percent	90
More than 15.0 percent but Less than or equal to 20.0 percent	75
More than 20.0 percent	Remove and Replace

1.1.4.2 Profilograph Testing

Record location and data from all profilograph measurements. Determine the computed percent payment for profilograph smoothness by entering Table 2.

TABLE 2	
PAYMENT ADJUSTMENT FOR SMOOTHNESS USING PROFILOGRAPH	
Profile Index of a 0.1 mile segment of a lot exceeds the tolerance specified in paragraph SURFACE SMOOTHNESS by:	Computed Percent Payment
Less than 1.0 inch per mile	100
1.0 inch per mile but Less than 2.0 inches per mile, after any reduction of high spots or removal and replacement	95

TABLE 2	
PAYMENT ADJUSTMENT FOR SMOOTHNESS USING PROFILOGRAPH	
Profile Index of a 0.1 mile segment of a lot exceeds the tolerance specified in paragraph SURFACE SMOOTHNESS by:	Computed Percent Payment
2.0 inches per mile but Less than 3.0 inches per mile	90
3.0 inches per mile but Less than 4.0 inches per mile	75
4.0 inches per mile or more	Remove and Replace

1.1.5 Payment Adjustment for Plan Grade

Determine the computed percent payment for plan grade by entering TABLE 3.

TABLE 3	
PAYMENT ADJUSTMENT FOR PLAN GRADE	
Percent of all measurements made within a lot that are within the payment adjustment limits specified in paragraph Plan Grade	Computed Percent Payment
Less than or equal to 5.0	100
More than 5.0 but Less than or equal to 10.0	95
More than 10.0 but Less than 20	90
More than 20.0 but Less than 50	75
50 or more	Remove and Replace

As an example, if 100 measurements are required for the specified lot, and

9 of the required measurements are within the Payment Adjustment limits identified in paragraph Plan Grade, 9 percent would be used to determine the computed percent payment of 95 percent.

1.1.6 Payment Adjustment for Thickness

Using the Average Thickness of the lot, determine the computed percent payment for thickness by entering Table 4.

TABLE 4

PAYMENT ADJUSTMENT FOR THICKNESS

Deficiency in Thickness Determined by cores inches	Computed Percent Payment	
	Pavements Equal To or Greater Than 8 inches Thick	Pavements Less Than 8 inches Thick
0.00 to 0.24	100	100
0.25 to 0.49	75	65
0.50 to 0.74	50	Remove and Replace
0.75 or greater	Remove and Replace	Remove and Replace

Where either of the two cores from a sublot show a thickness deficiency of 0.75 inch or greater, drill two more cores in the sublot and compute the average thickness of the four cores. If this average shows a thickness deficiency of 0.75 inch or more remove the entire sublot.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO M 182 (2005; R 2021; E 2024) Standard Specification for Burlap Cloth Made from Jute or Kenaf and Cotton Mats

AASHTO R 56 (2025) Standard Practice for Certification of Inertial Profiling Systems

AASHTO R 57 (2025) Standard Practice for Operating Inertial Profiling Systems

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 201.1R (2008) Guide for Conducting a Visual Inspection of Concrete in Service

ACI 211.1	(1991; R 2009) Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete
ACI 214R	(2011) Evaluation of Strength Test Results of Concrete
ACI 305R	(2020) Guide to Hot Weather Concreting
ACI 306R	(2016) Guide to Cold Weather Concreting
ACI 325.14R	(2017) Guide for Design and Proportioning of Concrete Mixtures for Pavements

ASTM INTERNATIONAL (ASTM)

ASTM A184/A184M	(2024) Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement
ASTM A615/A615M	(2025) Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
ASTM A996/A996M	(2016) Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
ASTM A1078/A1078M	(2019) Standard Specification for Epoxy-Coated Steel Dowels in Concrete Pavement
ASTM C31/C31M	(2026) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2024a) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2024) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C78/C78M	(2022) Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)
ASTM C88	(2018) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C94/C94M	(2025a) Standard Specification for Ready-Mixed Concrete
ASTM C114	(2024) Standard Test Methods for Chemical Analysis of Hydraulic Cement
ASTM C117	(2023) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing

ASTM C123/C123M	(2023) Standard Test Method for Lightweight Particles in Aggregate
ASTM C125	(2025b) Standard Terminology Relating to Concrete and Concrete Aggregates
ASTM C131/C131M	(2020) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C136/C136M	(2025) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C138/C138M	(2024a) Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
ASTM C142/C142M	(2017; R 2023) Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM C143/C143M	(2020) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2024) Standard Specification for Portland Cement
ASTM C172/C172M	(2017) Standard Practice for Sampling Freshly Mixed Concrete
ASTM C174/C174M	(2025) Standard Test Method for Measuring Thickness of Concrete Elements Using Drilled Concrete Cores
ASTM C192/C192M	(2025a) Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C231/C231M	(2026) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2024) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C294	(2024) Standard Descriptive Nomenclature for Constituents of Concrete Aggregates
ASTM C295/C295M	(2019) Standard Guide for Petrographic Examination of Aggregates for Concrete
ASTM C494/C494M	(2024) Standard Specification for Chemical Admixtures for Concrete
ASTM C595/C595M	(2025) Standard Specification for Blended Hydraulic Cements

ASTM C618	(2025a) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C666/C666M	(2015) Resistance of Concrete to Rapid Freezing and Thawing
ASTM C881/C881M	(2020a) Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete
ASTM C989/C989M	(2025) Standard Specification for Slag Cement for Use in Concrete and Mortars
ASTM C1017/C1017M	(2013; E 2015) Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
ASTM C1064/C1064M	(2023) Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
ASTM C1077	(2026) Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation
ASTM C1260	(2023) Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method)
ASTM C1567	(2025) Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method)
ASTM C1602/C1602M	(2022) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete
ASTM C1646/C1646M	(2024) Making and Curing Test Specimens for Evaluating Frost Resistance of Coarse Aggregate in Air-Entrained Concrete by Rapid Freezing and Thawing
ASTM C1895	(2020) Standard Test Method for Determination of Mohs Scratch Hardness
ASTM D75/D75M	(2019) Standard Practice for Sampling Aggregates
ASTM D1751	(2018) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D1752	(2018) Standard Specification for

	Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D2196	(2010) Standard Test Methods for Rheological Properties of Non-Newtonian Materials by Rotational (Brookfield type) Viscometer
ASTM D2995	(2023) Determining Application Rate of Bituminous Distributors
ASTM D3665	(2012; R 2017) Standard Practice for Random Sampling of Construction Materials
ASTM D4791	(2019) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM E1274	(2018); R 2024 Standard Test Method for Measuring Pavement Roughness Using a Profilograph

NATIONAL READY MIXED CONCRETE ASSOCIATION (NRMCA)

NRMCA QC 3	(2015) Quality Control Manual: Section 3, Plant Certifications Checklist: Certification of Ready Mixed Concrete Production Facilities

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 55	(1992) Test Method for Within-Batch Uniformity of Freshly Mixed Concrete
COE CRD-C 130	(2001) Standard Recommended Practice for Estimating Scratch Hardness of Coarse Aggregate Particles
COE CRD-C 143	(1962) Specifications for Meters for Automatic Indication of Moisture in Fine Aggregate
COE CRD-C 300	(1990) Specifications for Membrane-Forming Compounds for Curing Concrete
COE CRD-C 521	(1981) Standard Test Method for Frequency and Amplitude of Vibrators for Concrete
COE CRD-C 662	(2009) Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials, Lithium Nitrate Admixture and Aggregate (Accelerated Mortar-Bar Method)

U.S. DEPARTMENT OF DEFENSE (DOD)

TSPWG M 3-250-04.97-05	(2019) Proportioning Concrete Mixtures with Graded Aggregates for Rigid Airfield

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Proposed Techniques; G, DO

Preliminary Proposed Proportioning; G, DO

Pavement Quality Control Plan; G, DO

Stringless Technology; G, DO

SD-03 Product Data

Diamond Grinding Plan; G, DO

Dowels; G, RO

Dowel Bar Assemblies; G, RO

Equipment; G, RO

Concrete Patching Mixture; G, DO

SD-05 Design Data

Proportioning Studies; G, DO

SD-06 Test Reports

Batch Plant Manufacturer's Inspection Report; G, DO

Slipform Paver Manufacturer's Inspection Report; G, DO

Sampling and Testing; G, RO

Diamond Grinding of PCC Surfaces; G, DO

Mixer Performance (Uniformity) Testing; G, DO

Repair Recommendations Plan; G, DO

Paving Lot Report; G, RO

Test Section Paving Lot Report; G, DO

Test Section Lot Report; G, DO

SD-07 Certificates

Contractor Quality Control (CQC) Staff; G, DO

Laboratory Accreditation and Validation; G, DO

Commercial Laboratory; G

NRMCA Certificate of Conformance

Petrographer Resume; G, DO

Licensed Surveyor; G, RO

Concrete Batch Plant Operator; G, DO

Profilograph Operator; G, DO

Inertial Profiler Operator(S); G

1.4 QUALITY CONTROL

1.4.1 Contractor Quality Control (CQC) Staff

Reference Section 01 45 00 QUALITY CONTROL for general CQC personnel qualification requirements. In addition, submit specific CQC personnel qualification requirements listed below. Submit qualifications and resumes for the Concrete Paving CQC Manager and petrographer. Submit certification for all CQC personnel assigned to concrete construction for their respective position:

a. Identify an individual within the onsite work organization as the Concrete Paving CQC Manager, who is responsible for overall management of concrete paving CQC and has the authority to act in all concrete paving CQC matters including authority to stop concrete paving work which is out of compliance.

The minimum requirements for the Concrete Paving CQC Manager consist of 5 years concrete paving experience similar to work required under this contract with a minimum of 2 years in a concrete paving CQC role. The Concrete Paving CQC Manager can also serve as the Quality Control Manager provided they meet the requirements of Section 01 45 00 QUALITY CONTROL and the Concrete Paving CQC Manager experience requirements above.

b. CQC personnel responsible for inspection of concrete paving operations: ACI Concrete Transportation Construction Inspector. The ACI Concrete Transportation Construction Inspector is required to be present at the paving site during all paving operations, with the exception of the initial saw cutting operation. The QC manager is required to be present during initial saw cutting operations.

c. CQC staff is required to oversee all aspects of sawing operations (sawing, flushing, vacuuming, checking for random cracking, lighting).

d. Lead Foreman or Journeyman of the Concrete Placing, Finishing, and Curing Crews: ACI Advanced Concrete Flatwork Finisher.

e. Batch Plant Manufacturer's Inspection Report : A technical representative from the batch plant manufacturer is required to be

on-site to inspect and make necessary adjustments prior to uniformity testing and after major component repairs or replacements. The inspection and necessary adjustments of all batch plant components include but are not limited to aggregate bin weighing operations, water metering, cement and fly ash weighing devices. All necessary inspections and adjustments by the manufacturer technical representative are required to be performed prior to uniformity testing. Submit a written Batch Plant Manufacturer's Inspection Report signed by the technical representative noting all inspection items and corrections and stating the batch plant is capable of producing the volume of concrete as required herein.

f. Field Testing Technicians: ACI Concrete Field Testing Technician, Grade I.

g. Slipform Paving Equipment Manufacturer's Representative: A technical representative of the slipform paving equipment manufacturer is required to be on-site during the test section construction to inspect and make corrections to the paving equipment to provide proper operations. Perform a complete and full hydraulic flow test of the vibrator system prior to the test section being placed. Submit a written Slipform Paver Manufacturer's Inspection Report signed by the manufacturer's technical representative noting all inspections, corrections, and flow tests have been performed and the paver is in a condition to perform the required work.

h. Laboratory Testing Technicians: ACI Concrete Strength Testing Technician and ACI Concrete Laboratory Testing Technician, Level 1 or 2.

1.4.2 Other Staff

Submit for approval the qualifications and resumes for the following staff:

a. Petrographer: Bachelor of Science degree in geology or petrography, trained in petrographic examination of concrete aggregate according to ASTM C294 and ASTM C295/C295M and trained in identification of the specific deleterious materials and tests identified in this specification. Detail the education, training and experience related to the project-specific test methods and deleterious materials in the Petrographer Resume and submit at least 20 days before petrographic and deleterious materials examination is to commence.

b. Licensed Surveyor: Perform all survey work under the supervision of a professional land surveyor licensed in the state the work is being performed.

c. Concrete Batch Plant Operator: National Ready Mix Concrete Association (NRMCA) Plant Manager certification.

d. Profilograph Operator: Certification by equipment manufacturer or a state Department of Transportation.

e. Inertial Profiler Operator(s) - Individual certification(s) provided by the manufacturer or the state operating the equipment proposed for use.

1.4.3 Laboratory Accreditation and Validation

Provide laboratory and testing facilities. Submit accreditation of the commercial laboratory by an independent evaluation authority, indicating conformance to ASTM C1077, including all applicable test procedures identified in this specification. If multiple laboratories are proposed, identify which tests will be conducted by each. Submit accreditation documentation a minimum of 30 days before any specified testing is performed. The laboratories performing the tests are required to be accredited in accordance with ASTM C1077, including ASTM C78/C78M and ASTM C1260. Provide current accreditation and include the required and optional test methods, as specified. In addition, all laboratories performing testing require USACE validation by the Material Testing Center (MTC) for both parent laboratory and on-site laboratory. Validation on all laboratories is required to remain current throughout the duration of the paving project. Request MTC laboratory validation at https://mtc.erdc.dren.mil/requestvalidation.aspx for costs and scheduling. Contact the MTC Director at https//mtc.erdc.dren.mil/contact2.aspx with questions or additional information.

1.4.3.1 Aggregate Testing and Mix Proportioning

Aggregate testing and mixture proportioning studies are required to be performed by a commercial laboratory.

1.4.3.2 Acceptance Testing

Provide all materials, labor, and facilities required for molding, curing, testing, and protecting test specimens at the paving site and in the laboratory. Provide steel molds for molding the beam specimens. Provide on-site temperature-controlled concrete curing facilities. Provide and maintain boxes or other facilities suitable for storing and curing the specimens at the paving site while in the mold within the temperature range stipulated by ASTM C31/C31M. Provide flexural loading equipment in accordance with ASTM C78/C78M. Provide compressive loading equipment in accordance with ASTM C39/C39M.

1.4.3.3 Pavement Quality Control Plan

Submit the Pavement Quality Control Plan. The Pavement Quality Control Plan is specific to this specification and supplements the overall Quality Control Plan required by Section 01 45 00 QUALITY CONTROL. Do not produce portland cement concrete pavement for payment until the Pavement Quality Control Plan has been approved. In the Pavement Quality Control Plan, address all elements which affect the quality of the pavement including, but not limited to:

a. Condition of underlying course
b. Condition of adjacent pavement and dowels
c. Stockpile management and aggregate grading
d. Mix proportions and batching operations
e. Transportation
f. Placing and consolidation
g. Placing dowels
h. Finishing and texturing
i. Curing
j. Sawcutting Joints
k. CQC Testing and Inspection
l. Inclement / Hot / Cold Weather Plans

1.4.3.4 Laboratory Inspection

The Government will inspect all laboratories requiring validation for equipment and test procedures prior to the start of any concreting operations for conformance to ASTM C1077. Schedule and provide payment for laboratory inspections. Additional payment or a time extension due to failure to acquire the required laboratory validation is not allowed. The laboratory is to maintain this certification for the duration of the project.

1.4.4 Preconstruction Testing of Materials

All sampling and testing is required to be performed using an approved commercial laboratory or, for cementitious materials and chemical admixtures, a laboratory maintained by the manufacturer of the material. Materials are not allowed to be used until notice of acceptance has been given. Additional payment or extension of time due to failure of any material to meet project requirements, or for any additional sampling or testing required is not allowed. Additional tests may be performed by the Government; such Government testing does not relieve any required testing responsibilities.

1.4.4.1 Aggregates

Sample aggregates in the presence of a Government Representative. Obtain samples representative of the materials to be used for the project in accordance with ASTM D75/D75M. Perform all aggregate tests no earlier than 6 months prior to contract award.

1.4.4.2 Chemical Admixtures, Curing Compounds and Epoxies

At least 30 days before the material is used, submit certified copies of test results for the specific lots or batches to be used on the project. Provide test results less than 5 years old prior to use in the work. Retest chemical admixtures that have been in storage for longer than 6 months or that have been subjected to temperatures outside of manufacturer requirements. Reject if test results do not meet the Level 2 proof of compliance requirements of ASTM C494/C494M.

1.4.4.3 Testing of Cementitious Materials

All materials referenced under paragraph CEMENTITIOUS MATERIALS will be accepted on the basis of manufacturer's certification of compliance, accompanied by mill test reports showing that the material in each shipment meets the requirements of the specification under which it is provided. Provide mill test reports no more than 1 month old, prior to use in the work. Do not use cementitious materials until notice of acceptance has been given. Cementitious materials may be subjected to testing by the Government from samples obtained at the mill, at transfer points, or at the project site. If tests prove that a cementitious material that has been delivered is unsatisfactory, promptly remove it from the project site. Retest cementitious material that has not been used within 6 months after testing, and reject if test results do not meet manufacturer requirements.

1.4.5 Testing During Construction

During construction, sample and test aggregates, cementitious materials,

and concrete as specified herein. The Government will sample and test concrete and ingredient materials as considered appropriate. Provide facilities and labor necessary for procurement of representative test samples. Testing by the Government does not relieve the specified testing requirements.

1.4.6 Test Section

1.4.6.1 General

a. Schedule the test section after all required submittals and uniformity testing has been reviewed and approved. Perform a preparatory meeting before commencing the test section.

b. Construct a separate test section for each placement method (slipform, fixed form, and hand placement) proposed for use. Construct a separate test section for each paver and each batch plant proposed for use.

c. Up to 15 days, but not more than 60 days, prior to construction of the concrete pavement, construct a test section as part of the production paving area at an outer edge. Construct the pilot lane and fill-in lane test sections on separate days using the approved mixture proportions. Aggregate proportioning changes may be required due to specification requirements not being met.

d. Construct the test section matching the thickest pavement section and underlying structure required in the work. Use the same equipment, materials, and construction techniques on the test sections as proposed for use in all subsequent work. The underlying layers must be reviewed and approved by the Government prior to paving of the test section.

e. Perform underlying layer preparation, concrete production, placing, consolidating, texturing, curing, construction of joints, and all testing in accordance with applicable provisions of this specification.

f. Use the test sections to develop and demonstrate the proposed techniques of mixing, hauling, placing, consolidating, finishing, texturing, curing, initial saw cutting, start-up procedures, sampling, testing methods, plant operations, and the preparation of the joints for production paving. Report per requirements of paragraph Reports as the Test Section Paving Lot Report.

1.4.6.2 Pilot Lane

Construct the test section consisting of one continuous paving lane at least 200 feet long and to the same thickness as the thickest portion of pavement shown on the Drawings. The test section may not exceed 400 feet; all pavement placed for the test section before or after 200 feet of continuously acceptable placement must be removed. Construct at the same lane width as that required for use in the project. If doweled longitudinal construction joints are required in any of the production pavements, install them full length along one side of the test lane throughout the test section.

1.4.6.3 Fill-In Lane

A fill-in lane is defined as full width concrete placement using two adjacent lanes as forms. Consider the first 200 feet of the initial

production fill-in lane as a test section for purposes of testing and evaluation. All requirements for the test section are applicable. Obtain cores from the fill-in lane side of the longitudinal construction joint with the pilot lane. No measurements will be required for longitudinal vertical faces that are against existing or recently placed panels. Straightedge measurements are required across the joint per paragraph Testing Method.

1.4.6.3.1 Alternative Placement Method

If proposed techniques includes alternative placement method resulting in lanes with one free edge and one edge placed against existing or new pavement the first placement will be considered the fill-in lane for test section evaluation purposes. The fill-in lane test section requirements in paragraph Fill-In Lane will apply to the first lane that is not a pilot lane. Test the free edge for all measurements required for a pilot lane and the enclosed edge with all measurements for a fill-in lane.

1.4.6.4 Testing and Inspection

a. Provide aggregate, fresh concrete, and hardened concrete sampling and testing in accordance with paragraph Testing and Inspection by Contractor and Table 17. Provide inspection of the hardened concrete for surface smoothness, plan grade, edge slump and joint face deformation in accordance with the specifications. Provide a test section report in accordance with paragraph Reports.

b. Provide sampling and testing to determine the loss of air content through the paving equipment. Samples are to be obtained before and after the paving equipment along the vibrator path and in-between the vibrators. Obtain one sample of the fresh concrete before the paving equipment has passed with material in the sublot. Once the paver has passed, obtain two samples of the in-place, plastic concrete to the full depth of the placement avoiding the underlying layer. Provide stationing references for all samples. Report this data in the Test Section Lot Report. This testing is in addition to required testing in paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL DURING CONSTRUCTION and only required during the Test Section(s). Adjustments to air contents to meet the specified air content in paragraph Air Content are only to be made based on measured air contents before the paver has passed. Immediately fill voids resulting from sample collection with freshly mixed concrete, strike off, consolidate with an internal vibrator, and refinish.

c. No more than three working days after completion of the test sections, procure, evaluate and measure eight cores with a minimum diameter of 6 inches by full depth cut from points selected in the test sections by the Government on a basis of two cores per sublot. Evaluate cores in accordance with paragraph EVALUATION OF CORES. Measure cores in accordance with paragraph THICKNESS.

1.4.6.5 Acceptance of Test Section

a. Construct the test sections meeting the specification requirements including plastic and hardened concrete properties, surface texture, thickness, plan grade, smoothness, joint face deformation, edge slump, and plan joint alignment.

b. Do not commence production paving until the results on aggregates and

concrete, including evaluation of cores, and all pavement measurements for edge slump, joint face deformation, actual plan grade, surface smoothness, and thickness have been submitted and approved, and the payment calculation has been submitted for information only. Remove test sections which do not meet specification requirements and conduct additional test sections, as required. If an acceptable test section is unable to be constructed by slipform paving, repair or replace the slipform paving equipment, or complete the paving using fixed-forms and equipment as required by the specification. Pavement accepted as a production lot will be evaluated and paid as specified in PART 1 GENERAL.

1.4.7 Acceptability of Work

The materials and the pavement itself will be accepted on the basis of production testing. The Government may make check tests to validate the results of the production testing. If the results of the production testing vary by less than 2.0 percent of the Government's test results, the results of the production testing will be used. If the results of the Government and production tests vary by 2.0 percent, but less than 4.0 percent, the average of the two will be considered the value to be used. If these vary by 4.0 percent or more, carefully evaluate each sampling and testing procedure and obtain another series of Government and production tests on duplicate samples of material. If these vary by 4.0 percent or more, use the results of the tests made by the Government and the Government will continue check testing of this item on a continuous basis until the two sets of tests agree within less than 4.0 percent on a regular basis. Testing performed by the Government does not relieve the specified testing requirements.

1.4.8 Acceptance Requirements

1.4.8.1 Pavement Lots

A lot is that quantity of construction to be evaluated for acceptance with specification requirements. A lot is equal to production paving not to exceed 1000 cubic yards. In order to evaluate thickness, divide each lot into sublots not to exceed 250 cubic yards. Perform grade determinations on the lot as a whole. Perform surface smoothness determinations on every 0.1 mile segment in each lot. Select sample locations on a random basis in accordance with ASTM D3665. Areas of pavement placed with hand methods are considered a separate lot for evaluation. When operational conditions cause a lot to be terminated before the specified four sublots have been completed, use the following procedure to adjust the lot size and number of tests for the lot. Where three sublots have been completed, they constitute a lot. Where one or two sublots have been completed, incorporate them into the next lot (except for the last lot), and the total number of sublots used and acceptance criteria adjusted accordingly.

1.4.8.2 Evaluation

Provide all sampling and testing required for acceptance and payment adjustment, including batch tickets with all required acceptance testing. Individuals performing sampling, testing and inspection duties are required to meet the requirements of paragraph: Contractor Quality Control Staff. The Government reserves the right to direct additional samples and tests for any area which appears to deviate from the specification requirements. Testing in these areas are in addition to the sublot or lot testing, and the requirements for these areas are the same as those for a

sublot or lot. Provide facilities, and where directed personnel, to assist in obtaining samples for any Government testing.

1.5 AIRFIELD PCC PAVING WORKSHOP

USACE Transportation Systems Center will conduct a mandatory two day pavement workshop in advance of the concrete paving for the Contractor and his representatives for the minimum amount of time listed below. Additionally, personnel may attend any non-mandatory sessions on a space-available basis. Contractor is to acquire a facility for the workshop in the vicinity of the installation, or other appropriate location, as approved by the Government. Provide a facility that includes at a minimum, parking and seating for forty attendees, audio/visual with standard connections, including TV, projector, screen and any other items as required for display of digital presentations, and access to Wi-Fi. Coordinate schedule with the Government. Attendance requirements apply to each paving crew anticipated to be on the project. At a minimum, the following attendees are required.

a. Project Engineer/Pavement Engineer: 2 days
b. Project Superintendent: 2 days
c. Paving Superintendent or Foreman(s): 2 days
d. ACI Transportation Inspector: 2 days
e. Quality Control Manager & Alternate(s): 2 days
f. Quality Control Testing Lab Technicians: 2 days
g. Paving Machine Operator(s):2 days
h. Batch Plant Manager(s): 1 day
i. Sawing/Sealing/Contractor(s): 1 day.
j. PCC Aggregate Supplier: 1/2 day.
k. MTV Operator(s): 2 days

1.6 DELIVERY, STORAGE, AND HANDLING

1.6.1 Bulk Cementitious Materials

Provide all cementitious materials in bulk at a temperature, as delivered to storage at the site, not exceeding 150 degrees F. Provide sufficient cementitious materials in storage to sustain continuous operation of the concrete mixing plant while the pavement is being placed. Provide separate facilities to prevent any intermixing during unloading, transporting, storing, and handling of each type of cementitious material.

1.6.2 Aggregate Materials

Store aggregate at the site of the batching and mixing plant avoiding breakage, segregation, intermixing or contamination by foreign materials. Store each size of aggregate from each source separately and allow the fine aggregate and the smallest size coarse aggregate to drain. Provide a minimum 24 inch thick sacrificial layer left undisturbed for each aggregate stored on ground or provide a paved or chemically stabilized surface course beneath the stockpiles. Maintain sufficient aggregate at the site at all times to permit continuous uninterrupted operation of the mixing plant at the time concrete pavement is being placed. Do not allow tracked equipment on coarse aggregate stockpiles.

1.6.3 Other Materials

Store reinforcing bars and accessories above the ground on supports. Store all materials properly to avoid contamination and deterioration.

PART 2 PRODUCTS

2.1 SYSTEM DESCRIPTION

This section is intended to stand alone for construction of concrete pavement. However, where the construction covered herein interfaces with other sections, construct each interface to conform to the requirements of both this section and the other section, including tolerances for both.

2.1.1 Surface Smoothness

Use the profilograph method or a stop-and-go inertial profiler (SNG-IP) in accordance with Appendix A for all longitudinal testing, except for paving lanes less than 200 feet in length. Use the straightedge method for transverse testing, for longitudinal testing where the length of each pavement lane is less than 200 feet, and at the ends of the paving limits for the project. Smoothness requirements do not apply over crowns, drainage structures, or similar penetrations. Maintain detailed notes of the testing results and provide a copy to the Government after each day's testing.

2.1.1.1 Straightedge Testing

Provide the finished surfaces of the pavements with no sudden change in elevation or abrupt change of 1/4 inch or more from the as-built finished surface or face, and all pavements within the limits specified when checked with an approved 12 foot straightedge. Report measurements to the nearest 1/16 inch. Provide all airfield areas with a variation from a straight edge not greater than 1/4 inch in either the longitudinal or transverse direction.

2.1.1.2 Stop-and-Go Inertial Prfoliler (SNG-IP)

Provide the finished surfaces of the pavements with no sudden change in elevation or abrupt change of 1/4 inch or more from the as-built finished surface, and each 0.1 mile segment of each pavement lot with a Profile Index not greater than specified when tested with an approved California-type Stop-and-Go inertial profiler. Provide all airfield areas with a Profile Index not greater than 9 inches per mile in the longitudinal direction.

2.1.1.3 Profilograph Testing

Provide the finished surfaces of the pavements with no sudden change in elevation or abrupt change of 1/4 inch or more from the as-built finished surface, and each 0.1 mile segment of each pavement lot with a Profile Index not greater than specified when tested with an approved California-type profilograph. Provide all airfield areas with a Profile Index not greater than 9 inches per mile in the longitudinal direction.

2.1.1.4 Bumps ("Must Grind" Areas)

Reduce any bumps ("must grind" areas) shown on the profilograph trace or by straightedge measurements which exceed 0.4 inch in height by diamond grinding in accordance with paragraph DIAMOND GRINDING OF PCC SURFACES below until they do not exceed 0.3 inch when retested. Taper such diamond grinding in all directions to provide smooth transitions to areas not requiring diamond grinding.

2.1.1.5 Testing Method

After the concrete has hardened sufficiently to permit walking thereon, but not later than 48 hours after placement, test the entire surface of the pavement in each lot in such a manner as to reveal all surface irregularities exceeding the tolerances specified above. If any pavement areas are diamond ground, retest these areas immediately after diamond grinding. Test the entire area of the pavement in both a longitudinal and a transverse direction on parallel lines. Perform the transverse lines 15 feet or less apart, as directed. Perform the longitudinal lines at the 1/8th point in from each side of the lane and at the centerline of each paving lane shown on the drawings, regardless of whether multiple lanes are allowed to be paved at the same time. Also test other areas having obvious deviations. Perform longitudinal testing lines continuous across all joints. Perform transverse testing lines for pilot lanes carried to construction joint lines and for fill-in lanes carried 24 inches across construction joints, and the readings in this area applied to the fill-in lane. Perform straightedge testing of the longitudinal edges of slipformed pilot lanes before paving fill-in lanes as specified below.

2.1.1.5.1 Straightedge Testing

Hold the straightedge in contact with the surface and move ahead one-half the length of the straightedge for each successive measurement. Determine the amount of surface irregularity by placing the freestanding (unleveled) straightedge on the pavement surface and measuring the maximum gap between the straightedge and the pavement surface. Determine measurements along the entire length of the straight edge.

2.1.1.5.2 Profilograph Testing

Perform profilograph testing using approved California profilograph and procedures described in ASTM E1274. Utilize electronic recording and automatic computerized reduction of data equipment to indicate "must-grind" bumps and the Profile Index for each 0.1 mile segment of the pavement lot. Accommodate grade breaks on aprons by breaking the profile segment into short sections and repositioning the blanking band on each section. Provide the "blanking band" of 0.2 inch wide and the "bump template" span 1 inch with an offset of 0.4 inch. Count the profilograph testing of the last 30 feet of a paving lane in the longitudinal direction from each day's paving operation on the following day's continuation lane. Compute the profile index for each pass of the profilograph (3 per lane) in each 0.1 mile segment. The profile index for each segment is the average of the profile indices for each pass in each segment. Scale and proportion profilographs of unequal lengths to an equivalent 0.1 mile as outlined in the ASTM E1274. Provide a copy of the reduced tapes or digital record to the Government at the end of each day's testing.

2.1.1.5.3 Stop-and-Go Inertial Prfoliler (SNG-IP)

Measure longitudinal surface smoothness using a stop-and-go inertial profiler (SNG-IP) in accordance with Appendix A. The SNG-IP will be be operated by an approved, factory-trained operator in general compliance with AASHTO R 57, except for differences found in Appendix A. Test the full length of each paving lane, except paving lanes shorter than 0.10 mile or at the project's paving limits. Utilize the straightedge and tolerances in paragraph STRAIGHTEDGE TESTING for lanes shorter than 0.10 mile. Perform SNG-IP testing with a single trace in the longitudinal

direction at the centerline and at 1/8th points of the paving lane. Utilize software that is capable of computing a simulated profilograph response as described in ASTM E2955 to produce a Profile Inex as well as indicate "must-grind" bumps for the pavement. Use a "blanking band" that is 0.2 inch wide and the "bump template" span 1 inch with an offset of 0.4 inch. Determine the profile index for each pass of the profilograph in each 0.10 mile segment. For any bumps identified on the profilograph trace, follow procedures in paragraph DIAMOND GRINDING OF PCC SURFACES. After any corrective diamond grinding, if any 0.10 mile segment exceeds the maximum allowable segment profile index per Table 4, apply the pay factor in paragraph PAYMENT ADJUSTMENT FOR SMOOTHNESS (FINAL WEARING SURFACE ONLY) and Table 3. In instances where there are three traces, follow the same process, except average each 0.10 mile segment Profile Index to determine the controlling (highest value) Profile Index for the lot. Provide a digital copy of all test results to the Government in each paving lot report along with a summary of the controlling segment Profile Index for the lot and associated pay factor.

2.1.2 Edge Slump and Joint Face Deformation

2.1.2.1 Edge Slump

Provide a maximum of 15.0 percent of each free edge of each pavement panel with a maximum edge slump of 1/4 inch and none of the free edge of the pavement lot with an edge slump exceeding 3/8 inch. (A pavement panel is defined as a lane width by the length between two adjacent transverse contraction joints. The free edge of the pavement is the linear measurement of pavement panel edge originally constructed as non-adjacent to any existing pavement; for example, 100 feet of pilot lane originally constructed as a separate lane, would have 100 feet of free edge on each side; 100 feet of fill-in lane would have no free edge.) The area affected by the downward movement of the concrete along the pavement edge is a maximum of 18 inches back from the edge.

2.1.2.2 Joint Face Deformation

Provide a vertical joint face with a surface within the maximum limits shown in Table 5. Provide the offset measurements from all five Joint Face Deformation Limits from Table 5 at the specified testing frequency. Properly reference all recorded measurements in accordance with paving lane identification and stationing, and submit a report within 10 days after measurement is made. Identify areas requiring replacement within the report.

TABLE 5

JOINT FACE DEFORMATION LIMITS

Offset from Straightedge Applied Longitudinally to Pavement Surface (a)	Offset from Straightedge Applied Longitudinally to Vertical Face (b)	Offset from Straightedge Applied Top to Bottom Against the Joint Face (c)	Abrupt Offset in Any Direction (d)	Offset of Joint Face from True Vertical (e)
Airfield Pavement				
1/8 inch	1/4 inch	3/8 inch	1/4 inch	1 inch per 12 inches

(a) Measurement is taken by placing the straightedge longitudinally on the pavement surface 1 inch from the free edge. Record the longitudinal joint face deformation of the joint on a continuous line 1 inch back from the joint line using the 12 foot straightedge advanced one-half its length for each reading.

(b) Measurement is taken by applying the straightedge longitudinally along the center of the vertical joint face. Record the longitudinal joint face deformation using the 12 foot straightedge advanced one-half its length for each reading.

(c) Measurement places a 3/8 inch spacer attached to a straightedge and spaced approximately equal to the thickness of the concrete being measured. The offset from straightedge with spacers is measured by placing the spacers against the top and bottom of the vertical concrete face. Record measurements at 5 foot spacings.

(d) Check for abrupt offsets at any location that an abrupt change in the joint face plane appears to be present through use of a 12 foot straightedge.

(e) Measurement of the offset from the joint face to a level in the true vertical position against the joint face. Record measurements at 5 foot spacings.

2.1.2.3 Edge Slump Determination

Test the pavement surface to determine edge slump immediately after the concrete has hardened sufficiently to permit walking thereon. Perform testing with a minimum 12 foot straightedge to reveal irregularities exceeding the edge slump tolerance specified above. Determine the vertical edge slump at each free edge of each slipformed paving lane constructed. Place the straightedge transverse to the direction of paving and the end of the straightedge located at the edge of the paving lane. Record measurements at 5 to 10 foot spacings, as directed, commencing at the header where paving was started. Initially record measurements at 5 foot intervals in each lane. When no deficiencies are present after 5 measurements, the interval may be increased. The maximum interval is 10

feet. When any deficiencies exist, return the interval to 5 feet. Perform other tests of the exposed joint face to produce a uniform, true vertical joint face. Properly reference all recorded measurements in accordance with paving lane identification and stationing, and submit a report within 10 days after measurement is made. Identify areas requiring replacement within the report.

2.1.2.4 Excessive Edge Slump or Joint Face Deformation

When edge slump or joint face deformation exceeding the limits specified above is encountered on either side of the paving lane, record additional straightedge measurements to define the linear limits of the excessive slump or joint face deformation. Remove and replace concrete slabs having excessive edge slump or joint deformation to the next transverse joint in conformance with paragraph REPAIR, REMOVAL AND REPLACEMENT OF NEWLY CONSTRUCTED SLABS. Discontinue use of slip-form paving equipment and procedures that fail to consistently provide edges within the specified tolerances on edge slump and joint face deformation and construct by means of standard paving procedures using fixed forms.

2.1.3 Plan Grade

Within 5 working days after completion of a particular lot, survey the surface of the pavement area for conformance with specified plan grade requirements. The grade will be determined by running lines of levels at intervals corresponding to every longitudinal and transverse joint to determine the elevation at each joint intersection. Resurvey any areas corrected after initial survey.

TABLE 6

Plan Grade Tolerances

Airfield Pavements	**Finished Surface Measurements at Joint Intersections** (after allowable corrections)	
	0-0.04 foot from designed Plan Grade	Acceptable, no Payment Adjustment considered on grade measurements at these Joint Intersections
	0.041-0.06 foot from designed Plan Grade	Calculate Plan Grade Pay Adjustment Factor per paragraph PAYMENT ADJUSTMENT FOR PLAN GRADE
	Greater than 0.06 foot from designed Plan Grade	Remove and Replace affected Panel(s)

TABLE 6		

The above deviations from the approved grade line and elevation are not permitted in areas where closer conformance with the planned grade and elevation is required for the proper functioning of appurtenant structures. Provide finished surfaces of new abutting pavements that coincide at their juncture. Corrections within the tolerances of paragraph REPAIR, REMOVAL AND REPLACEMENT OF NEWLY CONSTRUCTED SLABS are allowed to improve the payment adjustment or to improve an unacceptable surface to allow for a payment adjustment. Provide horizontal control of the finished surfaces of all airfield pavements that vary not more than 1/2 inch from the plan joint alignment indicated.

2.1.3.1 Joint Alignment

Provide survey points for the joint intersections. Provide horizontal control of the finished surfaces of all airfield pavements.

TABLE 7		
Joint Alignment Tolerances		
All Airfield Pavements	**Horizontal Measurements of Joint Intersections (both transverse and longitudinal joints)**	
	0-1/2 inch from designed Jointing Plan	Acceptable
	Greater than 1/2 inch from the designed Jointing Plan	Remove and Replace affected Panel(s)

2.1.4 Flexural Strength

Each lot of pavement will be evaluated for acceptance for flexural strength in accordance with paragraph Sampling and Testing and paragraph

Computations.

2.1.4.1 Sampling and Testing

For acceptance, obtain one composite sample of concrete from each sublot in accordance with ASTM C172/C172M from one batch or truckload.Fabricate and cure test cylinders 6 x 12 inches in accordance with ASTM C31/C31M, and test at 14 days in accordance with ASTM C39/C39M. Test two test cylinders per sublot (8 per lot).

2.1.4.2 Computations

Average the eight 14-day strength tests for the lot. Use the average strength in accordance with paragraph Concrete Strength For Final Acceptance.

2.1.5 Thickness

Each lot of pavement will be evaluated for acceptance and payment adjustment in accordance with the following procedure. Drill two cores, between 4 and 6 inches in diameter, from the pavement, per sublot (8 per lot). Drill the cores within 3 days after lot placement, fill the core holes with an approved concrete patching mixture, and respray the cored areas with curing compound. Prevent the core hole from drying or damage until backfilled. Complete backfillng of core hole during the subsequent production placement or within 5 calendar days, whichever occurs first. Record eight measurements of thickness around the circumference of each core and one in the center, in accordance with ASTM C174/C174M. Provide the results with the thickness measurement data. Average the pavement thickness from the 8 cores for the lot and evaluate as described in paragraph Payment Adjustment For Thickness above.

2.1.6 Evaluation of Cores

Record and submit testing, inspection, and evaluation of each core for mortar-rich surface, uniformity of aggregate distribution, segregation, voids, cracks, and depth of reinforcement or dowels (if present). Moisten the core with water to visibly expose the aggregate and take a minimum of three photographs of the sides of the core's entire length, rotating the core approximately 120 degrees between photographs. Provide photographs with the clarity and quality to identify the defects identified above. Each core is to be identified on the top with the core number referenced to paving lot plan view. Photograph the core against a contrasting background, in profile, and with an extended tape measure parallel and to the right of the core with incremental measurements clearly visible. Provide plan view of location for each core. Store the cores and make available to the Government when requested, until otherwise directed.

2.1.7 Diamond Grinding of PCC Surfaces

Those performing diamond grinding are required to have a minimum of three years experience in diamond grinding of airfield pavements. In areas not meeting the specified limits for surface smoothness and plan grade, reduce high areas to attain the required smoothness and grade, except as depth and surface area is limited below. Reduce high areas by diamond grinding the hardened concrete with approved equipment after the concrete is at a minimum age of 14 days. Provide
diamond grinding equipment capable of cutting a path a minimum of 3 feet wide. Equip the cutting head with saw blades that are 3 mm 1/8-inch

wide with sufficient number of blades to create grooves between 0.090-inches and 0.130-inches wide and peaks and ridges approximately 1/32-inch higher than the bottom of the grinding cut. Diamond grinding equipment that causes ravels, aggregate fractures, spalls or disturbance to the joints is not permitted. The maximum area corrected by diamond grinding the surface of the hardened concrete is 10 percent of the total area of any sublot. The maximum depth of diamond grinding is 1/4 inch. Provide diamond grinding equipment capable of flushing and vacuuming the pavement surface. Dispose of all debris from diamond grinding operations off Government property, leaving the surface of the pavement in a clean condition. Prior to diamond grinding, submit a Diamond Grinding Plan for review and approval. At a minimum, include the daily reports for the deficient areas, the location and extent of deficiencies, corrective actions, and equipment. Remove and replace all pavement areas requiring plan grade or surface smoothness corrections in excess of the limits specified above in conformance with paragraph REPAIR, REMOVAL AND REPLACEMENT OF NEWLY CONSTRUCTED SLABS. Repair aggregate popouts using the core and patch method of paragraph REPAIRING SPALLS ALONG JOINTS. All areas in which diamond grinding has been performed are subject to the thickness tolerances specified in paragraph Thickness, above.

Prior to production diamond grinding operations, perform a test section at the approved location. Perform a test section that consists of a minimum of two adjacent passes with a minimum length of 40 feet to allow evaluation of the finish, transition between adjacent passes, and the results of crossing a transverse joint. Production diamond grinding operations are not to be performed prior to approval.

2.2 CEMENTITIOUS MATERIALS

Provide cementitious materials consisting of portland cement, blended cement or portland cement in combination with supplementary cementitious materials (SCM), that conform to appropriate specifications listed below. New submittals are required when the cementitious materials sources or types change.

2.2.1 Portland Cement

Provide portland cement conforming to ASTM C150/C150M, Type I or II

2.2.2 Blended Cements

Provide blended cement conforming to ASTM C595/C595M, Type IP, IS, or IL. Provide pozzolan added to the Type IP blend consisting of ASTM C618 Class F or Class N and that is interground with the cement clinker. Include a written statement from the manufacturer that the amount of pozzolan in the finished cement does not vary more than plus or minus 5 mass percent of the finished cement from lot to lot or within a lot. Provide limestone added to the Type IL blend that is interground with the cement clinker. Include a written statement from the manufacturer that the amount of limestone in the finished cement does not vary more than plus or minus 2.5 mass percent of the finished cement from lot to lot or within a lot. Limit the percent of slag, pozzolan, or limestone to a maximum of IS(50), IP(35) or IL(15). The percentage and type of mineral admixture used in the blend is not allowed to change from that submitted for the aggregate evaluation and mixture proportioning.

2.2.3 Pozzolan

2.2.3.1 Fly Ash

Provide fly ash that conforms to ASTM C618, Class F, including the optional requirement for uniformity with a loss on ignition not exceeding 3 percent. Provide Class F fly ash for use in mitigating Alkali-Silica Reactivity with a total equivalent alkali content less than 4 percent.

2.2.3.2 Raw or Calcined Natural Pozzolan

Provide natural pozzolan that is raw or calcined and conforms to ASTM C618, Class N, including the optional requirement for uniformity with a loss on ignition not exceeding 3 percent. Provide Class N pozzolan for use in mitigating Alkali-Silica Reactivity with a total equivalent alkali content less than 4 percent.

2.2.3.3 Ultra Fine Fly Ash and Ultra Fine Pozzolan

Provide Ultra Fine Fly Ash (UFFA) and Ultra Fine Pozzolan (UFP) that conforms to ASTM C618, Class F or N, and the following additional requirements:

a. The strength activity index at 28 days of age of at least 95 percent of the control specimens.

b. The average particle size is a maximum of 6 microns.

2.2.4 Slag Cement

Provide slag cement (ground-granulated blast-furnace slag) that conforms to ASTM C989/C989M, Grade 100 or Grade 120.

2.2.5 Supplementary Cementitious Materials (SCM) Content

Use of one of the SCMs listed below is optional, unless the SCM is required to mitigate ASR. The use of SCMs is encouraged.

TABLE 8

SUPPLEMENTARY CEMENTITIOUS MATERIALS CONTENT

Supplementary Cementitious Material	Minimum Content (percent)	Maximum Content (percent)
Class N Pozzolan and Class F Fly Ash		
$SiO_2 + Al_2O_3 + Fe_2O_3 > 70$ percent	25	35
$SiO_2 + A1_2O_3 + Fe_2O_3 > 80$ percent	20	35
$SiO_2 + A1_2O_3 + Fe_2O_3 > 90$ percent	15	35
UFFA and UFP	7	16
Slag Cement	40	50

TABLE 8		
SUPPLEMENTARY CEMENTITIOUS MATERIALS CONTENT		
Supplementary Cementitious Material	Minimum Content (percent)	Maximum Content (percent)

2.3 AGGREGATES

Provide aggregates meeting the requirements of this specification. If aggregate sources in the project area do not meet the requirements of this specification, provide aggregates from sources outside the project area.

2.3.1 Aggregate Sources

2.3.1.1 Durability of Coarse Aggregate

Provide aggregate with a satisfactory service record in freezing and thawing of at least 5 years successful service in three concrete paving projects. Include a condition survey of the existing concrete and a review of the concrete-making materials, including coarse aggregates, cement, and mineral admixtures in the service record. Consider the previous aggregate source and test results, cement mill certificate data, mineral admixture chemical and physical composition, and the mix design (cement factor and water-cementitious material ratio) in the review. Provide service record performed by an independent third party professional engineer, petrographer, or concrete materials engineer along with their resume. Include photographs and a written report addressing D-cracks and popouts in accordance with ACI 201.1R in the service record. Provide coarse aggregate with a durability factor of 80 or more when subjected to freezing and thawing of specimens prepared in accordance with ASTM C1646/C1646M and tested in accordance with ASTM C666/C666M, Procedure A, when a coarse aggregate size group or source proposed for use does not have a satisfactory demonstrable service record. Test all coarse aggregate size groups and sources proposed for use individually.

2.3.1.2 Alkali-Silica Reactivity

Evaluate and test fine and coarse aggregates to be used in all concrete for alkali-aggregate reactivity. Test all size groups and sources proposed for use individually.

a. Evaluate the aggregate size groups and sources separately using ASTM C1260. Reject individual aggregates with test results that indicate an expansion of greater than 0.08 percent after 28 days of immersion in 1N NaOH solution, or perform additional testing as follows: utilize the proposed portland cement, blended cement, and SCM, or Lithium Nitrate in combination with each individual aggregate. If only SCMs are being evaluated, test in accordance with ASTM C1567. If Lithium Nitrate is being evaluated, with or without SCMs, test in accordance with COE CRD-C 662. Determine the quantity that meets all the requirements of these specifications and that lowers the expansion equal to or less than 0.08 percent after 28 days of immersion in a 1N NaOH solution. Base the mixture proportioning on the highest percentage of SCM required to mitigate ASR-reactivity.

b. If any of the above options does not lower the expansion to less than 0.08 percent after 28 days of immersion in a 1N NaOH solution, reject the aggregate(s) and submit new aggregate sources for retesting. Submit the results of testing for evaluation and acceptance.

2.3.1.3 Combined Aggregate Gradation

In addition to the grading requirements specified for coarse aggregate and for fine aggregate, provide the combined aggregate grading meeting the following requirements:

a. Provide materials selected and the proportions used such that when the Coarseness Factor (CF) and the Workability Factor (WF) are plotted on a diagram as described in d. below, the point and its associated production tolerance thus determined falls within the parallelogram described therein. Refer to TSPWG M 3-250-04.97-05 for combined aggregate plot locations for the intended placement technique(s).

b. Determine the Coarseness Factor (CF) from the following equation:

$$CF = \frac{\text{(cumulative percent retained on the 3/8 inch sieve)(100)}}{\text{(cumulative percent retained on the No. 8 sieve)}}$$

c. The Workability Factor (WF) is defined as the percent passing the No. 8 sieve based on the combined aggregate gradation. Adjust the WF, prorated upwards only, by 2.5 percentage points for each 94 pounds per cubic yard of cementitious material greater than 564 pounds per cubic yard.

d. Plot a diagram using a rectangular scale with WF on the Y-axis with units from 20 (bottom) to 45 (top), and with CF on the X-axis with units from 80 (left side) to 30 (right side). On this diagram, plot a parallelogram with corners at the following coordinates (CF-75, WF-28), (CF-75, WF-40), (CF-45, WF-32.5), and (CF-45, WF-44.5). If the point determined by the intersection of the computed CF and WF does not fall within the above parallelogram, revise the grading of each size of aggregate used and the proportions selected as necessary.

e. Plot the associated production tolerance limits, identified in Table 17, around the CF and adjusted WF point.

2.3.2 Coarse Aggregate

2.3.2.1 Coarse Aggregate Composition

Provide coarse aggregate consisting of crushed gravel, crushed stone, or a combination thereof.Provide aggregates, as delivered to the mixers, consisting of clean, hard, uncoated particles meeting the requirements of ASTM C33/C33M except as specified herein. Provide coarse aggregate that has been washed sufficient to remove dust and other coatings. Provide coarse aggregate with no more than 40 percent loss when subjected to the Los Angeles abrasion test in accordance with ASTM C131/C131M. Provide coarse aggregates with a maximum sodium sulfate soundness loss of 12 percent, or with a magnesium sulfate soundness loss of 18 percent after five cycles when tested in accordance with ASTM C88.

2.3.2.2 Particle Shape Characteristics

Provide particles of the coarse aggregate that are generally spherical or

cubical in shape. The quantity of flat particles and elongated particles in any size group coarser than the 3/8 inch sieve are not allowed to exceed 20 percent by weight as determined by the Flat Particle Test and the Elongated Particle Test of ASTM D4791, Method A. A flat particle is defined as one having a ratio of width to thickness greater than 3; an elongated particle is one having a ratio of length to width greater than 3.

2.3.2.3 Size and Grading

Provide coarse aggregate with a nominal maximum size (as defined in ASTM C125) of 1.5 inches with a minimum of 10 percent retained on the 1.0 inch sieve of the proposed combined aggregate gradation that meets the criteria of paragraph COMBINED AGGREGATE GRADATION. Grade and provide the coarse aggregates in a minimum of three size groups. The ASTM C33/C33M, Size Number 4 coarse aggregate (1.5 inches to 0.75 inch) meets the 1.5 inches requirement. The ASTM C33/C33M, Size Number 67 (0.75 inch to No. 4) is a common medium coarse aggregate.

Mix designs that include a minimum of three coarse aggregate size groups can use grading limits not defined by ASTM C33/C33M provided all other requirements are met. Provide upper and lower grading limits of historic gradations and for all proposed coarse aggregates not defined by ASTM C33/C33M but intended for use in the mix design.

2.3.2.4 Deleterious Materials - Airfield Pavements

The amount of deleterious material in each individual size group and source of coarse aggregate is not allowed to exceed the limits shown in Table 7A below, determined in accordance with the test methods shown.

TABLE 9A

LIMITS OF DELETERIOUS MATERIALS IN COARSE AGGREGATE FOR AIRFIELD PAVEMENTS

Materials (h)	Percentage by Mass Severe Weather	
Clay lumps and friable particles (ASTM C142/C142M)	0.2	
Shale (a) (ASTM C295/C295M)	0.1	
Material finer than No. 200 sieve (b) (ASTM C117)	0.5	
Lightweight particles (c) (ASTM C123/C123M)	0.2	
Clay ironstone (d) (ASTM C295/C295M)	0.1	
Chert, cherty stone, and other aggregates (less than 2.40 Sp. Gr.) (e) (ASTM C123/C123M and ASTM C295/C295M)	0.1	
Claystone, mudstone, and siltstone (f) (ASTM C295/C295M)	0.1	
Shaly and argillaceous limestone (g) (ASTM C295/C295M)	0.2	

TABLE 9A

LIMITS OF DELETERIOUS MATERIALS IN COARSE AGGREGATE FOR AIRFIELD PAVEMENTS

Percentage by Mass

Materials (h)	Severe Weather	
Other soft particles (COE CRD-C 130)	1.0	
Total of all deleterious substances exclusive of material finer than No. 200 sieve	1.0	

(a) Shale is defined as a fine-grained, thinly laminated or fissile sedimentary rock. It is commonly composed of clay or silt or both. It has been indurated by compaction or by cementation, but not so much as to have become slate.

(b) Limit for material finer than No. 200 sieve is allowed to be increased to 1.5 percent for crushed aggregates if the fine material consists of crusher dust that is essentially free from clay or shale. Use XRD or other appropriate techniques as determined by petrographer to quantify amount and justify increase.

(c) Test with a separation medium with a density of Sp. Gr. of 2.0. This limit does not apply to coarse aggregate manufactured from blast-furnace slag unless contamination is evident.

(d) Clay ironstone is defined as an impure variety of iron carbonate, iron oxide, hydrous iron oxide, or combinations thereof, commonly mixed with clay, silt, or sand. It commonly occurs as dull, earthy particles, homogeneous concretionary masses, or hard-shell particles with soft interiors. Other names commonly used for clay ironstone are "chocolate bars" and limonite concretions.

(e) Chert is defined as a rock composed of quartz, chalcedony or opal, or any mixture of these forms of silica. It is variable in color. The texture is so fine that the individual mineral grains are too small to be distinguished by the unaided eye. Its hardness is such that it scratches glass but is not scratched by a knife blade. It may contain impurities such as clay, carbonates, iron oxides, and other minerals. Cherty stone is defined as any type of rock (generally limestone) that contains chert as lenses and nodules, or irregular masses partially or completely replacing the original stone. Other aggregates consist of obsidian, ash tuff, and palygorskite.

(f) Claystone, mudstone, or siltstone, is defined as a massive fine-grained sedimentary rock that consists predominantly of indurated clay or silt without laminations or fissility. It may be indurated either by compaction or by cementation.

(g) Shaly limestone is defined as limestone in which shale occurs as one or more thin beds or laminae. These laminae may be regular or very irregular and may be spaced from a few inches down to minute fractions of an inch. Argillaceous limestone is defined as a limestone in which clay minerals occur disseminated in the stone in the amount of 10 to 50 percent by weight of the rock; when these make up from 50 to 90 percent, the rock is known as calcareous (or dolomitic) shale (or claystone, mudstone, or siltstone).

TABLE 9A		
LIMITS OF DELETERIOUS MATERIALS IN COARSE AGGREGATE FOR AIRFIELD PAVEMENTS		
Percentage by Mass		
Materials (h)	Severe Weather	
(h) Perform testing in accordance with the referenced test methods, except use the minimum sample size specified below.		

2.3.2.5 Testing Sequence for Deleterious Materials in Coarse Aggregate - Airfields Only

No extension of time or additional payment due to any delays caused by the testing, evaluation, or personnel requirements is allowed. The minimum test sample size of the coarse aggregate is 200 pounds for the 3/4 inch and larger maximum size and 25 pounds for the No. 4 to 3/4 inch coarse aggregate. Provide facilities for the ready procurement of representative test samples. The testing procedure on each sample of coarse aggregate for compliance with limits on deleterious materials is as follows:

Step 1: Wash each full sample of coarse aggregate for material finer than the No. 200 sieve. Discard material finer than the No. 200 sieve.

Step 2: Test remaining full sample for clay lumps and friable particles and remove.

Step 3. Test remaining full sample for chert and cherty stone with SSD density of less than 2.40 specific gravity. Remove lightweight chert and cherty stone. Retain other materials less than 2.40 specific gravity for Step 4.

Step 4: Test the materials less than 2.40 specific gravity from Step 3 for lightweight particles (Sp. GR. 2.0) and remove. Restore other materials less than 2.40 specific gravity to the sample.

Step 5: Test remaining sample for clay-ironstone, shale, claystone, mudstone, siltstone, shaly and argillaceous limestone, and remove.

Step 6: Test a minimum of one-fifth of remaining full sample for other soft particles.

2.3.3 Fine Aggregate

2.3.3.1 Fine Aggregate Composition

Provide fine aggregate consisting of natural sand, manufactured sand, or a combination of the two, each composed of clean, hard, durable particles meeting the requirements of ASTM C33/C33M. Stockpile and batch each type of fine aggregate separately. Provide fine aggregate with particles that are generally spherical or cubical in shape. For fine aggregate provided as a combination of sources, test each source individually.

2.3.3.2 Grading

Provide fine aggregate, as delivered to the mixer, with a grading that

conforms to the requirements of ASTM C33/C33M and having a fineness modulus of not less than 2.50 nor more than 3.40. For fine aggregate supplied as a combination of sources, determine the fineness modulus on a composite sample.

2.3.3.3 Deleterious Material

The minimum test sample size for fine aggregate proposed for use in airfield paving is 10 pounds. The amount of deleterious material in the fine aggregate is not to exceed the limits listed in Table 8 when performed on the full sample:

TABLE 9

LIMITS OF DELETERIOUS MATERIALS IN FINE AGGREGATE

Material	Percentage by Mass
Clay lumps and friable particles ASTM C142/C142M	1.0
Material finer than No. 200 sieve ASTM C117	3.0
Lightweight particles ASTM C123/C123M using a medium with a density of Sp. Gr. of 2.0	0.5
Total of all above	3.0

2.3.3.4 Testing Sequence for Deleterious Materials in Fine Aggregate - Airfields Only

The testing procedure on each sample of fine aggregate for compliance with limits on deleterious materials is as follows:

Step 1: Wash each full sample of fine aggregate for material finer than the No. 200 sieve. Discard material finer than the No. 200 sieve.

Step 2: Test remaining full sample for clay lumps and friable particles and remove.

Step 3. Test remaining full sample for lightweight particles (Sp. GR. 2.0).

2.4 CHEMICAL ADMIXTURES

2.4.1 General Requirements

Only use chemical admixtures when the specific admixture type and manufacturer is the same material used in the mixture proportioning studies. Provide all chemical admixtures from the same manufacturer. Provide air-entraining admixture conforming to ASTM C260/C260M. Use an accelerating admixture conforming to ASTM C494/C494M, Type C or Type E, when specified in paragraph MIXTURE PROPORTIONS below provided it is not used to reduce the amount of cementitious material. Calcium chloride and admixtures containing calcium chloride are not allowed. Provide retarding or water-reducing admixture that meet the requirements of ASTM C494/C494M, Type A, B, or D, except that the 6-month and 1-year compressive strength

tests are waived. ASTM C494/C494M, Type F and G high range water reducing admixtures and Type S specific performance admixtures are not allowed. ASTM C1017/C1017M flowable admixtures are not allowed.

2.4.2 Lithium Nitrate

Provide lithium admixture consisting of a nominal 30 percent aqueous solution of Lithium Nitrate, with a density of 10 pounds per gallon, with the approximate chemical form as shown below:

TABLE 10

LITHIUM NITRATE COMPOSITION

Constituent	Limit (Percent by Mass)
$LiNo_3$ (Lithium Nitrate)	30 plus or minus 0.5
SO_4^{-2} (Sulfate Ion)	0.1 (max)
Cl^- (Chloride Ion)	0.2 (max)
Na^+ (Sodium Ion)	0.1 (max)
K^+ (Potassium Ion)	0.1 (max)

Provide the services of a manufacturer's technical representative experienced in dispensing, mixing, proportioning, placement procedures and curing of concrete containing lithium nitrate, at no expense to the Government. This representative is required to be present on the project prior to and during at least the first two days of placement using lithium nitrate.

2.5 MEMBRANE FORMING CURING COMPOUND

Provide membrane forming curing compound that conforms to COE CRD-C 300 and is white pigmented.

2.6 WATER

Provide water for mixing and curing that is fresh, clean, potable, and free of injurious amounts of oil, acid, salt, or alkali, except that non-potable water, or water from concrete production operations, can be used if it meets the requirements of ASTM C1602/C1602M.

2.7 JOINT MATERIALS

2.7.1 Expansion Joint Material

Provide preformed expansion joint filler material conforming to ASTM D1751 or ASTM D1752 Type II or III. Provide expansion joint filler that is 3/4 inch thick, unless otherwise indicated, and provided in a single full depth piece.

2.8 REINFORCING

Provide reinforcement that is free from loose, flaky rust, loose scale,

oil, grease, mud, or other coatings that might reduce the bond with concrete. Removal of thin powdery rust and tight rust is not required. However, reinforcing steel which is rusted to the extent that it does not conform to the required dimensions or mechanical properties is not allowed to be used.

2.8.1 Reinforcing Bars and Bar Mats

Provide reinforcing bars conforming to ASTM A615/A615M, billet-steel or ASTM A996/A996M, rail and axle steel, Grade 60 . Provide bar mats conforming to ASTM A184/A184M. The bar members may be billet rail or axle steel.

2.9 DOWELS

2.9.1 Dowels

Provide dowels in single piece bars fabricated or cut to length at the shop or mill before delivery to the site. Dowels are to be free of loose, flaky rust and loose scale and be clean and straight. Dowels may be sheared to length provided that the deformation from true shape caused by shearing does not exceed 0.04 inch on the diameter of the dowel and does not extend more than 0.04 inch from the end of the dowel. Dowels are required to be smooth steel bars conforming to ASTM A615/A615M, Grade 40 or 60; ASTM A996/A996M, Grade 50 or 60. Epoxy coat dowels in conformance with Type 1 coating requirements of ASTM A1078/A1078M, to include the ends. Provide grout retention rings that are fully circular metal or plastic devices capable of supporting the dowel until the epoxy hardens. Dowel sleeves or inserts are not permitted.

2.9.2 Dowel Bar Assemblies

Provide dowel bar assemblies that consist of a framework of metal bars or wires arranged to provide rigid support for the dowels throughout the paving operation, with a minimum of four continuous bars or wires extending along the joint line. Provide dowels that are welded to the assembly or held firmly by mechanical locking arrangements that prevent them from rising, sliding out, or becoming distorted during paving operations.

2.10 EPOXY RESIN

Provide epoxy-resin materials that consist of two-component materials conforming to the requirements of ASTM C881/C881M, Class as appropriate for each application temperature to be encountered, except that in addition, the materials meet the following requirements:

a. Type IV, Grade 3 for use for embedding dowels and anchor bolts.

b. Type III, Grade as required for use as patching materials for complete filling of spalls, saw-cut runouts, and other voids and for use in preparing epoxy resin mortar.

c. Type IV, Grade 1 for injecting cracks.

d. Type V, Grade as required for bonding freshly mixed portland cement concrete or mortar or freshly mixed epoxy resin concrete or mortar to hardened concrete.

2.11 EQUIPMENT

Maintain all plant, equipment, tools, and machines used in the work in satisfactory working conditions at all times. Submit the following:

a. Details and data on the batching and mixing plant prior to plant assembly including manufacturer's literature showing that the equipment meets all requirements specified herein.

b. Obtain National Ready Mixed Concrete Association (NRMCA) certification of the concrete plant, at no expense to the Government. Provide inspection report of the concrete plant by an engineer approved by the NRMCA. The NRMCA certified engineer cannot be employed by the primary contractor or a subcontractor. A list of NRMCA approved engineers is available on the NRMCA website at http://www.nrmca.org. Submit a copy of the NRMCA QC Manual Section 3 Concrete Plant Certification Checklist, NRMCA Certificate of Conformance, and Calibration documentation on all measuring and weighing devices prior to uniformity testing.

c. A description of the equipment proposed for transporting concrete mixture from the central mixing plant to the paving equipment.

d. A description of the equipment proposed for the machine and hand placing, consolidating and curing of the concrete mixture. Manufacturer's literature on the paver and finisher, together with the manufacturer's written instructions on adjustments and operating procedures necessary to assure a tight, smooth surface on the concrete pavement. The literature is required to show that the equipment meets all details of these specifications. Include detailed information on automatic laser controlled systems if proposed for use.

2.11.1 Batching and Mixing Plant

2.11.1.1 Location

Locate the batching and mixing plant off Government premises no more than a 15 minute haul time from the placing site. At no time is the haul time and gate security check time to exceed 30 minutes from the offloading of the concrete mixture into the truck to the placing site. Provide operable telephonic or radio communication between the plant and the placing site at all times concreting is taking place.

2.11.1.2 Type and Capacity

Provide a batching and mixing plant consisting of a stationary-type central mix plant, including permanent installations and portable or relocatable plants installed on stable foundations. Provide a plant designed and operated to produce concrete within the specified tolerances, with a minimum capacity of 250 cubic yards per hour, that conforms to the requirements of NRMCA QC 3 including provisions addressing:

1. Material Storage and Handling
2. Batching Equipment
3. Central Mixer
4. Ticketing System
5. Delivery System

2.11.1.3 Tolerances

TABLE 11

BATCH PLANT MIXING TOLERANCES

Materials	Percentage of Required Mass
Cementitious Materials	plus or minus 1
Aggregate	plus or minus 2
Water	plus or minus 1
Admixture	plus or minus 3

For volumetric batching equipment for water and admixtures, the above numeric tolerances apply to the required volume of material being batched. Dilute concentrated admixtures uniformly, if necessary, to provide sufficient volume per batch so that the batchers operate consistently within the above tolerance.

2.11.1.4 Moisture Control

Provide a plant capable of ready adjustment to compensate for the varying moisture contents of the aggregates and to change the quantities of the materials being batched. Provide an electric moisture meter complying with the provisions of COE CRD-C 143 for measuring of moisture in the fine aggregate. Provide a sensing element arranged so that measurement is made near the batcher charging gate of the fine aggregate bin or in the fine aggregate batcher.

2.11.2 Concrete Mixers

Use the project's approved mixture proportions for uniformity testing. Provide stationary or truck mixers that are capable of combining the materials into a uniform mixture and of discharging this mixture without segregation. Do not charge the mixers in excess of the capacity recommended by the manufacturer. Operate the mixers at the drum or mixing blade speed designated by the manufacturer. Maintain the mixers in satisfactory operating condition, with the mixer drums kept free of hardened concrete. Replace mixer blades or paddles when worn down more than 10 percent of their depth when compared with the manufacturer's dimension for new blades or paddles.

2.11.2.1 Stationary Mixers

Stationary mixers are required to be drum or pan mixers. Provide mixers with an acceptable device to lock the discharge mechanism until the required mixing time has elapsed. Perform mixer performance (uniformity) testing in accordance with COE CRD-C 55 and with paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL DURING CONSTRUCTION in PART 3.

2.11.2.1.1 Mixing Time and Uniformity for Stationary Mixers

For stationary mixers, before uniformity data are available, the minimum mixing time for each batch after all solid materials are in the mixer, provided that all of the mixing water is introduced before one-fourth of the mixing time has elapsed, is 1 minute for mixers having a capacity of 1

cubic yard. For mixers of greater capacity, increase this minimum time by 20 seconds for each additional 1.33 cubic yard or fraction thereof. Provide uniformity test results meeting the properties required by this specification in addition to meeting the requirements of Table 11. After results of uniformity tests are available, the mixing time may be reduced to the minimum time required to meet uniformity requirements; but if uniformity requirements are not being met, increase the mixing time as directed. Perform mixer uniformity tests at new mixing times immediately after any change in mixing time or volume. Any changes to the mix constituents or sequence of charging the mixer after a batch requires an additional three consecutive passing batches. For regular testing perform all six tests on three consecutive batches of concrete. The range for regular testing is the average of the ranges of the three consecutive batches. Conduct the Regular Test sequence for initial determination of the mixing time or as directed. When regular testing is performed, the concrete is required to meet the limits of any five of the six uniformity requirements listed in Table 11 below.

2.11.2.1.2 Abbreviated Uniformity Test

Conduct the Abbreviated Test sequence for production concrete verification at the frequency specified in Table 17. Provide uniformity test results meeting the fresh and hardened concrete properties required by this specification in addition to meeting the requirements of Table 11. When abbreviated testing is performed, the concrete is required to meet only those requirements listed for abbreviated testing. Abbreviated testing is performed on a single batch of concrete. The range for abbreviated testing is the range for one batch. If more than one mixer is used and all are identical in terms of make, type, capacity, condition, speed of rotation, the results of tests on one of the mixers apply to the others, subject to Government approval.

TABLE 12

UNIFORMITY REQUIREMENTS--STATIONARY MIXERS

Parameter	Regular Tests Allowable Maximum Range for 3 Consecutive Batches	Abbreviated Tests Allowable Maximum Range for 1 Batch
Unit weight of air-free mortar	2.0 pounds per cubic foot	2.0 pounds per cubic foot
Air content	1.0 percent	Not Applicable
Slump	1.0 inch	1.0 inch
Coarse aggregate	6.0 percent	6.0 percent
Compressive strength at 7	10.0 percent	10.0 percent
Water content	1.5 percent	Not Applicable

2.11.2.2 Truck Mixers

Truck mixers are not allowed for mixing or transporting slipformed paving concrete. Provide only truck mixers designed for mixing or transporting paving concrete with extra large blading and rear opening specifically for low-slump paving concrete. Provide truck mixers, the mixing of concrete therein, and concrete uniformity and testing thereof that conform to the requirements of ASTM C94/C94M. Any changes to the mix constituents or sequence of charging the truck mixer requires an additional three

consecutive passing batches. Determine the number of revolutions between 70 to 100 for truck-mixed concrete and the number of revolutions for shrink-mixed concrete by uniformity tests as specified in ASTM C94/C94M and in requirements for mixer performance stated in paragraph TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL DURING CONSTRUCTION in PART 3. If requirements for the uniformity of concrete are not met with 100 revolutions of mixing after all ingredients including water are in the truck mixer drum, discontinue use of the mixer until the condition is corrected. Water is not allowed to be added after the initial introduction of mixing water except, when on arrival at the job site, the slump is less than specified and the water-cement ratio is less than that given as a maximum in the approved mixture. Additional water may be added to bring the slump within the specified range provided the approved water-cement ratio is not exceeded. Inject water into the head of the mixer (end opposite the discharge opening) drum under pressure, and turn the drum or blades a minimum of 30 additional revolutions at mixing speed. The addition of water to the batch at any later time is not allowed.

2.11.3 Transporting Equipment

Provide non-agitating equipment conforming to ASTM C94/C94M or approved open top agitators for slipformed paving concrete transportation. Provide non-agitating equipment or approved truck mixers conforming to ASTM C94/C94M for fixed form and hand placement paving concrete transportation. Truck mixers are not allowed for mixing or transporting slipformed paving concrete. All truck mixers are to bedesigned with extra large blading and rear opening specifically for low slump concrete. Provide transporting equipment designed and operated to deliver and discharge the required concrete mixture completely without segregation.

2.11.4 Transfer and Spreading Equipment

Provide a Material Transfer Vehicle (MTV) capable of moving between the hauling equipment and the paver and equipped with a swing conveyor that delivers material to the paver from outside the paving lane without making contact with the paver while allowing the paver to operate at a constant speed.

2.11.5 Paver-Finisher

Provide paver-finisher consisting of a heavy-duty, self-propelled machine designed specifically for paving and finishing high quality pavement, with a minimum weight of 2200 pounds per foot of lane width, and powered by an engine having a minimum 6.0 horsepower per foot of lane width. The paver-finisher is required to spread, consolidate, and shape the plastic concrete to the desired cross section in one pass. The mechanisms for forming the pavement are required to be easily adjustable in width and thickness. In addition to other spreaders required by paragraph above, equip the paver-finisher with a full width knock-down auger or plow mechanism, capable of operating in both directions, which evenly spreads the fresh concrete in front of the screed or extrusion plate.

2.11.5.1 Vibrators

Provide gang mounted immersion vibrators at the front of the paver on a frame equipped with suitable controls so that all vibrators can be operated at any desired depth within the slab or completely withdrawn from the concrete, as required. Provide vibrators that are automatically

controlled to immediately stop as forward motion of the paver ceases. Equip the paver-finisher with an electronic vibrator monitoring device displaying the operating frequency of each individual internal vibrator with a readout display visible to the paver operator that operates continuously while paving, and displays all vibrator frequencies with manual or automatic sequencing among all individual vibrators. Discontinue paving if the vibrator monitoring system fails to operate properly during the paving operation. Provide the spacing of the immersion vibrators across the paving lane as necessary to properly consolidate the concrete, with a maximum clear distance between vibrators of 30 inches and outside vibrators a maximum of 12 inches from the lane edge. Determine vibrator frequency and amplitude per COE CRD-C 521.

2.11.5.2 Screed or Extrusion Plate

Equip the paver-finisher with a transversely oscillating screed or an extrusion plate to shape, compact, and smooth the surface and finish the surface that no significant amount of hand finishing, except use of cutting straightedges, is required. Provide adjustment for variation in lane width or thickness and to prevent more than 8 inches of the screed or extrusion plate extending over previously placed concrete on either side when paving fill-in lanes. Repair or replace machines that cause displacement of properly installed forms or cause ruts or indentations in the prepared underlying materials and machines that cause frequent delays due to mechanical failures.

2.11.5.3 Longitudinal Mechanical Float

A longitudinal mechanical float may be used. If used, provide a float that is specially designed and manufactured to smooth and finish the pavement surface without working excess paste to the surface and is rigidly attached to the rear of the paver-finisher or to a separate self-propelled frame spanning the paving lane. Provide float plate at least 5 feet long by 8 inches wide that automatically oscillates in the longitudinal direction while slowly moving from edge to edge of the paving lane, with the float plate in contact with the surface at all times.

2.11.5.4 Other Types of Finishing Equipment

Clary screeds (triple drum roller screeds), other rotating tube floats, or bridge deck finishers are not allowed on mainline paving (paving lanes 50' or longer, but may be allowed on irregular or odd-shaped slabs, and near buildings or trench drains, subject to approval. Only use vibrating screeds or pans for isolated slabs where hand finishing is permitted as specified, and only where specifically approved.

2.11.5.5 Fixed Forms

Provide paver-finisher equipped with wheels designed to ride the forms, keep it aligned with the forms, and spread the load so as to prevent deformation of the forms. When traveling on new or existing concrete to remain, provide paver-finishers traveling on guide rails located outside of the paving lane that are equipped with wheels that will not cause damage or spalling to concrete joint edges to remain. Alternatively, a modified slipform paver that straddles the forms may be used. Provide a modified slipform paver which has the side conforming plates removed or rendered ineffective and travels over or along pre-placed fixed forms.

2.11.5.6 Slipform

Provide an automatically controlled slipform paver-finisher that is crawler mounted with padded tracks so as to be completely stable under all operating conditions and provide a finish to the surface and edges so that no edge slump beyond allowable tolerance occurs. Provide suitable moving side forms that are adjustable and produce smooth, even edges, perpendicular to the top surface and meeting specification requirements for alignment, edge slump, and joint face deformation.

2.11.6 Curing Equipment

Provide equipment for applying membrane-forming curing compound mounted on a self-propelled frame that spans the paving lane. Constantly agitate the curing compound reservoir mechanically (not air) during operation and provide a means for completely draining the reservoir. Provide a spraying system that consists of a mechanically powered pump which maintains constant pressure during operation, an operable pressure gauge, and either a series of spray nozzles evenly spaced across the lane to provide uniformly overlapping coverage or a single spray nozzle which is mounted on a carriage which automatically traverses the lane width at a speed correlated with the forward movement of the overall frame. Protect all spray nozzles with wind screens. Calibrate the spraying system in accordance with ASTM D2995, Method A, for the rate of application required in paragraph MEMBRANE CURING. Provide hand-operated sprayers allowed by that paragraph with compressed air supplied by a mechanical air compressor. Immediately replace curing equipment if it fails to apply an even coating of compound at the specified rate.

2.11.7 Texturing Equipment

Provide texturing equipment as specified below. Before use, demonstrate the texturing equipment on the test section, and modify the equipment as necessary to produce the texture directed.

2.11.7.1 Burlap Drag

Securely attach a burlap drag to a separate wheel mounted frame spanning the paving lane or to one of the other similar pieces of equipment. Provide length of the material between 24 to 36 inches dragging flat on the pavement surface and with a width at least equal to the width of the slab. Provide clean, reasonably new burlap material, completely saturated with water before attachment to the frame, moistened before start of use, and kept clean and maintained moist during use. Provide burlap conforming to AASHTO M 182, Class 3 or 4. Burlap drag is not to include any impervious layers, such as a polyethylene layer.

2.11.8 Sawing Equipment

Provide equipment for sawing joints and for other similar sawing of concrete consisting of standard diamond-type concrete saws mounted on a wheeled chassis which can be easily guided to follow the required alignment. Provide diamond tipped blades. If demonstrated to operate properly, abrasive blades may be used. Provide spares as required to maintain the required sawing rate. Provide wheel saws used in the removal of concrete with large diameter tungsten carbide tipped blades mounted on a heavy-duty chassis which produce a saw kerf at least 1-1/2 inches wide. Provide saws capable of sawing to the full depth required. Early-entry saws may be used, subject to demonstration and approval. No change to the

initial sawcut depth is permitted.

2.11.9 Straightedge

Provide and maintain at the job site, in good condition, a minimum 12 foot straightedge for each paving train for testing the hardened portland cement concrete surfaces. Provide straightedges constructed of aluminum or magnesium alloy and blades of box or box-girder cross section with flat bottom, adequately reinforced to maintain rigidity and accuracy. Provide straightedges with handles for operation on the pavement.

2.11.10 Work Bridge

Provide a self-propelled work bridge capable of spanning the required paving lane width where workmen can efficiently and adequately reach the pavement surface.

2.11.11 Hand Finishing Tools

Provide hand finishing equipment in accordance with the provisions of this specification. Use the hand method only on isolated areas of odd slab widths or shapes and in the event of a breakdown of the mechanical finishing equipment. Keep supplemental hand finishing for machine finished pavement to an absolute minimum. Do not seal the paving surface with steel trowels.

2.12 SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES

2.12.1 Specified Flexural Strength

Specified flexural strength, R, for concrete is 650 psi at 90 days, as determined by tests made in accordance with ASTM C78/C78M of beams fabricated and cured in accordance with ASTM C192/C192Mequivalent flexural strength, as specified in paragraph Mixture Proportioning For Flexural Strength below.

2.12.2 Allowable Water-Cementitious Materials Ratio

The allowable water-cementitious material ratio is 0.38 to 0.45. The water-cementitious material ratio is the equivalent water-cement ratio as determined by conversion from the weight ratio of water to cement plus SCM by the mass equivalency method described in ACI 211.1.

2.12.3 Air Content

Provide concrete that is air-entrained with a total air content of 6.0 plus or minus 1.5 percentage points, at the point of placement. Determine air content in accordance with ASTM C231/C231M.

2.12.4 Slump

The maximum allowable slump of the concrete at the point of placement is listed in Table 12.

TABLE 13
MAXIMUM ALLOWABLE SLUMP

TABLE 13	
Placement Method	Maximum Slump
Slipform	As required to meet edge slump and joint face deformation limits
Fixed Form	2 inches
Hand Placement utilizing Other Types of Finishing Equipment	3 inches

The selected slump is applicable to both pilot and fill-in lanes. Perform separate trial mixture studies for each placement method, as specified in paragraph Trial Mixture Studies.

2.12.5 Concrete Temperature

The temperature of the concrete as delivered is required to conform to the requirements of paragraphs Paving In Hot Weather and Paving In Cold Weather. Determine the temperature of concrete in accordance with ASTM C1064/C1064M.

2.12.6 Concrete Strength for Final Acceptance

The strength of the concrete will be considered acceptable when the average equivalent 90-day flexural strengths for each lot are above the 'Specified Flexural Strength' as determined by correlation with 14-day compressive strength tests specified in paragraph Mixture Proportioning For Flexural Strength below, and no individual set (2 specimens per sublot) in the lot are 25 psi or more below the equivalent 'Specified Flexural Strength'. If any lot or sublot, respectively, fails to meet the above criteria, remove and replace the lot or sublot at no additional cost to the Government. This is in addition to and does not replace the average strength required for day-to-day CQC operations as specified in paragraph Average Cqc Flexural Strength Required For Mixtures, below.

2.13 MIXTURE PROPORTIONS

2.13.1 Mixture Proportions Composition

Provide concrete composed of cementitious material, water, fine and coarse aggregates, and admixtures. Include supplementary Cementitious Materials (SCM) choice and usage in accordance with paragraph Supplementary Cementitious Materials (SCM) Content. Provide a minimum total cementitious materials content of 517 pounds per cubic yard. Limit the total alkali loading contributed by the portland cement or the portland cement portion of a blended cement to a maximum of 3.0 lb per cubic yard. Calculate the alkali loading as the product of the portland cement content of the concrete multiplied by the alkali content of the portland cement or the portland cement portion of the blended cement, divided by 100. Determine the alkali content in accordance with ASTM C114. Acceptable admixtures consist of air entraining admixture and may also include, as approved, water-reducing and retarding admixtures.

2.13.2 Proportioning Studies

Perform trial design batches, mixture proportioning studies, and testing,

at no expense to the Government. Submit for approval the Preliminary Proposed Proportioning to include items a., b., and i. below a minimum of 21 days prior to beginning a mixture proportioning study. Submit the results of the mixture proportioning studies signed and stamped by the registered professional engineer having technical responsibility for the mix design study, and submitted at least 30 days prior to commencing concrete placing operations. Include a statement summarizing the maximum nominal coarse aggregate size and the weights and volumes of each ingredient proportioned on a one cubic yard basis. Base aggregate quantities on the mass in a saturated surface dry condition. Provide test results demonstrating that the proposed mixture proportions produce concrete of the qualities indicated. Base methodology for trial mixtures having proportions, slumps, and air content suitable for the work as described in ACI 211.1, modified as necessary to accommodate flexural strength. ACI 211.1 can be supplemented with ACI 325.14R. Submit test results including:

a. Individual coarse and fine aggregate gradations and plots that meet ASTM C33. Include historic gradation averages and standard deviations on individual sieves for each aggregate size group produced within the past 12 months. Historical gradation averages are not to be utilized for the Proportioning Studies.
b. Combined aggregate gradation and coarseness vs. workability plots.
c. Coarse aggregate quality test results. Report the Aggregate Correction Factor (ACF).
d. Fine aggregate quality test results.
e. Mill certificates for cement and supplementary cementitious materials.
f. Certified test results for air entraining, water reducing, retarding, and Lithium Nitrate admixtures.
g. Specified flexural strength, slump, and air content.
h. Documentation of required average CQC flexural strength, Ra.
i. Recommended proportions and volumes for each proposed mixture for each proposed placement method (slipform, fixed form, and hand placement) if different. Include three trial water-cementitious materials ratios for each proposed placement method (slipform, fixed form, and hand placement).
j. Individual beam and cylinder breaks.
k. Flexural and compressive strength summaries and plots.
l. Correlation ratios for acceptance testing and CQC testing.
m. Historical record of ACI 214R strength test results, documenting production standard deviation (if available).
n. Narrative discussing methodology on how the mix design was developed in accordance with ACI 211.1 and ACI 325.14R.
o. Alternative aggregate blending to be used during the test section if necessary to meet the required surface and consolidation requirements.

2.13.2.1 Water-Cementitious Materials Ratio

Perform at least three different water-cementitious materials ratios, within the limits specified in paragraph Allowable Water-Cementitious Materials Ratio, which produce a range of strength encompassing that required on the project. The minimum and maximum water-cementitious materials ratios of the approved mix design become the minimnum and maximum water-cementitious materials ratio for the project during production.

2.13.2.2 Trial Mixture Studies

Perform separate sets of trial mixture studies made for each combination

of cementitious materials and each combination of admixtures proposed for use. No combinations are to be used until proven by such studies, except that, if approved in writing and otherwise permitted by these specifications, a retarding admixture can be used without separate trial mixture study. Perform separate trial mixture studies for each placing method (slip form, fixed form, or hand placement) proposed. Report the temperature of concrete in each trial batch. Design each mixture to promote easy and suitable concrete placement, consolidation and finishing, and to prevent segregation and excessive bleeding. Proportion laboratory trial mixtures for maximum slump and air content, as permitted by the placement method being utilized.

2.13.2.3 Mixture Proportioning for Flexural Strength

Follow the step by step procedure below:

a. Fabricate all beams and cylinders for each mixture from the same batch or blend of batches. Fabricate and cure all beams and cylinders in accordance with ASTM C192/C192M, using 6 x 6 inches steel beam molds and 6 x 12 inches single-use cylinder molds.

b. Cure test beams from each mixture for 3, 7, 14, 28, 56 and 90-day flexural tests; 6 beams to be tested per age.

c. Cure test cylinders from each mixture for 3, 7, 14, 28, 56 and 90-day compressive strength tests; 6 cylinders to be tested per age.

d. Test beams in accordance with ASTM C78/C78M, cylinders in accordance with ASTM C39/C39M.

e. Using the average strength for each w/c at each age, plot all results from each of the three mixtures on separate graphs for w/c versus:

3-day flexural strength
7-day flexural strength
14-day flexural strength
28-day flexural strength
56 and 90-day flexural strength

3-day compressive strength
7-day compressive strength
14-day compressive strength
28-day compressive strength
56 and 90-day compressive strength

f. From these graphs select a w/c that produces a mixture giving a 90-day flexural strength equal to the required strength determined in accordance with paragraph Average CQC Flexural Strength Required for Mixtures.

g. Using the above selected w/c, select from the graphs the expected 3, 7, 14, 90-day flexural strengths and the expected 3, 7, 14, 90-day compressive strengths for the mixture.

h. From the above expected strengths for the selected mixture determine the following Correlation Ratios:

(1) Ratio of the 14-day compressive strength of the selected mixture to the 90-day flexural strength of the mixture (for acceptance).

(2) Ratio of the 7-day compressive strength of the selected mixture to the 90-day flexural strength of the mixture (for CQC control).

i. If there is a change in materials, perform additional mixture design studies using the new materials and new Correlation Ratios determined.

j. No concrete pavement placement is allowed until the mixture proportions are approved. The approved water-cementitious materials ratio is restricted to the minimum and maximum values specified in paragraph Water-Cementitious Materials Ratio and is not to be increased without written approval.

2.13.3 Average CQC Flexural Strength Required for Mixtures

a. In order to meet the strength requirements specified in paragraph SPECIFIED CONCRETE STRENGTH AND OTHER PROPERTIES during production, the mixture proportions selected during mixture proportioning studies and used during construction require an average CQC flexural strength, Ra, exceeding the specified flexural strength, R, by the amount indicated below.

b. The required average CQC flexural strength, Ra, is used only for proportioning studies and CQC operations as specified in paragraph Concrete Strength Testing for CQC.

c. Acceptance of production flexural strength results is based on the specified flexural strength R specified in paragraph: Specified Flexural Strength.

2.13.3.1 From Previous Test Records

Where a concrete production facility has previous test records current to within 18 months, establish a standard deviation in accordance with the applicable provisions of ACI 214R. Include test records from which a standard deviation is calculated that represent materials, quality control procedures, and conditions similar to those expected, that represent concrete produced to meet a specified flexural strength or strengths within 150 psi of the 90-day flexural strength specified for the proposed work, and that consist of at least 30 consecutive tests. Perform verification testing to document the current strength. A strength test is the average of the strengths of two specimens made from the same sample of concrete and tested at 90 days. Required average CQC flexural strength, Ra, used as the basis for selection of concrete proportions is the value from the equation that follows, using the standard deviation as determined above:

$$Ra = R + 1.34S$$

Where: S = standard deviation
R = specified flexural strength
Ra = required average CQC flexural strength

Where a concrete production facility does not have test records meeting the requirements above but does have a record based on 15 to 29 consecutive tests, establish a standard deviation as the product of the calculated standard deviation and a modification factor from Table 13:

TABLE 14	
MODIFICATION FACTOR FOR STANDARD DEVIATION	
NUMBER OF TESTS	MODIFICATION FACTOR
20	1.08
25	1.03
30 or more	1.00

2.13.3.2 Without Previous Test Records

When a concrete production facility does not have sufficient field strength test records for calculation of the standard deviation, determine the required average CQC flexural strength, Ra, by adding 15 percent to the specified flexural strength, R.

PART 3 EXECUTION

3.1 PREPARATION FOR PAVING

Before commencing paving, perform the following actions to prepare for paving operations. If used, place cleaned, coated, and adequately supported forms. Have any reinforcing steel needed at the paving site; all transporting and transfer equipment ready for use, clean, and free of hardened concrete and foreign material; equipment for spreading, consolidating, screeding, finishing, and texturing concrete at the paving site, clean and in proper working order; and all equipment and material for curing and for protecting concrete from weather or mechanical damage at the paving site, in proper working condition, and in sufficient amount for the entire placement.

3.1.1 Weather Precaution

When windy conditions during paving appear probable, have equipment and material at the paving site to provide windbreaks, shading, fogging, or other action to prevent plastic shrinkage cracking or other damaging drying of the concrete. During these conditions, record and report the evaporation rate hourly.

3.1.2 Proposed Techniques

Submit placing and protection methods; paving sequence; jointing pattern; data on curing equipment and profilographs; repair in accordance with paragraph REPAIR, REMOVAL AND REPLACEMENT OF NEWLY CONSTRUCTED SLABS, demolition of existing pavements, as specified; pavement diamond grinding equipment and procedures. Submit for approval the following items:

a. Pavement demolition work plan, presenting the proposed methods and equipment to remove existing pavement and protect pavement to remain in place.

b. A description of the placing and protection methods proposed when concrete is to be placed in or exposed to hot, cold, or inclement weather conditions

c. A detailed paving sequence plan and proposed paving pattern showing

all planned construction joints; transverse and longitudinal dowel bar spacing; and identifying pilot lanes, fill-in lanes, and hand placement areas. Include stationing for reference to all sampling and testing performed. Deviations from the jointing pattern shown on the drawings are not allowed without written approval of the design engineer.

d. Plan and equipment proposed to control alignment of sawn joints within the specified tolerances.

e. Data on the curing equipment, media and methods to be used.

f. Data on profilograph and methods to measure pavement smoothness.

g. A description of the equipment and methods to be used for grinding and repairs.

3.2 CONDITIONING OF UNDERLYING MATERIAL

3.2.1 General Procedures

Confirm the underlying material upon which concrete is to be placed is clean, damp, and free from debris, waste concrete or cement, frost, ice, and standing or running water. Prior to setting forms or placement of concrete, confirm the underlying material is well drained and has been satisfactorily graded and uniformly compacted in accordance with the applicable contract documents. Test the surface of the underlying material to crown, elevation, and density in advance of setting forms or of concrete placement using slip-form techniques. Trim high areas to proper elevation. Fill and compact low areas to a condition similar to that of surrounding grade, or fill with concrete monolithically with the pavement. Low areas filled with concrete are not to be cored for thickness to avoid biasing the average thickness used for evaluation and payment adjustment. Rework and compact any underlying material disturbed by construction operations to specified density immediately in front of the paver. If a slipform paver is used, continue the same underlying material beyond the edge of the lane a sufficient distance to provide a suitable trackline for the slipform paver and firm support for the edge of the paving lane.

3.2.2 Traffic on Underlying Material

After the underlying material has been prepared for concrete placement, equipment is not permitted thereon with exception of the paver. Subject to specific approval, crossing of the prepared underlying material at specified intervals for construction purposes may be permitted, provided rutting or indentations do not occur. Rework and repair the surface before concrete is placed. Transporting equipment is not to be allowed to operate on the prepared and compacted underlying material in front of the paver-finisher.

3.3 WEATHER LIMITATIONS

3.3.1 Placement and Protection During Inclement Weather

Do not commence placing operations when heavy rain or other damaging weather conditions appear imminent. At all times when placing concrete, maintain on-site sufficient waterproof cover and means to rapidly place it over all unhardened concrete or concrete that might be damaged by rain.

Immediately cover and protect all unhardened concrete from rain or other damaging weather. Suspend placement of concrete whenever rain, high winds, or other weather commences to damage the surface or texture of the placed unhardened concrete, washes cement out of the concrete, or changes the water content of the surface concrete.

Remove and replace any slab damaged by rain or other weather, as defined in paragraph Weak Surfaces, full depth, by full slab width, to the nearest original joint as specified in paragraph REPAIR, REMOVAL AND REPLACEMENT OF NEWLY CONSTRUCTED SLABS, at no expense to the Government.

3.3.2 Paving in Hot Weather

Prepare for hot weather paving in accordance with ACI 305R. When the ambient temperature during paving is expected to exceed 90 degrees F, properly place and finish the concrete in accordance with procedures previously submitted, approved, and as specified herein. Provide concrete that does not exceed the temperature shown in Table 14 below when measured in accordance with ASTM C1064/C1064M at the time of delivery. Cool the mixing water or aggregates or place in the cooler part of the day to obtain an adequate placing temperature. Cool steel forms and reinforcing as needed to maintain steel temperatures below 120 degrees F. Cool or protect transporting and placing equipment if necessary to maintain proper concrete placing temperature. Keep the finished surfaces of the newly laid pavement damp by applying a fog spray (mist) with approved spraying equipment until the pavement is covered by the curing medium.

TABLE 15

Maximum Allowable Concrete Placing Temperature

Relative Humidity, Percent, During Time of Concrete Placement	Maximum Allowable Concrete Temperature in Degrees F
Greater than 60	90
55-60	85
Less than 55	75

3.3.3 Prevention of Plastic Shrinkage Cracking

During weather with low humidity, and particularly with high temperature and appreciable wind, develop and institute measures to prevent plastic shrinkage cracks from developing. If plastic shrinkage cracking occurs, halt further placement of concrete until protective measures are in place to prevent further cracking. Periods of high potential for plastic shrinkage cracking can be anticipated by use of ACI 305R. In addition to the protective measures specified in the previous paragraph, further protect the concrete placement by erecting shades and windbreaks and by applying fog sprays of water, the addition of monomolecular films, or wet covering. If monomolecular films are used, apply only after finishing is complete, do not use in the finishing process, and follow manufacturer recommendations. Immediately commence curing procedures when such water treatment is stopped. Repair plastic shrinkage cracks in accordance with paragraph REPAIR, REMOVAL AND REPLACEMENT OF NEWLY CONSTRUCTED SLABS. Never trowel over or fill plastic shrinkage cracks with slurry.

3.3.4 Paving in Cold Weather

Cold weather paving is required to conform to ACI 306R. Use special protection measures, as specified herein, if freezing temperatures are anticipated or occur before the expiration of the specified curing period. Do not begin placement of concrete unless the ambient temperature is at least 35 degrees F and rising. Thereafter, halt placement of concrete whenever the ambient temperature drops below 40 degrees F. When the ambient temperature is less than 50 degrees F, the temperature of the concrete when placed is required to be not less than 50 degrees F nor more than 75 degrees F. Provide heating of the mixing water or aggregates as required to regulate the plastic concrete temperature. Provide materials entering the mixer that are free from ice, snow, or frozen lumps. Do not incorporate salt, chemicals or other materials in the concrete to prevent freezing. Provide covering and other means for maintaining the concrete at a temperature of at least 10 degrees C 50 degrees F for not less than 72 hours after placing, and at a temperature above freezing for the remainder of the curing period as defined in paragraph Protection of Concrete. Remove pavement slabs, full depth by full width, damaged by freezing or falling below freezing temperature to the nearest planned joint, and replace as specified in paragraph REPAIR, REMOVAL AND REPLACEMENT OF NEWLY CONSTRUCTED SLABS, at no expense to the Government.

3.4 CONCRETE PRODUCTION

Maintain a continuous, uniform forward movement of the paver of not less than 2.5 feet per minute. Provide batching, mixing, and transporting equipment with a capacity sufficient to meet this production rate. Deposit concrete transported in non-agitating equipment in front of the paver within 45 minutes from the time cement has been charged into the mixing drum, except that if the ambient temperature is above 90 degrees F, the time is reduced to 30 minutes. Deposit concrete transported in truck mixers in front of the paver within 90 minutes from the time cement has been charged into the mixer drum of the plant or truck mixer. Truck mixers are not allowed for mixing or transporting slipformed paving concrete. If the ambient temperature is above 90 degrees F, the time is reduced to 60 minutes. Accompany every load of concrete delivered to the paving site with a batch ticket from the operator of the batching plant. Provide batch ticket information required by ASTM C94/C94M on approved forms. In addition provide design quantities in mass or volume for all materials, batching tolerances of all materials, mixture batching time, and design and actual water cementitious materials ratio on each batch delivered, the water meter and revolution meter reading on truck mixers and the time of day on all batch tickets. Provide batch tickets for each truck delivered as part of the lot acceptance package to the placing foreman to maintain on file and deliver them to the Government weekly.

3.4.1 Batching and Mixing Concrete

Remove any equipment which fails to perform as specified immediately from use until properly repaired and adjusted or replaced.

3.4.2 Transporting and Transfer - Spreading Operations

Operate non-agitating equipment only on smooth roads and for haul time less than 30 minutes. Deposit concrete as close as possible to its final position in the paving lane using a transfer-spreader. Operate all equipment to discharge and transfer concrete without segregation. Dumping of concrete in discrete piles is not permitted. No transfer or spreading

operation which requires the use of front-end loaders, dozers, or similar equipment to distribute the concrete is permitted. No equipment is permitted to operate on the grade in front of the paver.

3.5 PAVING

3.5.1 General Requirements

Construct pavement with paving and finishing equipment utilizing rigid fixed forms or by use of slipform paving equipment. Provide paving and finishing equipment and procedures resulting in paving lanes of the required width at a rate of at least 2.5 feet of paving lane per minute on a routine basis. Control paving equipment and its operation, and coordinate with all other operations, such that the paver-finisher has a continuous forward movement at a reasonably uniform speed from beginning to end of each paving lane, except for inadvertent equipment breakdown. Backing the paver and refinishing a lane is not permitted. Remove and replace concrete refinished in this manner. Failure to achieve a continuous forward motion requires halting operations, and modifying procedures, equipment, or mix proportions to achieve this requirement. Personnel are not permitted to walk or operate in the plastic concrete at any time. Select paving equipment and procedures which operate properly on the underlying material without causing displacement or other damage.

3.5.2 Consolidation

Consolidate concrete with the specified type of lane-spanning, gang-mounted, mechanical, immersion type vibrating equipment mounted in front of the paver, supplemented, in rare instances as specified, by hand-operated vibrators. Insert vibrators into the concrete to a depth that provides the best full-depth consolidation but not closer to the underlying material than 2 inches. Excessive vibration is not permitted. If vibrators cause visible tracking in the paving lane, discontinue paving operations until equipment and operations have been modified to prevent it. Consolidate concrete in small, odd-shaped slabs or in isolated locations inaccessible to the gang-mounted vibration equipment with an approved hand-operated immersion vibrator operated from a bridge spanning the area. Do not use vibrators to transport or spread the concrete. Do not operate hand-operated vibrators in the concrete at one location for more than 20 seconds. Insert hand-operated vibrators between 6 to 15 inches on centers. For each paving train, provide at least one additional vibrator spud, or sufficient parts for rapid replacement and repair of vibrators at the paving site at all times. Any evidence of inadequate consolidation (honeycomb along the edges, large air pockets, or any other evidence) requires the immediate stopping of the paving operation and approved adjustment of the equipment or procedures.

3.5.3 Operation

When the paver approaches a header at the end of a paving lane, maintain a sufficient amount of concrete ahead of the paver to provide a roll of concrete which spills over the header. Provide a sufficient amount of extra concrete to prevent any grout that is formed and carried along ahead of the paver from being deposited adjacent to the header. Maintain the spud vibrators in front of the paver at the desired depth as close to the header as possible before they are lifted. Provide additional consolidation adjacent to the headers by hand-manipulated vibrators. When the paver is operated between or adjacent to previously constructed pavement (fill-in lanes), provide provisions to prevent damage to the

adjacent pavement. Electronically control screeds or extrusion plates so as to prevent them from applying pressure to the existing pavement and to prevent abrasion of the pavement surface. Maintain the overlapping area of existing pavement surface completely free of any loose or bonded foreign material as the paver-finisher operates across it. Pavers using transversely oscillating screeds are not allowed to form fill-in lanes that have widths less than a full width for which the paver was designed or adjusted.

3.5.4 Required Results

Adjust and coordinate the paver-finisher, its gang-mounted vibrators, and operating procedures with the concrete mixture being used, to produce a thoroughly consolidated slab throughout that is true to line and grade within specified tolerances. Provide a paver-finishing operation that produces a surface finish with a minimum, isolated amount of irregularities, tears, voids of any kind, and any other discontinuities in a single pass across the pavement; multiple passes are not permitted. Provide equipment and its operation that produce a finished surface requiring no hand finishing other than the use of cutting straightedges, except in very infrequent instances. Stop paving if any equipment or operation fails to produce the above results. Prior to recommencing paving, properly adjust or replace the equipment, modify the operation, or modify the mixture proportions, in order to produce the required results. No water, other than fog sprays (mist) as specified in paragraph Prevention Of Plastic Shrinkage Cracking above, is allowed to be applied to the concrete or the concrete surface during paving and finishing.

3.5.5 Fixed Form Paving

Provide paving equipment for fixed-form paving and operation that conforms to the requirements of paragraph EQUIPMENT, and all requirements specified herein.

3.5.5.1 Forms for Fixed-Form Paving

a. Provide straight forms made of steel and in sections not less than 10 feet in length that are clean and free of rust or other contaminants. Seal any holes or perforations in forms prior to paving unless otherwise permitted. Maintain forms in place and passable by all equipment necessary to complete the entire paving operation without need to remove horizontal form supports. Provide flexible or curved forms of proper radius for curves of 100-foot radius or less. Provide wood forms for curves and fillets made of well-seasoned, surfaced plank or plywood, straight, and free from warp or bend that have adequate strength and are rigidly braced. Provide forms with a depth equal to the pavement thickness at the edge. Where the project requires several different slab thicknesses, build up forms by bolting or welding a tubular metal section or by bolting wood planks to the bottom of the form to completely cover the underside of the base of the form and provide an increase in depth of not more than 25 percent. Provide forms with the base width of the one-piece or built-up form not less than eight-tenths of the vertical height of the form, except provide forms 8 inches or less in vertical height with a base width not less than the vertical height of the form. Provide forms with maximum vertical deviation of top of any side form, including joints, not varying from a true plane more than 1/8 inch in 10 feet, and the upstanding leg not varying more than 1/4 inch.

b. Provide form sections that are tightly locked and free from play or movement in any direction. Provide forms with adequate devices for secure settings so that when in place they withstand, without visible spring or settlement, the impact and vibration of the consolidating and finishing equipment.

c. Set forms for full bearing on foundation for entire length and width and in alignment with edge of finished pavement. Support forms during entire operation of placing, consolidation, and finishing so that forms do not deviate vertically more than 0.01 foot from required grade and elevations indicated. Check conformity to the alignment and grade elevations shown on the drawings and make necessary corrections immediately prior to placing the concrete. Clean and oil the forms each time before concrete is placed. Concrete placement is not allowed until setting of forms has been checked and approved by the CQC team.

d. Do not anchor guide rails for fixed form pavers into new concrete or existing concrete to remain.

3.5.5.2 Form Removal

Keep forms in place at least 12 hours after the concrete has been placed. When conditions are such that the early strength gain of the concrete is delayed, leave the forms in place for a longer time. Remove forms by procedures that do not damage the concrete. Do not use bars or heavy metal tools directly against the concrete in removing the forms. Promptly repair any concrete found to be defective after form removal, using procedures specified or as directed.

3.5.6 Slipform Paving

3.5.6.1 General

Provide paving equipment for slipform paving and the operation thereof that conforms to the requirement of paragraph EQUIPMENT, and all requirements specified herein. Provide a slipform paver capable of shaping the concrete in one pass to the specified and indicated cross section, meeting all tolerances, with a surface finish and edges that require only a very minimum isolated amount of hand finishing. If the paving operation does not meet the above requirements and the specified tolerances, immediately stop the operation and modify any equipment, paving procedures, or the concrete mix in order to resolve the problem. Provide a slipform paver that is automatically electronically controlled from a taut guideline for horizontal alignment and on both sides from a taut guideline for vertical alignment, except that electronic control from a ski operating on a previously constructed adjoining lane is required where applicable for either or both sides. Automatic, electronic controls are required for vertical alignment on both sides of the lane. Control from a slope-adjustment control or control operating from the underlying material is not allowed. Properly adjust side forms on slipform pavers so that the finished edge of the paving lane meets all specified tolerances. Install dowels in longitudinal construction joints as specified below. The installation of these dowels by dowel inserters attached to the paver or by any other means of inserting the dowels into the plastic concrete is not permitted.

3.5.6.2 Guideline for Slipform Paving

Accurately and securely install guidelines well in advance of concrete placement. Provide supports at necessary intervals to eliminate all sag in the guideline when properly tightened. Provide guideline consisting of high strength material designed for use as a paving guideline with sufficient tension to remove all sag between supports. Provide supports that are securely staked to the underlying material or make other provisions to keep the supports from displacing when the guideline is tightened or when the guideline or supports are accidentally touched by workmen or equipment during construction. Provide appliances for attaching the guideline to the supports that are capable of easy adjustment in both the horizontal and vertical directions. When it is necessary to leave gaps in the guideline to permit equipment to use or cross underlying material, provide provisions for quickly and accurately replacing the guideline without any delay to the forward progress of the paver. Provide supports on either side of the gap that are secured in such a manner as to avoid disturbing the remainder of the guideline when the portion across the gap is positioned and tightened. Check the guideline across the gap and adjacent to the gap for a distance of 200 feet for horizontal and vertical alignment after the guideline across the gap is tightened. Provide vertical and horizontal positioning of the guideline such that the finished pavement conforms to the alignment and grade elevations shown on the drawings within the specified tolerances for grade and smoothness. The specified tolerances are intended to cover only the normal deviations in the finished pavement that occur under good supervision and do not apply to setting of the guideline. Set the guideline true to line and grade.

3.5.6.3 Stringless Technology

If the use of any type of stringless technology is proposed, submit a detailed description of the system and perform a trial field demonstration at least one week prior to start of paving. Approval of the control system will be based on the results of the demonstration and on continuing satisfactory operation during paving.

3.5.7 Placing Reinforcing Steel

Provide the type and amount of steel reinforcement indicated. Regardless of placement procedure, provide reinforcing steel free from coatings which could impair bond between the steel and concrete, with reinforcement laps as indicated. Regardless of the equipment or procedures used for installing reinforcement, adequately consolidate the entire depth of concrete. Install steel reinforcement at the required elevation within a tolerance of plus of minus 1/2 inch.

3.5.7.1 Pavement Thickness Greater Than 12 inches

For pavement thickness of 12 inches or more, place an initial lift of concrete on the underlying material to the required elevation of the steel reinforcement, consolidate the initial lift of concrete, place the steel reinforcement upon the surface of the initial lift, place a second lift of concrete to final grade, consolidate, and finish in the required manner. When placement of the second lift causes the steel reinforcement to be displaced horizontally from its original position, provide provisions for increasing the thickness of the initial lift and depressing the steel reinforcement into the unhardened concrete to the required elevation. Limit the increase in thickness only as necessary to permit correct

horizontal alignment to be maintained. Remove and replace any portions of the initial lift of concrete that have been placed more than 30 minutes without being covered with the second lift with newly mixed concrete without additional cost to the Government.

3.5.8 Placing Dowels

Provide a method to install and hold dowels in position that meets the tolerances for location, alignment, and spacing of Table 15. Do not place longitudinal dowels closer than 0.6 times the dowel bar length to the planned joint line. If the last regularly spaced longitudinal dowel is closer than that dimension, move it away from the joint to a location 0.6 times the dowel bar length, but not closer than 6 inches to its nearest neighbor. Resolve dowel interference at a transverse joint-longitudinal joint intersection by deleting the closest transverse dowel. Do not position the end of a transverse dowel closer than 12 inches from the end of the nearest longitudinal dowel. Install dowels as specified in the following subparagraphs.

TABLE 16

DOWEL ALIGNMENT TOLERANCES

Dowel Measurement	Tolerance
Horizontal alignment (a)	Maximum of 1/8 inch per foot after the pavement has been completed
Vertical alignment (b)	Maximum of 1/8 inch per foot after the pavement has been completed
Horizontal spacing	plus or minus 5/8 inch, except as otherwise specified above
Vertical location on the face of the slab	plus or minus 1/2 inch

(a) Check horizontal alignment perpendicular to the joint edge with a framing square.

(b) Measure the vertical alignment of the dowels parallel to the designated top surface of the pavement, except for those across the crown or other grade change joints. Measure dowels across crowns and other joints at grade changes to a level surface.

3.5.8.1 Contraction Joints

Securely hold dowels in longitudinal and transverse contraction joints within the paving lane in place, as indicated, by means of rigid metal frames or basket assemblies of an approved type. Securely hold the basket assemblies in the proper location by means of suitable pins or anchors. Do not cut or crimp the dowel basket tie wires.

3.5.8.2 Construction Joints-Fixed Form Paving

Install dowels by the bonded-in-place method or the drill-and-dowel method. Installation by removing and replacing in preformed holes is not permitted. Prepare and place dowels across joints where indicated, correctly aligned, and securely held in the proper horizontal and vertical position during placing and finishing operations, by means of devices fastened to the forms. Provide the spacing of dowels in construction joints as indicated, except that, where the planned spacing cannot be maintained because of form length or interference with form braces, provide closer spacing with additional dowels.

3.5.8.3 Dowels Installed in Hardened Concrete

Install dowels in hardened concrete by bonding the dowels into holes drilled into the hardened concrete. Before drilling commences, cure the concrete for 7 days or until it has reached a minimum field cured compressive strength of 2500 psi. Drill holes 1/8 inch greater in diameter than the dowels into the hardened concrete using rotary-core drills. Rotary-percussion drills are permitted, provided that excessive spalling does not occur at the concrete joint face. Excessive spalling is defined as spalling deeper than 1/4 inch from the joint face or 1/2 inch radially from the outside of the drilled hole. Continuing damage requires modification of the equipment and operation. Drill depth of dowel hole within a tolerance of plus or minus 1/2 inch of the half length of the embedded dowel. Upon completion of the drilling operation, blow out the dowel hole with oil-free, compressed air. Bond dowels in the drilled holes using epoxy resin. Inject epoxy resin at the back of the hole before installing the dowel and extrude to the collar during insertion of the dowel so as to completely fill the void around the dowel. Application by buttering the dowel is not permitted. Hold the dowels in alignment at the collar of the hole, after insertion and before the grout hardens, by means of a suitable metal or plastic grout retention ring fitted around the dowel. Provide dowels required between new and existing concrete in holes drilled in the existing concrete, all as specified above.

3.5.8.4 Lubricating Dowel Bars

Wipe clean the portion of each dowel intended to move within the concrete and coat with a thin, even film of lubricating oil or light grease before the concrete is placed. Form oil is not acceptable.

3.6 FINISHING

Provide finishing operations as a continuing part of placing operations starting immediately behind the paver. Provide finishing by the machine method. Hand finishing requirements are specifed in paragraph HAND FINISHING. Provide the sequence of operations consisting of transverse finishing, longitudinal machine floating if used, straightedge finishing, texturing, and then edging of joints. Provide a work bridge as necessary for consolidation and hand finishing operations. Use the hand method only on isolated areas of odd slab widths or shapes and in the event of a breakdown of the mechanical finishing equipment. Keep supplemental hand finishing for machine finished pavement to an absolute minimum. Immediately stop any machine finishing operation which requires appreciable hand finishing, other than a moderate amount of straightedge finishing. Prior to recommencing machine finishing, properly adjust or replace the equipment. Immediately halt any operations which produce more than 1/8 inch of mortar-rich surface (defined in paragraph Weak Surfaces)

and modify the equipment, mixture, or procedures as necessary. Compensate for surging behind the screeds or extrusion plate and settlement during hardening and adjust the paving and finishing machines so that the finished surface of the concrete (not just the cutting edges of the screeds) is at the required line and grade. Maintain finishing equipment and tools clean and in an approved condition. Water is not allowed to be added to the surface of the slab with the finishing equipment or tools, or in any other way, except for fog (mist) sprays specified to prevent plastic shrinkage cracking.

3.6.1 Machine Finishing With Fixed Forms

Replace machines that cause displacement of the forms. Only one pass of the fixed form finishing machine is allowed over each area of pavement. If the equipment and procedures do not produce a surface of uniform texture, true to grade, in one pass, immediately stop the operation and adjust the equipment, mixture, and procedures as necessary.

3.6.2 Machine Finishing with Slipform Pavers

Operate the slipform paver so that only a very minimum of additional finishing work is required to produce pavement surfaces and edges meeting the specified tolerances. Immediately modify or replace any equipment or procedure that fails to meet these specified requirements as necessary. A non-rotating pipe float can be used while the concrete is still plastic, to remove minor irregularities and score marks. Only one pass of the pipe float is allowed. If there is concrete slurry or fluid paste on the surface that runs over the edge of the pavement, immediately stop the paving operation and modify the equipment, mixture, or operation to prevent formation of such slurry. Immediately remove any slurry which runs down the vertical edges by hand, using stiff brushes or scrapers. Slurry, concrete or concrete mortar is not allowed to build up along the edges of the pavement to compensate for excessive edge slump, either while the concrete is plastic or after it hardens.

3.6.3 Surface Correction and Testing

After all other finishing is completed but while the concrete is still plastic, eliminate minor irregularities and score marks in the pavement surface by means of cutting straightedges. Provide cutting straightedges with a minimum length of 12 feet that are operated from the sides of the pavement or from bridges. Provide cutting straightedges operated from the side of the pavement equipped with a handle 3 feet longer than one-half the width of the pavement. Test the surface for trueness with a straightedge held in successive positions parallel and at right angles to the center line of the pavement, and cover the whole area to detect variations. Advance the straightedge along the pavement in successive stages of not more than one-half the length of the straightedge. Immediately fill depressions with freshly mixed concrete, strike off, consolidate with an internal vibrator, and refinish. Strike off projections above the required elevation and refinish. Continue the straightedge testing and finishing until the entire surface of the concrete is free from observable departure from the straightedge and conforms to the surface requirements specified in paragraph SURFACE SMOOTHNESS. This straightedging is not allowed to be used as a replacement for the straightedge testing of paragraph SURFACE SMOOTHNESS. Use long-handled, flat bull floats very sparingly and only as necessary to correct minor, scattered surface defects. If frequent use of bull floats is necessary, stop the paving operation and adjust the equipment, mixture

or procedures to eliminate the surface defects. Keep finishing with hand floats and trowels to the absolute minimum necessary. Take extreme care to prevent overfinishing joints and edges. Produce the surface finish of the pavement essentially by the finishing machine and not by subsequent hand finishing operations. All hand finishing operations are subject to approval.

3.6.4 Hand Finishing

Use hand finishing operations only as specified below. Provide a work bridge to be used as necessary for consolidation and placement operations to avoid standing in concrete.

3.6.4.1 Equipment and Template

In addition to approved mechanical internal vibrators for consolidating the concrete, provide a strike-off and tamping template and a longitudinal float for hand finishing. Provide a template at least 1 foot longer than the width of pavement being finished, of an approved design, and sufficiently rigid to retain its shape, that is constructed of metal or other suitable material shod with metal. Provide a longitudinal float at least 10 feet long, of approved design, that is rigid and substantially braced to maintain a plane surface on the bottom. Grate tampers (jitterbugs) are not allowed.

3.6.4.2 Finishing and Floating

As soon as the plastic concrete is placed and consolidated, strike off the concrete and screed to the cross section and to such elevation above grade that when consolidated and finished, the surface of the pavement is at the required elevation. Immediately following the final tamping of the surface, float the pavement longitudinally from bridges resting on the side forms and spanning but not touching the concrete. Do not advance the floating operation more than half the length of the float and continue over the new and previously floated surfaces.

3.6.5 Texturing

Before the surface sheen has disappeared and before the concrete hardens or curing compound is applied, texture the surface of the pavement as described herein. After the curing period is complete, thoroughly power broom all textured surfaces to remove all debris.

3.6.5.1 Burlap Drag Surface

Apply surface texture by dragging the surface of the pavement, in the direction of the concrete placement, with an approved burlap drag. Operate the drag with the fabric moist, and maintain the fabric clean. Change as required to keep clean. Perform the dragging so as to produce a uniform finished surface having a fine sandy texture without disfiguring marks.

3.6.6 Edging

Before texturing has been completed, carefully finish the edge of the slabs along the forms, along the edges of slipformed lanes, and at the joints with an edging tool to form a smooth rounded surface of 1/8 inch radius. Eliminate tool marks, and provide edges that are smooth and true to line. Water is not allowed to be added to the surface during edging.

Take extreme care to prevent overworking the concrete.

3.6.7 Pavement Penetrations

Construct recesses for the tie-down anchors, lighting fixtures, and other outlets in the pavement to conform to the details and dimensions shown. Carefully finish the concrete in these areas to provide a surface of the same texture as the surrounding area that is within the requirements for plan grade and surface smoothness.

3.7 CURING

3.7.1 Protection of Concrete

Continuously protect concrete against loss of moisture and rapid temperature changes for at least 7 days from the completion of finishing operations. Have all equipment needed for adequate curing and protection of the concrete on hand and ready for use before actual concrete placement begins. If any selected method of curing does not afford the proper curing and protection against concrete cracking, remove or replace the damaged pavement, and provide another method of curing as directed. Accomplish curing by one of the following methods.

3.7.2 Membrane Curing

Apply a uniform coating of white-pigmented, membrane-forming, curing compound to the entire exposed surface of the concrete as soon as the free water has disappeared from the surface after finishing. Apply immediately along the formed edge faces after the forms are removed. Do not allow the concrete to dry before the application of the membrane. If any drying has occurred, moisten the surface of the concrete with a fine spray of water, and apply the curing compound as soon as the free water disappears. Apply the curing compound to the finished surfaces by means of an approved automatic spraying machine. Apply the curing compound with an overlapping coverage that provides a two-coat application at a coverage of 400 square feet per gallon, plus or minus 5.0 percent for each coat. A one-coat application is allowed provided it is applied in a uniform application and coverage of 200 square feet per gallon, plus or minus 5.0 percent is obtained. The application of curing compound by hand-operated, mechanical powered pressure sprayers is permitted only on odd widths or shapes of slabs and on concrete surfaces exposed by the removal of forms. When the application is made by hand-operated sprayers, apply a second coat in a direction approximately at right angles to the direction of the first coat. If pinholes, abrasions, or other discontinuities exist, apply an additional coat to the affected areas within 30 minutes. Respray curing compound to concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied. Within the curing period, immediately respray areas where the curing compound is damaged by subsequent construction operations. During the entire curing period, adequately protect membrane-cured concrete surfaces from pedestrian and vehicular traffic, except as required for joint-sawing operations and surface tests, and from any other possible damage to the continuity of the membrane.

3.8 JOINTS

3.8.1 General Requirements for Joints

Construct joints that conform to the locations and details indicated and

are perpendicular to the finished grade of the pavement. Provide joints that are straight and continuous from edge to edge or end to end of the pavement with no abrupt offset and no gradual deviation greater than 1/2 inch. Where any joint fails to meet these tolerances, remove and replace the slabs adjacent to the joint at no additional cost to the Government. Changes from the jointing pattern shown on the drawings are not allowed without written approval. Seal joints immediately following curing of the concrete or as soon thereafter as weather conditions permit as specified in Section 32 01 19.61 SEALING OF JOINTS IN RIGID PAVEMENT and 32 13 73.19 COMPRESSION CONCRETE PAVING JOINT SEALANT.

3.8.2 Longitudinal Construction Joints

Install dowels in the longitudinal construction joints, or thicken the edges as indicated. Install dowels as specified above. After the end of the curing period, saw longitudinal construction joints to provide a reservoir at the top for sealant conforming to the details and dimensions indicated.

3.8.3 Transverse Construction Joints

Install transverse construction joints at the end of each day's placing operations and at any other points within a paving lane when concrete placement is interrupted for 30 minutes or longer. Provide transverse construction joints by utilizing headers or by paving through the joint, then full-depth sawcutting the excess concrete. Construct pavement with the paver as close to the header as possible, with the paver run out completely past the header. Provide transverse construction joints at a planned transverse joint constructed as shown or, if not shown otherwise, dowelled in accordance with paragraph DOWELS INSTALLED IN HARDENED CONCRETE, or paragraph FIXED FORM PAVING above.

3.8.4 Expansion Joints

Provide expansion joints where indicated, and about any structures and features that project through or into the pavement, using joint filler of the type, thickness, and width indicated, and installed to form a complete, uniform separation between the structure and the pavement or between two pavements. Attach the filler to the original concrete placement with adhesive and mechanical fasteners and extending to the full slab depth. Tightly fit adjacent sections of filler together, with the filler extending across the full width of the paving lane or other complete distance in order to prevent entrance of concrete into the expansion space. Finish edges of the concrete at the joint face with an edger with a radius of 1/8 inch. After placement and curing of the adjacent slab, sawcut the sealant reservoir depth from the filler.

3.8.5 Contraction Joints

Construct transverse and longitudinal contraction joints by an initial sawcut in the concrete with a 1/8 inch blade to the indicated depth. During sawing of joints, and again 24 hours later, inspect all exposed lane edges for development of cracks below the saw cut, and immediately report results. If there are more than six consecutive uncracked joints after 48 hours, saw succeeding joints 25 percent deeper than originally indicated at no additional cost to the Government. Vary the time of initial sawing depending on existing and anticipated weather conditions to prevent uncontrolled cracking of the pavement. Commence sawing of the joints as soon as the concrete has hardened sufficiently to permit cutting

the concrete without chipping, spalling, or tearing. Inspect the sawed faces of joints for undercutting or washing of the concrete due to the early sawing, and delay sawing if undercutting is sufficiently deep to cause structural weakness or excessive roughness in the joint. Continue the sawing operation as required during both day and night regardless of weather conditions. Saw the joints in the sequence of the concrete placement. Provide adequate lighting for night work. Illumination using vehicle headlights is not permitted. Provide a chalk line or other suitable guide to mark the alignment of the joint. Before sawing a joint, examine the concrete closely for cracks, and do not saw the joint if a crack has occurred near the planned joint location. Discontinue sawing if a crack develops ahead of the saw cut. Immediately after the joint is sawed, thoroughly flush the saw cut and adjacent concrete surface with water and vacuum until all waste from sawing is removed from the joint and adjacent concrete surface. Properly protect the concrete from damage and cure at sawed joints. Tightly seal the top of the joint opening and the joint groove at exposed edges with cord backer rod before the concrete in the region of the joint is resprayed with curing compound, and maintain until removed immediately before sawing the joint sealant reservoir. Respray the surface with curing compound as soon as free water disappears. Seal the exposed saw cuts on the vertical faces of pilot lanes with bituminous mastic or masking tape. After expiration of the curing period, widen the upper portion of the groove by sawing with ganged diamond saw blades to the width and depth indicated for the joint sealer. Center the reservoir over the initial sawcut.

3.8.6 Thickened Edge Joints

Construct thickened edge joints as indicated on the drawings. Grade the underlying material in the transition area as shown and meet the requirements for smoothness and compaction specified for all other areas of the underlying material.

3.9 REPAIR, REMOVAL AND REPLACEMENT OF NEWLY CONSTRUCTED SLABS

3.9.1 General Criteria

Repair or remove and replace new pavement slabs as specified at no cost to the Government. Removal of partial slabs is not permitted. Prior to any repairs, submit a Repair Recommendations Plan detailing areas exceeding the specified limits as well as repair recommendations required to bring these areas within specified tolerances.

3.9.2 Repair of Free Edge Lane Vertical Faces

Repair excessive edge slump and joint face deformation while concrete is in a plastic state by approved methods using forms in accordance with paragraph Forms for Fixed-Form Paving.

3.9.3 Slabs with Cracks

The Government may require cores to be taken over cracks to determine depth of cracking. Drill cores with a minimum diameter of 6 inches, and backfill with an approved concrete mixture. Perform drilling of cores and filling of holes at no expense to the Government. Clean cracks that do not exceed 2 inches in depth; then pressure inject full depth with epoxy resin, Type IV, Grade 1. In lieu of injectable epoxy the following may be used:

a. For cracks of a width less than or equal to 0.015 inch: A High Molecular Weight Methyl Methacrylate (HMWMMA) with a neat monomer viscosity of less than or equal to 50 centipoise and greater than 5 centipoise as measured using ASTM D2196. If measuring the viscosity of a catalyzed or polymerization initiated HMWMMA the viscosity as measured using ASTM D2196 must be less than or equal to 60 centipoise and greater than 5 centipoise.

b. For crack widths greater than 0.015 inch: A HMWMMA with a neat monomer viscosity of less than 300 centipoise as measured using ASTM D2196. The cured surface of the MMA must be flush with the surface of the surrounding PCC Plus or minus 1/16 inch.

c. Do not apply HMWMMA to surfaces larger than 25 square feet prior to 70 days of curing of the PCC. Perform a test section with the HMWMMA product manufacturer's representative present before production application in the presence of the government.

Remove and replace slabs containing cracks deeper than 2 inches.

3.9.4 Removal and Replacement of Full Slabs

Remove new or existing slabs damaged during construction that contain more than 15.0 percent of each longitudinal or transverse joint edge spalled. Where it is necessary to remove full slabs, remove in accordance with paragraph Removal Of Existing Pavement Slab below. Remove and replace full depth, by full width of the slab, and extend to each original joint. Compact and shape the underlying material as specified in the appropriate section of these specifications, clean the surfaces of all four joint faces of all loose material and contaminants, and coat with a double application of membrane forming curing compound as a bond breaker and to protect concrete that has not been cured for at least 7 days. Install dowels of the size and spacing as specified for other joints in similar pavement by epoxy grouting them into holes drilled into the existing concrete using procedures as specified in paragraph PLACING DOWELS, above. Provide dowels for all four edges of the new slab. Cut off original damaged dowels flush with the joint face. Lightly oil or grease protruding portions of new dowels. Place concrete as specified for original construction. Take care to prevent any curing compound from contacting dowels. Prepare and seal the resulting joints around the new slab as specified for original construction.

3.9.5 Repairing Spalls Along Joints

Repair spalls along joints to be sealed to a depth to restore the full joint-face support prior to placing adjacent pavement. Where directed, repair spalls along joints of new slabs, along edges of adjacent existing concrete, and along parallel cracks by first making a vertical saw cut at least 3 inches outside the spalled area and to a depth of at least 2 inches. Provide saw cuts consisting of straight lines forming rectangular areas without sawing beyond the intersecting saw cut. Chip out the concrete between the saw cut and the joint, or crack, to remove all unsound concrete and into at least 1/2 inch of visually sound concrete. Thoroughly clean the cavity thus formed with high pressure water jets supplemented with oil-free compressed air to remove all loose material. Immediately before filling the cavity, apply a prime coat to the dry cleaned surface of all sides and bottom of the cavity, except any joint face. Apply the prime coat in a thin coating and scrub into the surface with a stiff-bristle brush. Provide prime coat for portland cement

repairs consisting of a neat cement grout and for epoxy resin repairs consisting of epoxy resin, Type III, Grade 1. Fill the prepared cavity with material identified in Table 16 based on the cavity volume.

TABLE 17

SPALL REPAIRS

Volume of Prepared Cavity After Removal Operations	Material
less than 0.03 cubic foot	epoxy resin mortar or epoxy resin or latex modified mortar
0.03 cubic foot and 1/3 cubic foot	portland cement mortar
more than 1/3 cubic foot	portland cement concrete or latex modified mortar

Provide portland cement concretes and mortars that consist of very low slump mixtures, 1/2 inch slump or less, proportioned, mixed, placed, consolidated by tamping, and cured, all as directed. Provide epoxy resin mortars made with Type III, Grade 1, epoxy resin, using proportions and mixing and placing procedures as recommended by the manufacturer and approved. Proprietary patching materials may be used, subject to Government approval. Place the epoxy resin materials in the cavity in layers with a maximum thickness of 2 inches. Provide adequate time between placement of additional layers such that the temperature of the epoxy resin material does not exceed 140 degrees F at any time during hardening. Provide mechanical vibrators and hand tampers to consolidate the concrete or mortar. Remove any repair material on the surrounding surfaces of the existing concrete before it hardens. Where the spalled area abuts a joint, provide an insert or other bond-breaking medium to prevent bond at the joint face. For existing joints, seal the bottom contraction crack with backer rod to prevent instrusion of primer or mortar. Saw a reservoir for the joint sealant to the dimensions required for other joints. Thoroughly clean the reservoir and then seal with the sealer specified for the joints. In lieu of sawing, spalls and popouts, less than 6 inches in maximum dimension and not adjacent to a joint, may be prepared by drilling a core 2 inches in diameter greater than the size of the defect, centered over the defect, and 2 inches deep or 1/2 inch into sound concrete, whichever is greater. Repair the core hole as specified above for other spalls.

3.9.6 Weak Surfaces

Weak surfaces are defined as mortar-rich, rain-damaged, uncured, or containing exposed voids or deleterious materials. Rain damaged pavement is pavement with coarse aggregate exposed at the surface. Cores evaluated by a qualified petrographer to contain carbonation to a depth greater than 1/8 inch or Mohs hardness of less than 2, when tested in accordance with ASTM C1895, are also considered rain damaged. A mortar-rich surface is defined as pavement deficient in plus 4.75 mm U.S. No. 4 sieve size aggregate. Diamond grind slabs containing weak surfaces less than 1/4 inch thick to remove the weak surface. Diamond grind in accordance with paragraph Diamond Grinding Of PCC Surfaces. All diamond ground areas are required to meet the thickness, smoothness and plan grade criteria specified in PART 1 GENERAL. Remove and replace slabs containing weak

surfaces greater than 1/4 inch thick.

3.9.7 Repair of Pilot Lane Vertical Faces

Repair excessive edge slump and joint face deformation while concrete is in a plastic state by approved methods.

3.10 EXISTING CONCRETE PAVEMENT REMOVAL AND REPAIR

Demolition of existing operational pavement is not allowed prior to approval of the Proportioning Studies. Remove existing concrete pavement at locations indicated on the drawings. Prior to commencing pavement removal operations, inventory the pavement distresses (cracks, spalls, and corner breaks) along the pavement edge to remain. After pavement removal, survey the remaining edge again to quantify any damage caused by removal operations. Perform both surveys in the presence of the Government. Perform repairs as indicated and as specified herein. Carefully control all operations to prevent damage to the concrete pavement and to the underlying material to remain in place. Perform all saw cuts perpendicular to the slab surface, forming rectangular areas. Perform all existing concrete pavement repairs prior to paving adjacent lanes.

3.10.1 Removal of Existing Pavement Slab

When existing concrete pavement is to be removed and adjacent concrete is to be left in place, perform the first full depth saw cut on the joint between the removal area and adjoining pavement to stay in place with a standard diamond-type concrete saw. Next, perform a full depth saw cut parallel to the joint that is at least 24 inches from the joint and at least 6 inches from the end of any dowels with a wheel saw as specified in paragraph SAWING EQUIPMENT. Remove all pavement beyond this last saw cut in accordance with the approved demolition work plan. Remove all pavement between this last saw cut and the joint line by carefully pulling pieces and blocks away from the joint face with suitable equipment and then picking them up for removal. In lieu of this method, this strip of concrete may be carefully broken up and removed using hand-held jackhammers, 30 lb or less, or other approved light-duty equipment which does not cause stress to propagate across the joint saw cut and cause distress in the pavement which is to remain in place. In lieu of the above specified removal method, the slab may be sawcut full depth to divide it into several pieces and each piece lifted out and removed. Use suitable equipment to provide a truly vertical lift, and safe lifting devices used for attachment to the slab.

3.10.2 Edge Repair

Protect the edge of existing concrete pavement against which new pavement abuts from damage at all times. Remove and replace slabs which are damaged during construction as directed at no cost to the Government. Repair of previously existing damaged areas is considered a subsidiary part of concrete pavement construction. Saw off all exposed keys and keyways full depth.

3.10.2.1 Spall Repair

Repair spalls caused by construction activities if less than 15.0 percent of any slab's edge. Provide repair materials and procedures as previously specified in paragraph, Repairing Spalls Along Joints. Remove and replace full slabs if spalls exceed 15.0 percent of any slab's edge as specified

in paragraph, Removal and Replacement of Full Slabs.

3.10.2.2 Underbreak and Underlying Material

Repair all underbreak by removal and replacement of the damaged slabs in accordance with paragraph REMOVAL AND REPLACEMENT OF FULL SLABS above. Protect the underlying material adjacent to the edge of and under the existing pavement which is to remain from damage or disturbance during removal operations and until placement of new concrete, and shape as directed. Maintain sufficient underlying material in place outside the joint line to completely prevent disturbance of material under the pavement which is to remain in place. Remove and replace any slab with underlying material that is disturbed or loses its compaction.

3.11 PAVEMENT PROTECTION

Exclude traffic from the new pavement by erecting and maintaining barricades and signs until the concrete is at least 14 days old, or for a longer period if so directed. As a construction expedient in paving intermediate lanes between newly paved pilot lanes, operation of the hauling and paving equipment is permitted on the new pavement after the pavement has been cured for 7 days, the joints have been sealed or otherwise protected, the concrete has attained a minimum field cured flexural beam strength of 550 psi and approved means are provided to prevent damage to the slab edge. Fabricate and field cure specimens in accordance with ASTM C31/C31M. Continuously maintain all new and existing pavement carrying construction traffic or equipment completely clean, and clean up spillage of concrete or other materials immediately upon occurrence. Take special care in areas where traffic uses or crosses active airfield pavement. Power broom other existing pavements at least daily when traffic operates. For fill-in lanes, provide equipment that does not damage or spall the edges or joints of the previously constructed pavement. Protect the pavement against all damage prior to final acceptance of the work by the Government. Placement of aggregates, rubble, or other similar construction materials on airfield pavements is not allowed.

3.12 TESTING AND INSPECTION FOR CONTRACTOR QUALITY CONTROL DURING CONSTRUCTION

3.12.1 Testing and Inspection by Contractor

During construction, perform sampling and testing of aggregates, cementitious materials (cement, slag cement, and pozzolan), and concrete to determine compliance with the specifications. Provide facilities and labor for procurement of representative test samples. Furnish sampling platforms and belt templates to obtain representative samples of aggregates from charging belts at the concrete plant. Obtain samples of concrete at the point of delivery to the paver. Testing by the Government in no way relieves the specified testing requirements. Perform the inspection and tests described below, and based upon the results of these inspections and tests, take the action required and submit reports as required. Perform this testing regardless of any other testing performed by the Government, either for pay adjustment purposes or for any other reason. Include stationing for all sampling and testing.

3.12.2 Testing and Inspection Requirements

Perform CQC sampling, testing, inspection and reporting in accordance with

the following Table. Retest aggregate sources and stockpiles in accordance with Table 17 if not used within the previous 3 months.

TABLE 18
TESTING AND INSPECTION REQUIREMENTS

Frequency	Test Method	Control Limit	Corrective Action
Fine Aggregate Gradation and Fineness Modulus			
2 per lot	ASTM C136/C136M sample at belt	9 of 10 tests vary less than 0.15 from average	Retest, resolve, retest
		Outside limits on any sieve	Retest
		2nd gradation failure	Stop, resolve, retest
1 per 10 gradations	ASTM C117	Outside limits on any sieve	Retest
		2nd gradation failure	Stop, repair, retest
Coarse Aggregate Gradation (each aggregate size)			
2 per lot	ASTM C136/C136M sample at belt	Outside limits on any sieve	Retest
		2nd gradation failure	report to COR, correct
		2 consecutive averages of 5 tests outside limits	report to COR, stop ops, repair, retest
1 per 10 gradations	ASTM C117	Outside limits on any sieve	Retest
		2nd gradation failure	report to COR, correct
		2 consecutive averages of 5 tests outside limits	report to COR, stop ops, repair, reverify all operations
Workability Factor and Coarseness Factor Computation			

TABLE 18
TESTING AND INSPECTION REQUIREMENTS

Frequency	Test Method	Control Limit	Corrective Action
Same as C.A. and F.A.	see paragraph AGGREGATES	Use individual C.A. and F.A. gradations. Combine using batch ticket percentages (average of aggregate percentages from 3 before and 3 after sampling). Tolerances: plus or minus 3 points on WF; plus or minus 5 points on CF from approved adjusted mix design values; only the portion of the tolerance box within the parallelogram is available for use	Check batching tolerances, recalibrate scales
		2 consecutive averages of 5 tests outside limits	Stop production paving, report to COR, and revise materials and operations to be in compliance prior to restarting production paving
Aggregate Deleterious, Quality, and ASR Tests			
Every 30 days of concrete production	see paragraph AGGREGATES		Stop production, retest, replace aggregate. Increase testing interval to 90 days if previous 2 tests pass
Plant - Scales, Weighing Accuracy			
Monthly	NRMCA QC 3		Stop plant ops, repair, recalibrate
Plant - Batching and Recording Accuracy			
Weekly	Record/Report	Record required/recorded/actual batch mass	Stop plant ops, repair, recalibrate
Plant - Batch Plant Control			
Every lot	Record/Report		Record type and amount of each material per lot
Plant - Mixer Uniformity - Stationary Mixers			

TABLE 18
TESTING AND INSPECTION REQUIREMENTS

Frequency	Test Method	Control Limit	Corrective Action
Before test section and Every 4 months during paving or Every 6 months when not generating production paving	COE CRD-C 55	After initial approval, use abbreviated method	Increase mixing time, change batching sequence, reduce batch size to bring into compliance. Retest
Plant - Mixer Uniformity - Truck Mixers			
Every 4 months during paving	ASTM C94/C94M	Random selection of truck.	Increase mixing time, change batching sequence, reduce batch size to bring into compliance. Retest
Concrete Mixture - Air Content			
When test specimens prepared plus 2 random per lot	ASTM C231/C231M sample at point of discharge within the paving lane	Individual test control chart: Warning plus or minus 1.0	Adjust AEA, retest
		Individual test control chart: Action plus or minus 1.5	Halt operations, repair, retest
		Range between 2 consecutive tests: Warning plus 2.0	Recalibrate AEA dispenser
		Range between 2 consecutive tests: Action plus 3.0	Halt operations, repair, retest
Concrete Mixture - Unit Weight and Yield			
Same as Air Content	ASTM C138/C138M sample at point of discharge within the paving lane	Individual test basis: Warning Yield minus 0 or plus 1 percent	Check batching tolerances
		Individual test basis: Action Yield minus 0 or plus 5 percent	Halt operations
Concrete Mixture - Slump			

TABLE 18
TESTING AND INSPECTION REQUIREMENTS

Frequency	Test Method	Control Limit	Corrective Action
When test specimens prepared plus 4 random per lot	ASTM C143/C143M sample at point of discharge within the paving lane	Individual test control chart: Upper Warning slipform minus 1/2 inch below max fixed form 1.5 inches hand placement 2.5 inches	Adjust batch masses within max W/C ratio
		Individual test control chart: Upper Action at maximum allowable slump	Stop operations, adjust, retest
		Range between each consecutive test: 1-1/2 inches	Stop operations, repair, retest
Concrete Mixture - Temperature			
When test specimens prepared	ASTM C1064/C1064M sample at point of discharge within the paving lane	See paragraph WEATHER LIMITATIONS	
Concrete Mixture - Strength			
8 per lot	ASTM C31/C31M sample at point of discharge within the paving lane	See paragraph CONCRETE STRENGTH TESTING for CQC Perform fabrication of strength specimens and initial cure outside the paving lane and within 1,000 feet of the sampling point.	
Paving - Inspection Before Paving			
Prior to each paving operation	Report	Inspect underlying materials, construction joint faces, forms, reinforcing, dowels, and embedded items	
Paving - Inspection During Paving			
During paving operation		Monitor and control paving operation, including placement, consolidation, finishing, texturing, curing, and joint sawing.	
Paving - Vibrators			
Weekly during paving	COE CRD-C 521	Test frequency (in concrete), and amplitude (in air), average measurement at tip and head.	Repair or replace defective vibrators.
Moist Curing			
2 per lot, min 4 per	Visual		Repair defects, extend curing by 1 day

TABLE 18
TESTING AND INSPECTION REQUIREMENTS

Frequency	Test Method	Control Limit	Corrective Action
Membrane Compound Curing			
Daily	Visual	Calculate coverage based on quantity/area	Respray areas where coverage defective. Recalibrate equipment
Cold Weather Protection			
Once per day	Visual		Repair defects, report conditions to COR

3.12.3 Control Charts

Maintain linear control charts for fine and coarse aggregate gradation, combined gradation coarseness factor/workability factor, slump, air content, unit weight, yeld, and 7 and 14 day flexural strengths.

Post the control charts as directed and maintain current at all times. Identify the following on the control charts: the project number, the test

parameter being plotted, the individual sample numbers, the Warning and Action Limits listed in Table 17 applicable to the test parameter being plotted, and the test results. Use the control charts as part of the process control system for identifying trends so that potential problems can be corrected before they occur. Make decisions concerning mix modifications based on analysis of the results provided in the control charts.

3.12.4 Concrete Strength Testing for CQC

Perform Contractor Quality Control operations for concrete strength consisting of the following steps:

a. Take samples for strength tests at the paving site. Fabricate and cure test cylinders in accordance with ASTM C31/C31M; test them in accordance with ASTM C39/C39M.

b. Fabricate and cure 2 test cylinders per sublot from the same batch or truckload and at the same time acceptance cylinders are fabricated and test them for compressive strength at 7-day age.

c. Average all 8 compressive tests per lot. Convert this average 7-day compressive strength per lot to equivalent 90-day flexural strength using the Correlation Ratio determined during mixture proportioning studies.

d. Compare the equivalent 90-day flexural strength from the conversion to the required average CQC flexural strength, Ra.

e. If the equivalent average 90-day strength for the lot is below the required average CQC flexural strength, Ra, by 20 psiflexural strength or more, at any time, adjust the mixture to increase the strength, as approved.

f. Fabricate and cure two beams for every 2000 cubic yards of concrete placed. Fabricate and cure in accordance with ASTM C31/C31M; test at 14-days of age in accordance with ASTM C78/C78M. Use the flexural strength results to verify the cylinder-beam acceptance correlation ratio.

g. Maintain up-to-date control charts for strength, showing the 7-day CQC compressive strength, the 14-day compressive strength (from acceptance tests) and the 90-day equivalent flexural strength of each of these for each lot.

3.12.5 Reports

Report all results of tests or inspections conducted as they are completed and in writing daily. Post updated control charts and identify accepted paving lots on the detailed paving sequence paving plan covering the entire period from the start of paving through the current week. These requirements do not relieve the obligation to report failures immediately as required in preceding paragraphs and Section 01 45 00 QUALITY CONTROL. Confirm reports of failures and the corrective action taken in writing in the daily Quality Control reports and within each respective Paving Lot Report. Compile, reduce, analyze and compute pay adjustment factors for all associated test data collected on each paving lot.

Submit complete and comprehensive Paving Lot Reports for the test section and production paving within 16 days after the completion of the placement. Do not place an adjacent or contiguous lane/lot prior to providing required pavement data identified in items a.-y. conforming to the acceptance criteria. Payment will not be made until all required data identified in items a.-y. has been submitted and reviewed by the government. Organize each Paving Lot Report by the following specific items. The list below is not all inclusive. Add tests and inspections as appropriate for each specific paving lot constructed.

Table Summary of payment adjustment factors and pass/fail factors Detailed Placement Plan, labeling lots/sublots with stationing. Identify core locations, and testing locations.

Provide narrative addressing the following at a minimum:

a. Protective Measures: Rain, Cold, Hot and/or windy on-site conditions including evaporation rates, high/low ambient temperature. Post-Production protection and traffic control.
b. Success, failures, and issues encountered during all operations associated with the placement to include, but not limited to, batching, transporting, paving, texturing and curing.Include any process control changes that were necessary to meet specified tolerances.
c. Stockpile Management before and during placement.
d. Initial saw cutting operation to include start and finish times (early entry or wet diamond, flushing and vacuuming, backer rod installation and reapplication of curing compound).
e. Finishing operations (cutting straight-edge, automatic longitudinal float, edging tool, minimal hand work and excess paste).
f. Texturing operations to include start and finish times.
g. Curing operations to include start and finish times.
h. Environmental conditions of initial cure facility to include location and temperatures.
i. Planned correction(s) or correction(s) completed
j. Dowel installation

Provide required inspection documentation for the following at a minimum:

k. Batch Plant, Equipment, and Curing Equipment Verification
l. Dowel Baskets, forms, reinforcing, embeds and block-outs
m. Summary of recent underlying material test results showing compliance. Include information such as submittal numbers or date of daily report(s) where the detailed testing data is located.

Quality Control Testing

n. PCC Plastic Mixture Properties (temperature, air content, slump, unit weight)
o. Aggregate gradation test results and CF-WF plot
p. Control Charts
q. Joint Crack Tracking and Record

Acceptance Testing (before and after corrections)

r. Surface Smoothness test results (straightedge and profilograph) in both longitudinal and transverse directions.
s. Edge Slump test results(identify excessive, lost and rebuilt edge(s)).
t. Joint Face Deformation test results.
u. Plan Grade: table providing x, y, and elevation values versus design values signed by licensed surveyor.
v. Strength: beam/cylinder strength results (with updated correlation

ratios and control chart).

w. Cores: Locations/Stationing of cores shown on Placement Plan, thickness measurements, photos and evaluation of cores.

x. Dowel holes, and dowel alignment

y. Legible copies of batch tickets. Tickets should include all required data, time received, and time discharge completed.

APPENDIX A - METHOD OF TEST FOR OPERATION, CALIBRATION AND OPERATOR CERTIFICATION OF INERTIAL PROFILERS

A. SCOPE

Inertial Profilers are used to measure a longitudinal surface elevation profile of airfield pavements based on an inertial reference system that is mounted on a host vehicle. The devices must be calibrated, and operators certified, to measure profiles for acceptance and verification on projects.

While the below procedures utilize IRI as a means to determine calibration and operator competency, airfield specifications utilize the Profile Index for acceptance testing. If necessary, modify the inertial profiler to allow only a single path sensor. For airfield aspahlt pavements, utilize a high-speed or lightweight inertial profiler with the single path sensor center-mounted on the front or rear bumper. For airfield PCC pavements, utilize only lightweight inertial profilers with the single path sensor side-mounted. For airfield pavements, utilize only stop-and-go inertial profilers.

The following procedures are used to assure the devices are calibrated, and operators are certified to perform profile measurements:

a. Verifying the calibration of an inertial profiling system.

b. Calibration of equipment.

c. Certification of operators.

B. STANDARDS

a. Longitudinal

(1) The longitudinal verification standard will be a straight and level pavement test section of at least 528 feet in length.

(2) Measure this length accurately to within 0.1 feet using a temperature compensated steel survey measurement tape.

b. Vertical (Block Test)

(1) The vertical measurement calibration will be flat plates or gauge blocks 0.25, 0.50, 1.0 and 2.0 inches in thickness.

(2) Mark each block with it's known thickness. Verify the block thickness accurate to within 0.001 inches, utilizing a calibrated digital caliper. Test a smooth base plate and the 0.25, 0.50, 1.0 and 2.0 inches gauge blocks.

c. Vertical (Bounce Test)

(1) The vertical displacement will be measured from flat plates centered on the ground beneath the height sensors.

(2) Performed over a simulated distance of 528 feet. A vertical displacement (bounce) of the vehicle of 1 to 2 inches will be performed.

C. APPARATUS

a. Distance measuring subsystem, accurate to within 1.0 feet per 528 feet measured.

b. Host vehicle, equipped with a dedicated speed channel logger, capable of traveling under 15 miles per hour while collecting pavement profile data using a stop-and-go pavement profile system data.

c. Inertial reference (accelerometer) subsystem, capable of measuring the vertical movement of the host vehicle as it traverses the pavement being tested.

d. Non-contact height measurement (sensor) subsystem, capable of measuring the height from the mounted sensor face to the surface of the pavement being tested.

e. Inertial Profiler

(1) Must include hardware and software capable of storing inertial profiles by combining the data from the inertial referencing system, the distance measuring instrument, and the height sensor.

(2) Must be capable of measuring and storing profile elevations at 1 inch intervals or less and outputting in Picture Publisher File (PPF) format.

(3) Must be capable of measuring and storing host vehicle speed at longitudinal distance intervals of 1 foot or less and outputting data in a format readable by a text editor.

(4) Must have the capability of summarizing the profile elevation data into summary roughness statistics over a section length equal to 0.1 mile.

(5) Must have a design to allow field calibration and verification of calibration for the distance measurement (horizontal) subsystem and the height measurement (vertical) subsystem described in paragraph PROCEDURES.

D. PROCEDURES

a. VERIFYING CALIBRATIONS

(1) The following daily verification procedures is required for Acceptance testing. It is also recommended when an inertial profiler is used as a QC instrument.

(a) Verify the tire air pressure on the wheels of the host vehicle daily and maintain according to the vehicle manufacturer’s recommendations.

(b) Maintain a log with the inertial profiler in accordance with AASHTO R 56.

(c) Longitudinal Verification of Calibration:

1. Perform the longitudinal verification of calibration by navigating the inertial profiler over a measured test

section of 528 feet plus or minus 0.1 feet.

2. Warm up the vehicle tires and electronic systems in accordance with the manufacturer's recommendations. Verify the inertial profilers distance measuring subsystem by measuring the length of the test section to 528 feet plus or minus 1 foot.

3. Adjust the inertial profilers distance measurement system according to the manufacturer's guidelines as required.

(d) Vertical Verification of Calibration

1. (Block) sensor check tests are run after the profiler has reached operational stability as defined by the manufacturer. This test will be conducted with the inertial profiler on a flat and level area. Its purpose is the check the height measurements, in inches from the height sensor(s) of the test vehicle using blocks of known heights. During the test, do not lean on the profiler or cause it to move in any way. Under windy conditions, it may be necessary to perform this test indoors. The test procedure consists of the following steps:

2. Center the smooth base plate under the height sensor of the profiler and allow the system to take height measurements. Zero out the sensors.

3. Center a 0.25 inch block underneath the height sensor on top of the base plate and record the height measurement.

(a) Replace the 0.25 inch block from the base plate with a 0.50 inch block. Record the measurement.

(b) Replace the 0.50 inch block from the base plate with a 1.00 inch block and record the height measurement.

(C) Finally, replace the 1.00 inch block with a 2.00 inch block and record the height measurement.

4. Each inertial profiler must be furnished with their own base plate and gauge blocks. The operator of the profiler will tabulate the gauge block measurements and record them in a calibration log. Determine the difference between each measurement on a gauge block and the base plate to the get thickness of the gauge block as measured by the height sensor. Repeat this calculation for each gauge block. Determine the absolute values of the differences between the computed thickness and the known average block thickness. The absolute differences should be less than or equal to 0.01 inches for each gauge block.

(a) (Bounce) tests are performed by positioning the host vehicle on a flat and level surface. Power the system and ensure the profiler has reached operational stability as specified by the manufacturer. Follow the

manufacturer's recommended procedure for performing the bounce test (The only difference between a bounce test and a normal data collection run is that there is an artificial longitudinal travel signal supplied and the vehicle is not actually traveling along the road. The bounce test utilizes the same data collection software and routines used during normal data collection). See Appendix X1 of AASHTO R 56 for further details concerning the bounce test.

5. Failure to verify the above after two attempts will require adjustments and rescheduling of verification.

b. CALIBRATION EQUIPMENT

It is desireable for the Contractor to follow the below procedures for calibration. In lieu of the below procedure, obtain certification from a State that follows AASHTO R 56 and AASHTO R57.

(1) The inertial profiler must successfully perform and pass verification tests to establish compliance with the minimum requirements for accuracy and repeatability set forth in this procedure. Inertial profilers must be calibrated annually.

(2) Calibration testing may be performed on two test sections, one a jointed plain concrete (JPC) surface and the other a hot mix asphalt (HMA) surface; having been established for the purpose of calibrating Inertial Profilers (IP). IP equipment calibrated for use on HMA surfaces will be tested on the HMA surfaced section, and equipment calibrated for use on JPC surface will be tested on either the HMA surfaced section or on both sections depending upon the availability of the JPC surfaced section.

(3) An 800 ft long section with two-wheel paths has been marked out on each test section. Calibration will be performed on a section 528 ft plus of minus 0.1 ft long within the 800 ft test section. The beginning of the 528 ft calibration section may be adjusted by the Government to establish different profiles for calibration. A minimum 300 ft lead in distance to allow proper "settle" of the inertial profiler's filters and testing speed is required and is available for the test sections. A similar lead-out distance is also available. The ground distance of each test section will be established to within 1 ft.

(4) Two longitudinal lines, identified by painted dots every five feet, have been painted on the test section surfaces 69 in. apart for the 800 ft lengths. Inertial profilers are required to follow these designated paths through each test section. Cones and/or other appropriate material will be used during the calibration procedure to define the start and end locations of the test sections. Ensure that the intended test path is clear of loose material and foreign objects.

(5) Ten repeat runs of the IP must be made on each of the designated test sections in the prescribed direction of measurement. Data collection must be automatically triggered at the starting location of each run of the section and reported so that a longitudinal position of "zero" occurs at the starting location. An automatically detected mark at the end of the section must be

used to verify the DMI repeatability and accuracy.

(6) Test Data – Profile data must be reported in a Picture Publisher File (PPF) format.

(a) During the calibration tests, the same profile is measured for all runs on a given test section.

1. The performance of the profiler is evaluated by analyzing the test data using cross correlation as described in the following sections to establish the repeatability and accuracy for the application of the device. ProVAL software will be used to perform the calculations specified below. The version of the ProVAL software to be used for evaluation will be determined by the calibrating agency.

2. Equipment Repeatability – Evaluate repeatability using cross correlation of the filtered output as described in Section 8.3.1.4 of AASHTO R 56. Calculate the repeatability agreement score of each trace. For single sensor set profilers, one score for each path will be determined. For dual-path profilers, two profiles will be used for each test section. The IRI filter should be used on profiles for cross correlation. On each trace, cross correlate each of the ten profiles to each of the remaining nine. Allow a maximum longitudinal offset of 3 ft. The repeatability agreement score for each trace is the average of all values. Cross correlation shall result in a score of 0.92 or greater.

3. Equipment Accuracy – Evaluate accuracy using cross correlation of the appropriate filtered output as described in Section 8.3.1.4 of AASHTO R 56. On each trace, cross correlate each of the ten profiles to the reference profile. The accuracy agreement score for each trace is the average of the ten individual cross correlation values. Cross correlation must result in a score of 0.90 or greater.

(b) Test data must be submitted with the following file naming convention.

1. The first three characters of the filename are reserved for identifying the profiler tested. This will be given to the operator on the day of testing.

2. The fourth character must be “A” for asphalt or “C” for concrete.

3. The fifth character must be “H” for high speed or “L” for lightweight device.

4. The sixth character shall designate the path tested. “L” for left, “R” for right or “B” for both.

5. The seventh and eighth characters shall designate the run number (01 to 10).

(c) Verification of Computed Ride Statistics (IRI) – Each IRI value should be comparable to the value from the reference profile with an error not greater than 5 percent.

(7) Distance Measurement Index Test – Test the accuracy of the DMI on one of the tests sections.

(a) Distance Measurement Index Test Section – The test section must be the same test section used for the ten repeat runs performed for repeatability and accuracy. The starting and ending points of the test section will be measured to 528 ft +/- 0.1 ft and clearly marked.

(b) Three auto-triggered runs of the candidate inertial profiler shall be made on the designated length of pavement in the prescribed direction of measurement. At the end of each run, record the reading from the profiler’s DMI.

(c) Distance Measurement Index Accuracy – Compute the absolute difference between the DMI readings and the known distance of the path tested for each run. The average of the absolute differences shall be 1.0 ft or less to pass the test.

(8) Test Results – Ensure the results of the calibration tests are documented by the calibration agency. Calibration documentation will include the following:

(a) Identification of the profiler tested (i.e., make, model serial number, software version, owner):

1. Date of last calibration (if applicable)

2. Operator of the profiler.

3. Operator of the profiler.

4. Date of test.

5. Number of paths the profiler can measure in the same run.

6. Filter type, name of the filter program, and the applicable program version number used to evaluate the profiler accuracy.

7. Overall determination from the test: Pass or Fail.

8. Known longitudinal distance of the DMI test section.

9. Average absolute difference between the DMI readings and the known distance, expressed in distance unit and as a percentage of the known longitudinal distance. The following information is to be provided for each trace:

(a) Overall repeatability score.

(b) Overall accuracy score.

(c) The average percent difference of the IRIs computed profiles and those from the reference profile.

(b) The report will also label each test result with a Pass or Fail depending on whether the given test value meets or fails to meet the prescribed criterion. The IP must pass all tests to be calibrated. A decal will be affixed to each accelerometer/sensor unit and a certificate of successful calibration will be issued at successful completion of the calibration procedure.

c. SPECIALIZED RUNS FOR STOP-AND-GO-OPERATION

(1) Perform the additional runs specified here for testing at low speed, during braking, and through stops. These tests are required for profilers that will perform field measurements under “stop and go” conditions. Unless otherwise specified, the provisions in CERTIFICATION EQUIPMENT, parts 1-6and 8 apply. The specialized runs are made for equipment certification only. These runs don’t apply to operator certification.

(2) Cones will be placed beside the test section as landmarks to help profiler drivers achieve the required speed profiles. Place a cone (O - origin) at a location at least 250 ft from the start of the test section and no less than 100 ft from the end of the test section. Place a cone (A) 200 ft upstream of cone O (toward the section start). Place cone (B) 75 ft upstream of cone O (toward the section start). Place a cone (C) 50 ft downstream of cone O (toward the end of the test section).

(3) Three repeat runs of the IP must be made on a designated test section for each of the speed profiles specified (sections a-d) below. The operator may make practice runs under the supervision of the testing agency before the official test passes.

(a) Enter the test section at a speed of at least 30 mph. Maintain a speed of at least 30 mph until cone B is reached. Once cone B is reached,decelerate smoothly (at a constant rate) to a speed of 15 mph or less at cone O. (A change in speed from 30 mph to 15 mph over this distance corresponds to an average deceleration of 0.3 g.) Traverse the rest of the test section at a speed of 15 mph or less.

(b) Enter the test section at a speed of at least 30 mph. Maintain a speed of at least 30 mph until cone A is reached. Once cone A is reached,decelerate to a stop at cone O. (A stop from 30 mph from this distance requires an average deceleration of 0.15 g.) Remain in the location of the stop for at least 30 seconds. After the 30-second wait, accelerate gently (at a constant rate) to 30 mph and continue to traverse the rest of the test section.

(c) Enter the test section at a speed of at least 30 mph. Maintain a speed of at least 30 mph until cone A is reached. Once cone A is reached,decelerate to a stop at cone O. (A stop from 30 mph from this distance requires an average deceleration of 0.15 g.) Proceed from cone O to cone C at a speed of no more than 5 mph. Once cone C is passed,accelerate gently to 30 mph, and continue to traverse the rest of the test section.

(d) Traverse the entire test section at a speed of 3 mph +/- 1 mph.

(4) Follow the naming convention described in CALIBRATION EQUIPMENT, part6b, except for the fourth character. For the fourth character, use “B” for the runs with braking at 0.3 g, use “S” for the runs with a 30-second stop,use “N” for the runs with a stop followed by slow movement, and use “L”for the runs at 3 mph.

(5) Evaluate repeatability and accuracy of the profiles as described in CALIBRATION EQUIPMENT, part 6a. For Stop-and-Go operation, allow a maximum longitudinal offset of 5 ft, and a maximum adjustment to the distance measurement of 0.2 percent.

d. CERTIFICATION OF OPERATOR

(1) Operators of inertial profilers used for project level acceptance testing of pavement ride quality must pass a written and practical proficiency test to be certified to operate an inertial profiler in California. An operator must be certified annually.

-- End of Section --

SECTION 32 13 73.19

COMPRESSION CONCRETE PAVING JOINT SEALANT
11/19

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D412	(2016) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D2628	(1991; R 2016) Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
ASTM D2835	(1989; R 2017) Standard Specification for Lubricant for Installation of Preformed Compression Seals in Concrete Pavements

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 548	(1988) Standard Specification for Jet-Fuel and Heat-Resistant Preformed Polychloroprene Elastomeric Joint Seals for Rigid Pavements

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Equipment; G, RO

Manufacturer's Instructions

SD-04, Samples

Compression Seals; G, RO

SD-06 Test Reports

Test Requirements; G, RO

1.3 QUALITY ASSURANCE

1.3.1 Trial Joint Seal and Lubricant/Adhesive Installation

Prior to the cleaning and sealing of the joints for the entire project, prepare a test section at least 200 ft long at a designated location in the project pavement, using the specified materials and the approved equipment to demonstrate the proposed joint preparation and sealing of the joints in the project. Following the completion of the trial length and before another joint is sealed, the Government will inspect the trial joints to determine that the materials and installation meet the requirements specified. If materials or installation do not meet requirements, remove the materials, and reclean and reseal the joints at no cost to the Government. Do not seal other joints until the test installation has been approved. If the trial section is approved, permit the section to be incorporated into the permanent work. Seal other joints in the manner approved for sealing the trial joint.

1.4 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to the jobsite for defects. Unload and store materials with a minimum of handling to avoid damage. Provide storage facilities that protect materials from weather and maintain materials within temperatures recommended by the manufacturer.

1.5 ENVIRONMENTAL REQUIREMENTS

Install materials only when the ambient temperature and the pavement temperature within the joint wall is at least 35 degrees F and rising. Do not permit sealant installation if moisture or foreign material is observed in the joint.

PART 2 PRODUCTS

2.1 SYSTEM EQUIPMENT

Provide machines, tools, and equipment, for use in the performance of the work required by this section, approved before the work is started, and maintained in satisfactory condition. Submit list of proposed machines, tools, and equipment to be used in the performance of joint sealing, including descriptive data, 60 days prior to use on the project.

2.1.1 Joint Cleaning Equipment

2.1.1.1 Concrete Saw

Provide a self-propelled power saw with water-cooled diamond saw blades for cutting joints to the depths and widths specified and for removing filler, existing old joint seal, or other material embedded in the joints or adhered to the joint faces.

2.1.1.2 Waterblasting Equipment

Include with the waterblasting equipment a trailer-mounted water tank, pumps, high-pressure hose, a wand with safety release cutoff controls, nozzle, and auxiliary water resupply equipment. Use a water tank and auxiliary water resupply equipment of sufficient capacity to permit continuous operations. Use pumps, hoses, wand, and nozzle of sufficient capacity to permit the cleaning of both walls of the joint and the

pavement surface for a width of at least 1/2 in on either side of the joint. Use a pressure gauge mounted at the pump that shows the pressure in psi at which the equipment is operating.

2.1.2 Sealing Equipment

Install the compression seal by placing the compression seal to the prescribed depths and within the specified tolerances without cutting, nicking, twisting, or otherwise damaging the seal. Use equipment capable of placing the seal with not more than two percent longitudinal stretch or compression of the seal during installation. Use a machine that is an automatic self-propelled joint seal application equipment and engine powered. Use a machine that includes a reservoir for the lubricant/adhesive, a device for conveying the lubricant/adhesive in the proper quantities to the sides of the compression seal or the sidewalls of the joints, a reel capable of holding one full spool of compression seal, and a power-driven apparatus for feeding the joint seal through a compression device and inserting the seal into the joint. Include a guide with the equipment to maintain the proper course along the joint being sealed. Operate the machine by an experienced operator.

2.1.3 Test Requirements

Submit certified copies of test results, 60 days prior to use of material on the project. Sample, identify and test each lot of compression joint seal and lubricant/adhesive for conformance with the material specification.

a. A lot of compression seal consists of 1 day's production or 20,000 linear ft for each cross section, whichever is less. A lot of lubricant/adhesive consists of 1 day's production.

b. Testing of the compression joint seal and lubricant/adhesive material is the responsibility of the Contractor. Perform testing in an approved, independent laboratory, and submit certified copies of the test reports for approval 60 days prior to the use of the materials at the jobsite.

c. Submit samples of each lot of material to be retained by the Government for possible future testing if the materials appear defective during or after application. Provide additional samples of materials, in sufficient quantity to be tested, upon request. Base final acceptance on conformance to the specified test requirements and the performance of the in-place materials with respect to slipping down the joint or material coming out of the joint.

2.2 COMPRESSION SEALS

Regardless of testing responsibility, submit 9 ft long samples of the materials, 60 days prior to use on the project. Provide printed directions from the manufacturer on recommended installation criteria with the samples plus the manufacturer's certification that the selected seal is recommended for the installation on this project. Use compression joint seal materials that are vulcanized elastomeric compound using polychloroprene as the only base polymer. Use material and manufactured seal in accordance with ASTM D2628 and COE CRD-C 548 as tested by ASTM D412. Use a labryinth seal for the joint seal. The uncompressed depth of the face of the compression seal (that is to be bonded to the joint wall) is greater than the uncompressed width of the seal, except

that for seals 1 in or greater in width, the depth need be only 1 in or greater. The actual width of the uncompressed seal for construction and contraction joints is 1 in and for expansion joints is 1.25 in. The tolerance on the seal is plus 1/8 in or minus 1/16 in.

2.3 LUBRICANT/ADHESIVE

Use a lubricant/adhesive for the compression elastomeric joint seal that is a one-component compound conforming to ASTM D2835.

PART 3 EXECUTION

3.1 PREPARATION OF JOINTS

Immediately before installation of the compression joint seal, clean the joints to remove laitance, filler, existing sealer, foreign material and protrusions of hardened concrete from the sides and upper edges of the joint space to be sealed. Clean by waterblasting and extend along pavement surfaces at least 1/2 in on either side of the joint. After final cleaning and immediately prior to sealing, blow out the joints with compressed air and leave free of debris and water. Demonstrate that the selected cleaning operation meets the cleanliness requirements resulting in joint sidewalls that are clean and dry and exhibit newly exposed concrete. Correct irregularities in the joint face which would prevent uniform contact between the joint seal and the joint face prior to the installation of the joint seal.

3.1.1 Sawing

Clean and open joints to the specified width and depth by sawing. Immediately following the sawing operation, clean the joint faces and opening using a water jet to remove saw cuttings or debris remaining on the faces or in the joint opening. Install compression seal within 3 calendar days of the time the joint cavity is sawed. Provide a depth of the joint cavity in accordance with manufacturer's instructions. Where installation procedures are required in accordance with the manufacturer's recommendations, submit printed copies of manufacturers' instructions, 60 days prior to use on the project. Center the saw cut for the joint seal cavity over the joint line. Provide the nominal width of the sawed joint seal cavity as follows:

a. If a nominal 1 in wide compression seal is provided, the nominal width of the saw cut is 9/16 inches when the pavement temperature at the time of sawing is between 25 and 140 degrees F. If the pavement temperature at the time of sawing is above this range, decrease the nominal width of the saw cut 1/16 in. If the pavement temperature at the time of sawing is below this range, increase the nominal width of the saw cut 1/16 in.

b. Measure the pavement temperature in the presence of the Contracting Officer. Make measurement each day before commencing sawing and when the temperature appears to be varying from the allowable sawing range.

Use a tolerance of plus or minus 1/16 in for the actual width.

3.1.2 Waterblast Cleaning

Use a multiple pass waterblast technique until the surfaces are free of dust, dirt, curing compound, or residue that might prevent ready insertion or uniform contact of the seal and bonding of the lubricant/adhesive to the concrete. After final cleaning and immediately prior to sealing, blow out the joints with compressed air and leave completely free of debris and water.

3.1.3 Rate of Progress

Limit waterblasting of joint faces to the length of joint that can be sealed during the same workday.

3.2 INSTALLATION OF THE COMPRESSION SEAL

Confirm a representative of the joint seal manufacturer is present at the trial joint installation to correct installation issues prior to full installation.

3.2.1 Time of Installation

Seal joints immediately within 3 calendar days of sawing the joint seal cavity and following concrete cure and the final cleaning of the joint walls. Provide open joints, ready for sealing that cannot be sealed under the specified conditions, with an approved temporary seal to prevent infiltration of foreign material. When rain interrupts the sealing operations, wash, clean with air pressure, and allow joints to dry prior to installing the lubricant/adhesive and compression seal.

3.2.2 Sequence of Installation

Seal longitudinal joints first, followed by transverse joints. Install seals in longitudinal joints so that transverse joint seals are intact from edge to edge of the pavement. Make intersections monolithic by use of joint seal adhesive and care in fitting the intersection parts together. Do not permit extender pieces of seal at intersections. Remove and replace seals falling short at the intersection with new seals at no additional cost to the Government. Require a poured sealant at the intersection where seals are required to change direction by more than 20 degrees. Provide poured sealant in accordance with compression seal manufacturer's instructions.

3.3 SEALING OF JOINTS

Cover the sides of the joint seal or the sides of the joint with a coating of lubricant/adhesive and the seal installed as specified. Coat butt joints and seal intersections with liberal applications of lubricant/adhesive. Immediately removed lubricat/adhesive spilled on the pavement to prevent setting on the pavement.

Provide the in-place joint seal will be in an upright position and free from twisting, distortion, and cuts. Adjustments will be made to the installation equipment and procedure, if the stretch exceeds 1 percent. Remove and replace seals exceeding 2 percent stretch. Place the joint seal at a uniform depth within the tolerances specified. Remove and replace in-place joint seals which fail to meet the specified requirements with new joint seal at no cost to the Government.

Place the compression joint seal to a depth of 3/16 in, plus or minus 1/16 in, below the pavement surface except when the joint is beveled or has a radius at the surface, or unless otherwise directed. For beveled joints or joints with a radius at the surface, install the compression joint seal at a depth of 1/8 in, plus or minus 1/8 in, below the bottom of the edge of the bevel or radius. Do not permit the seal to project above the surface of the pavement or above the edge of the bevel or radius.

Install the seal in the longest practicable lengths in longitudinal joints and cut at the joint intersections to provide continuous installation of the seal in the transverse joints. Permit the lubricant/adhesive in the longitudinal joints to set for 1 hour prior to cutting at the joint intersections to reduce the possibility of shrinkage. For transverse joints, the minimum length of the compression joint seal is the pavement width from edge to edge.

3.4 CLEAN-UP

Upon completion of the project, remove unused materials from the site, remove lubricant/adhesive on the pavement surface, and leave the pavement in clean condition.

3.5 QUALITY CONTROL PROVISIONS

3.5.1 Application Equipment

Inspect the application equipment to assure uniform application of lubricant/adhesive to the sides of the compression joint seal or the walls of the joint. If equipment causes cutting, twisting, nicking, excessive stretching or compressing of the seal, or improper application of the lubricant/adhesive, suspend the operation until causes of the deficiencies are determined and corrected.

3.5.2 Procedures

3.5.2.1 Quality Control Inspection

Provide quality control provisions during the joint cleaning process to prevent or correct improper equipment and cleaning techniques that damage the concrete. Cleaned joints will be approved by the Government prior to installation of the lubricant/adhesive and compression joint seal.

3.5.2.2 Conformance to Stretching and Compression Limitations

Determine conformance to stretching and compression limitations. Mark the top surface of the compression seal at 1 ft intervals in a manner clear and durable to enable length determinations of the seal. After installation, measure the distance between the marks on the seal. If the stretching or compression exceeds 2 percent, remove the seal and replace it with new joint at no additional cost to the Government. Remove the seal up to the last correct measurement. Inspect the seal a minimum of once per 400 ft of seal for compliance to the shrinkage or compression requirements. Make measurements at the same interval to determine conformance with depth and width of installation requirements. Remove and replace compression seal that is not in conformance with specification requirements with new joint seal at no additional cost to the Government.

3.5.2.3 Pavement Temperature

Determine the pavement temperature by placing a thermometer in the initial saw cut for the joint and record the reading. Pemrit the thermometer to remain in the joint for an adequate time to provide a stable control reading.

3.5.3 Acceptance

Inspect the joint sealing system (compression seal and lubricant/adhesive) for proper rate of cure and bonding to the concrete, cuts, twists, nicks and other deficiencies. Remove, waste and replace seals exhibiting defects prior to final acceptance of the project from the joint.

-- End of Section --

SECTION 32 17 23

PAVEMENT MARKINGS
08/16

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D4061	(2013) Standard Test Method for Retroreflectance of Horizontal Coatings
ASTM E1710	(2011) Standard Test Method for Measurement of Retroreflective Pavement Marking Materials with CEN-Prescribed Geometry Using a Portable Retroreflectometer
ASTM E2177	(2011) Standard Test Method for Measuring the Coefficient of Retroreflected Luminance (RL) of Pavement Markings in a Standard Condition of Wetness
ASTM E2302	(2003; R 2016) Standard Test Method for Measurement of the Luminance Coefficient Under Diffuse Illumination of Pavement Marking Materials Using a Portable Reflectometer

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

FED-STD-595	(Rev C; Notice 1) Colors Used in Government Procurement
FS TT-B-1325	(Rev D; Notice 1; Notice 2 2017) Beads (Glass Spheres) Retro-Reflective (Metric)
FS TT-P-1952	(2015; Rev F; Notice 1) Paint, Traffic and Airfield Markings, Waterborne

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only or as otherwise designated. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Surface Preparation Equipment List; G, RO

Application Equipment List; G, RO

Exterior Surface Preparation

Material Safety Data Sheets (MSDS) for proposed materials; G, RO

Reflective Media for Airfields; G, RO

Waterborne Paint; G, RO

SD-06 Test Reports

Reflective Media for Airfields; G, RO

Waterborne Paint; G, RO

SD-07 Certificates

Qualifications; G, RO

Waterborne Paint

Volatile Organic Compound, (VOC); G, RO

SD-08 Manufacturer's Instructions

Waterborne Paint; G, RO

1.3 QUALITY ASSURANCE

1.3.1 Regulatory Requirements

Submit certificate stating that the proposed pavement marking paint meets the Volatile Organic Compound, (VOC) regulations of the local Air Pollution Control District having jurisdiction over the geographical area in which the project is located. Submit Material Safety Data Sheets (MSDS) for each product.

1.3.2 Qualifications

Submit documentation certifying that pertinent personnel are qualified for equipment operation and handling of applicable chemicals. The documentation should include experience on five projects of similar size and scope with references for all personnel.

1.3.3 Qualifications For Airfield Marking Personnel

Submit documentation of qualifications in resume format a minimum of 14 days before pavement marking work is to be performed showing personnel who will be performing the work have experience working on airfields, operating mobile self-powered marking, cleaning, and paint removal equipment and performing these tasks. Include with resume a list of references complete with points of contact and telephone numbers. Provide certification for pavement marking machine operator and Foreman demonstrating experience successfully completing a minimum of two airfield pavement marking projects of similar size and scope. Provide documentation demonstrating personnel have a minimum of two years of experience operating similar equipment and performing the same or similar work in similar environments, similar in size and scope of the planned project.

The Contracting Officer reserves the right to require additional proof of competency or to reject proposed personnel.

1.4 DELIVERY AND STORAGE

Deliver paint materials and reflective media in original sealed containers that plainly show the designated name, specification number, batch number, color, date of manufacture, manufacturer's directions, and name of manufacturer.

The Contractor shall provide storage facilities for maintaining materials at temperatures recommended by the manufacturer.

1.5 PROJECT/SITE CONDITIONS

1.5.1 Environmental Requirements

1.5.1.1 Weather Limitations for Application

Apply pavement markings to clean, dry surfaces, and unless otherwise approved, only when the air and pavement surface temperature is at least 5 degrees F above the dew point and the air and pavement temperatures are within the limits recommended by the pavement marking manufacturer. Allow pavement surfaces to dry after water has been used for cleaning or rainfall has occurred prior to striping or marking. Test the pavement surface for moisture before beginning work each day and after cleaning. Do not commence marking until the pavement is sufficiently dry and the pavement condition has been approved by the Contracting Officer. Employ the "plastic wrap method" to test the pavement for moisture as specified in paragraph TESTING FOR MOISTURE.

1.5.2 Airfield Traffic Control

Coordinate performance of all work in the controlled movement area of the airfield with the Contracting Officer and with the Airfield Manager. Neither equipment nor personnel can use any portion of the airfield without permission of these officers.

1.5.3 Airfield Emergency Aircraft Operations

Emergencies take precedence over all operations. Upon notification from the control tower of an emergency aircraft operation, stop all operations immediately and evacuate all personnel and equipment to an area not utilized for aircraft traffic which is at least 250 feet measured perpendicular to and away from the near edge of the airfield pavement areas unless otherwise authorized by the Contracting Officer. Equipment and chemicals or detergents as well as excess water must be able to clear the work area within 3 minutes.

1.5.4 Lighting

Pavement marking night operations are not allowed on the airfield. All pavement markings shall be applied during daylight hours.

PART 2 PRODUCTS

2.1 EQUIPMENT

2.1.1 Surface Preparation Equipments

Pavement markings to be removed are as indicated on the contract drawings.Submit a surface preparation equipment list by serial number, type, model, and manufacturer. Include descriptive data indicating area of coverage per pass, pressure adjustment range, tank and flow capacities, and safety precautions required for the equipment operation. Mobile equipment must allow for removal of markings without damaging the pavement surface or joint sealant. Maintain machines, tools, and equipment used in the performance of the work in satisfactory operating condition.

2.1.1.1 Waterblasting Equipment

Use mobile waterblasting equipment capable of producing a pressurized stream of water that effectively removes paint from the pavement surface without significantly damaging the pavement. Provide equipment, tools, and machinery which are safe and in good working order at all times.

2.1.2 Application Equipment

Submit application equipment list appropriate for the material(s) to be used. Include manufacturer's descriptive data and certification for the planned use that indicates area of coverage per pass, pressure adjustment range, tank and flow capacities, and all safety precautions required for operating and maintaining the equipment. Provide and maintain machines, tools, and equipment used in the performance of the work in satisfactory operating condition, or remove them from the work site. Provide mobile and maneuverable application equipment to the extent that straight lines can be followed and normal curves can be made in a true arc.

2.1.2.1 Paint Application Equipment

2.1.2.1.1 Self-Propelled or Mobile-Drawn Spraying Machines

Provide self-propelled or mobile-drawn spraying machine with suitable arrangements of atomizing nozzles and controls to obtain the specified results. Provide machine having a speed during application capable of applying the stripe widths indicated at the paint coverage rate specified herein and of even uniform thickness with clear-cut edges.

2.1.2.1.1.1 Airfield Marking

Provide self-propelled or mobile-drawn spraying machine for applying the paint for airfield pavements with an arrangement of atomizing nozzles capable of applying the specified line width in a single pass. Provide paint applicator with paint reservoirs or tanks of sufficient capacity and suitable gages to apply paint in accordance with requirements specified. Equip tanks with suitable mechanical agitators. Equip spray mechanism with quick-action valves conveniently located, and include necessary pressure regulators and gages in full view and reach of the operator. Install paint strainers in paint supply lines to ensure freedom from residue and foreign matter that may cause malfunction of the spray guns. The paint applicator must be readily adaptable for attachment of a dispenser for the reflective media approved for use.

2.1.2.1.1.2 Hand Application

Provide spray guns for hand application of paint in areas where the mobile paint applicator cannot be used.

2.1.2.2 Reflective Media Dispenser

Attach the dispenser for applying the reflective media to the paint dispenser and designed to operate automatically and simultaneously with the applicator through the same control mechanism. The bead applicator must be capable of adjustment and designed to provide uniform flow of reflective media over the full length and width of the stripe at the rate of coverage specified in paragraph APPLICATION.

2.2 MATERIALS

Use reflectorized waterborne paint for airfield markings. The maximum allowable VOC content of pavement markings is 150 grams per liter. Color of markings are indicated on the drawings and must conform to FED-STD-595 for airfields. Provide materials conforming to the requirements specified herein.

2.2.1 Waterborne Paint

FS TT-P-1952, Type III.

2.2.2 Reflective Media

2.2.2.1 Reflective Media for Airfields

FS TT-B-1325, Type III, Gradation A for permanent pavement markings..

PART 3 EXECUTION

3.1 EXAMINATION

3.1.1 Testing for Moisture

Test the pavement surface for moisture before beginning pavement marking after each period of rainfall, fog, high humidity, or cleaning, or when the ambient temperature has fallen below the dew point. Do not commence marking until the pavement is sufficiently dry and the pavement condition has been approved by the Contracting Officer or authorized representative.

Employ the "plastic wrap method" to test the pavement for moisture as follows: Cover the pavement with a 12 inch by 12 inch section of clear plastic wrap and seal the edges with tape. After 15 minutes, examine the plastic wrap for any visible moisture accumulation inside the plastic. Do not begin marking operations until the test can be performed with no visible moisture accumulation inside the plastic wrap. Re-test surfaces when work has been stopped due to rain.

3.1.2 Surface Preparation Demonstration

Prior to surface preparation, demonstrate the proposed procedures and equipment. Prepare areas large enough to determine cleanliness, adhesion of remaining coating and rate of cleaning. Perform a demonstration removal of pavement marking in an area designated by the Contracting Officer. Approved demonstration area establishes the standard for the

remainder of the work.

3.1.3 Test Stripe Demonstration

Prior to paint application, demonstrate test stripe application within the work area using the proposed materials and equipment. Apply separate test stripes in each of the line widths and configurations required herein using the proposed equipment. Make the test stripes long enough to determine the proper speed and operating pressures for the vehicle(s) and machinery, but not less than 50 feet long.

3.1.4 Application Rate Demonstration

During the Test Stripe Demonstration, demonstrate compliance with the application rates specified herein. Document the equipment speed and operating pressures required to meet the specified rates in each configuration of the equipment and provide a copy of the documentation to the Contracting Officer prior to proceeding with the work.

3.1.5 Retroreflective Value Demonstration

After the test stripes have cured to a "no-track" condition, demonstrate compliance with the average retroreflective values specified herein. Take a minimum of ten readings on each test stripe with a Retroreflectometer with a direct readout in millicandelas per square meter per lux (mcd/m2/lx). Conform testing per ASTM D4061, ASTM E1710, ASTM E2177, and ASTM E2302.

3.1.6 Level of Performance Demonstration

The Contracting Officer will be present at the application demonstrations to observe the results obtained and to validate the operating parameters of the vehicle(s) and equipment. If accepted by the Contracting Officer, the test stripe is the measure of performance required for this project. Do not proceed with the work until the demonstration results are satisfactory to the Contracting Officer.

3.2 EXTERIOR SURFACE PREPARATION

Allow new pavement surfaces to cure for a period of not less than 30 days before application of marking materials. Thoroughly clean surfaces to be marked before application of the paint. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods as required. Remove existing paint markings, residual curing compounds, and other coatings adhering to the pavement by water blasting.

a. Do not use shot blasting on airfield pavements due to the potential of Foreign Object Damage (FOD) to aircraft. Scrub affected areas, where oil or grease is present on old pavements to be marked, with several applications of trisodium phosphate solution or other approved detergent or degreaser and rinse thoroughly after each application. After cleaning oil-soaked areas, seal with shellac or primer recommended by the manufacturer to prevent bleeding through the new paint. Do not commence painting in any area until pavement surfaces are dry and clean.

3.2.1 Early Painting of Rigid Pavements

Pretreat rigid pavements that require early painting with an aqueous solution containing 3 percent phosphoric acid and 2 percent zinc chloride. Apply the solution to the areas to be marked.

3.2.2 Early Painting of Asphalt Pavements

For asphalt pavement systems requiring painting application at less than 30 days, apply the paint and beads at half the normal application rate, followed by a second application at the normal rate after 30 days.

3.3 APPLICATION

Apply pavement markings to dry pavements only.

3.3.1 Paint

Apply paint pneumatically with approved equipment at rate of coverage specified herein. Provide guidelines and templates as necessary to control paint application. Take special precautions in marking numbers, letters, and symbols. Manually paint numbers, letters, and symbols. Sharply outline all edges of markings. The maximum drying time requirements of the paint specifications will be strictly enforced, to prevent undue softening of bitumen, and pickup, displacement, or discoloration by tires of traffic. If there is a deficiency in drying of the markings, painting operations must cease until the cause of the slow drying is determined and corrected.

3.3.1.1 Waterborne Paint

3.3.1.1.1 Airfields

For non-reflectorized markings, apply paint conforming to FS TT-P-1952 Type III at a rate of 121 plus or minus 6 square feet per gallon.

For reflectorized markings, apply paint and glass spheres at the following rates:

TABLE IV

Bead Type	Paint Type	Paint Application Rate	Bead Application Rate
Type III(Gradation A)	Type III	121 plus or minus 6 Sq Ft/Gallon	10 plus or minus 1 lb/gallon

3.3.2 Cleanup and Waste Disposal

Keep the worksite clean and free of debris and waste from the removal and application operations. Immediately cleanup following removal operations in areas subject to aircraft traffic. Dispose of debris off Government controlled lands.

3.4 FIELD QUALITY CONTROL

3.4.1 Sampling and Testing

As soon as the paint materials and reflective media are available for sampling, obtain by random selection from the sealed containers, two quart samples of each batch in the presence of the Contracting Officer. Accomplish adequate mixing prior to sampling to ensure a uniform, representative sample. A batch is defined as that quantity of material processed by the manufacturer at one time and identified by number on the label. Clearly identify samples by designated name, specification number, batch number, project contract number, intended use, and quantity involved.

At the discretion of the Contracting Officer, samples provided may be tested by the Government for verification.

3.4.2 Material Inspection

Examine material at the job site to determine that it is the material referenced in the report of test results or certificate of compliance. A certificate of compliance shall be accompanied by test results substantiating conformance to the specified requirements.

3.4.3 Dimensional Tolerances

Apply all markings in the standard dimensions provide in the drawings. New markings may deviate a maximum of 10 percent larger than the standard dimension. The maximum deviation allowed when painting over an old marking is up to 20 percent larger than the standard dimensions.

3.4.4 Bond Failure Verification

Inspect newly applied markings for signs of bond failure based on visual inspection and comparison to results from Test Stripe Demonstration paragraph.

3.4.5 Reflective Media and Coating Application Verification

Use a wet film thickness gauge to measure the application of wet paint. Use a microscope or magnifying glass to evaluate the embedment of glass beads in the paint. Verify the glass bead embedment with approximately 50 percent of the individual bead spheres embedded and 50 percent of the individual bead spheres exposed.

3.4.6 Retroreflective Markings

Collect and record readings for white and yellow retroreflective markings at the rate of one reading per 1000 linear feet. The minimum acceptable average for white markings is 200 millicandelas per square meter per lux (mcd/m2/lx) (measured with Retroreflectometer). The minimum acceptable average for yellow markings is 175 millicandelas per square meter per lux (mcd/m2/lx). Compute readings by averaging a minimum of 10 readings taken

within the area at random locations. Re-mark areas not meeting the retroreflective requirements stated above.

3.4.7 Material Bond Verification and Operations Area Cleanup for Airfields

Vacuum sweep the aircraft operating area before it is opened for aircraft operations to preclude potential foreign object damaged to aircraft engines. Visually inspect the pavement markings and the material captured by the vacuum. Verify that no significant loss of reflective media has occurred to the pavement marking due to the vacuum cleaning.

-- End of Section --

SECTION 32 31 13.53

HIGH-SECURITY FENCES
02/20

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A116	(2011) Standard Specification for Metallic-Coated, Steel Woven Wire Fence Fabric
ASTM A121	(2013) Standard Specification for Metallic-Coated Carbon Steel Barbed Wire
ASTM A153/A153M	(2016a) Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
ASTM A392	(2011a; R 2017) Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
ASTM A702	(2013) Standard Specification for Steel Fence Posts and Assemblies, Hot Wrought
ASTM A780/A780M	(2020) Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
ASTM A824	(2011; R 2017) Standard Specification for Metallic-Coated Steel Marcelled Tension Wire for Use With Chain Link Fence
ASTM C94/C94M	(2020) Standard Specification for Ready-Mixed Concrete
ASTM F567	(2014a) Standard Practice for Installation of Chain Link Fence
ASTM F626	(2014) Standard Specification for Fence Fittings
ASTM F883	(2013) Padlocks
ASTM F900	(2011; R 2017) Standard Specification for Industrial and Commercial Swing Gates
ASTM F1043	(2018) Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework

ASTM F1083	(2018) Standard Specification for Pipe, Steel, Hot-Dipped Zinc Coated (Galvanized) Welded, for Fence Structures
ASTM F1184	(2016) Industrial and Commercial Horizontal Slide Gates

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Fence Installation Drawings; G, RO

SD-03 Product Data

Fabric; G, RO

Posts; G, RO

Post Caps; G, RO

Chain Link Braces; G, RO

Line Posts; G, RO

Sleeves

Top Rail; G, RO

Bottom Rail; G, RO

Tension Wire; G, RO

Barbed Wire; G, RO

Barbed Wire Supporting Arms; G, RO

Latches; G, RO

Hinges; G, RO

Stops; G, RO

Keepers; G, RO

Rollers; G, RO

Padlocks; G, RO

Wire Ties; G, RO

SD-07 Certificates

Chain Link Fence; G, RO

Fabric

Barbed Wire

Concrete; G, RO

Operating and maintenance instructions

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in an undamaged condition. Store materials elevated off of the ground to protect against oxidation caused by ground contact.

PART 2 PRODUCTS

2.1 COMPONENTS

2.1.1 Chain Link Fence Fabric

2.1.1.1 General

Provide ASTM A392, Class 1, zinc-coated steel wire with minimum coating weight of 1.2 ounces of zinc per square foot of coated surface. Fabricate fence fabric of 9 gauge wire woven in 2 inch mesh conforming to ASTM A116. Provide twisted and barbed fabric on the top selvage and knuckled on the bottom selvage.

2.1.2 Posts

2.1.2.1 Metal Posts for Chain Link Fence

Provide posts conforming to ASTM F1083, zinc-coated. Group IA, with external coating Type A steel pipe. Group IC steel pipe, zinc-coated with external coating Type A or Type B and Group II, roll-formed steel sections, meeting the strength and coating requirements of ASTM F1043 and ASTM A702. Group III, ASTM F1043 steel H-section may be used for line posts in lieu of line post shapes specified for the other classes. Provide sizes as shown on the drawings. Use line posts and terminal (corner, gate, and pull) posts of the same designation throughout the fence. Provide gate post for the gate type specified subject to the limitation specified in ASTM F900 and/or ASTM F1184.

2.1.2.2 Accessories

a. Provide accessories conforming to ASTM F626. Coat ferrous accessories with zinc or aluminum coating.

b. Provide truss rods (with turnbuckles or other means of adjustment)for each terminal post.

c. Provide barbed wire supporting arms of the single45 degree outward angle 3-strand arm type and of the design required for the post furnished. Secure arms by top rail.

d. Furnish post caps in accordance with manufacturer's standard accessories.

e. Provide 9 gauge steel tie wire for attaching fabric to rails, braces, and posts and match the coating of the fence fabric. Provide miscellaneous hardware coatings which conform to ASTM A153/A153M unless modified.

2.1.3 Chain Link Braces and Rails

2.1.4 Chain Link Gates

2.1.4.1 Gate Assembly

Provide gate assembly conforming to ASTM F900 and/or ASTM F1184 of the type and swing shown. Provide gate frames conforming to strength and coating requirements of ASTM F1083 for Group IA, steel pipe, with external coating Type A, nominal pipe size (NPS) 1-1/2. Provide gate frames conforming to strength and coating requirements of ASTM F1043, for Group IC, steel pipe with external coating Type A or Type B, nominal pipe size (NPS) 1-1/2. Use gate fabric that matches the specified chain link fabric.

2.1.4.2 Gate Leaves

For gate leaves, more than 8 feet wide, provide either intermediate members and diagonal truss rods or tubular members as necessary to provide rigid construction, free from sag or twist. For gate leaves less than 8 feet wide, provide truss rods or intermediate braces. Provide intermediate braces on all gate frames with an electro-mechanical lock. Attach fabric to the gate frame by method standard with the manufacturer. Welding is not an acceptable method for attaching fabric to gate frames.

2.1.4.3 Gate Hardware and Accessories

Submit manufacturer's catalog data. Furnish and install latches, hinges, stops, keepers, rollers, and other hardware items as required for the operation of the gate. All items are required to match the material characteristics of the fence system being installed. Arrange latches for padlocking so that the padlock will be accessible from both sides of the gate. Provide stops for holding the gates in the open position. For high security applications, extend each end member of gate frames sufficiently above the top member to carry three strands of barbed wire in horizontal alignment with barbed wire strands on the fence.

2.1.5 Padlocks

Provide padlocks conforming to ASTM F883, Type PO1, OptionB, Grade 6. Size 1-3/4 inch. Key all padlocks into master key system.

2.2 MATERIALS

2.2.1 Wire

2.2.1.1 Wire Ties

Submit samples as specified. Provide wire ties constructed of the same

material as the fencing fabric.

2.2.1.2 Barbed Wire

Provide barbed wire conforming to ASTM A121 zinc-coated, Type Z, Class 3, or aluminum-coated, Type A, with 12.5 gauge wire with 14 gauge, round, 4-point barbs spaced no more than 5 inches apart.

2.2.1.3 Tension Wire

Provide Type I or Type II tension wire, Class 4 coating, in accordance with ASTM A824.

2.2.2 Concrete

ASTM C94/C94M, using 3/4 inch maximum size aggregate, and having minimum compressive strength of 3000 psi at 28 days. Use grout consisting of one part portland cement to three parts clean, well-graded sand and the minimum amount of water to produce a workable mix.

PART 3 EXECUTION

3.1 PREPARATION

Perform complete installation conforming to ASTM F567.

3.1.1 Line and Grade

Install fence to the lines and grades indicated. Clear the area on either side of the fence line to the extent indicated. Space line posts equidistant at intervals not exceeding 10 feet. Set terminal (corner, gate, and pull) posts whenever abrupt changes in vertical and horizontal alignment are encountered. Provide continuous fabric between terminal posts; however, ensure runs between terminal posts do not exceed 500 feet. Repair any damage to galvanized surfaces, including welding, with paint containing zinc dust in accordance with ASTM A780/A780M.

3.1.2 Excavation

Excavate holes to depths indicated. Clear all post holes of loose material and spread waste material where directed. Eliminate ground surface irregularities along the fence line to the extent necessary to maintain a 1 inch clearance between the bottom of the fabric and finish grade.

3.2 INSTALLATION

3.2.1 Installation Drawings

Submit complete Fence Installation Drawings for review and approval by the Contracting Officer prior to shipment. Submit drawing details that include, but are not limited to the following information: Fence Installation Drawings, corner, end, and pull posts. Install fence system per approved drawings.

3.2.2 Security Fencing

Install new security fencing, remove existing security fencing, and perform related work to provide continuous security for facility.

Schedule and fully coordinate work with Contracting Officer.

3.2.3 Posts

3.2.3.1 Earth and Bedrock

a. Set posts plumb and in alignment. Except where solid rock is encountered, set posts in concrete to the depth indicated on the drawings. Where solid rock is encountered with no overburden, set posts to a minimum depth of 18 inches in rock. Where solid rock is covered with an overburden of soil or loose rock, set posts to the minimum depth indicated on the drawing unless a penetration of 18 inches in solid rock is achieved before reaching the indicated depth, in which case terminate depth of penetration. Grout all portions of posts set in rock.

b. Set portions of posts not set in rock in concrete from the rock to ground level. Set posts in holes not less than the diameter shown on the drawings. Make diameters of holes in solid rock at least 1 inch greater than the largest cross section of the post. Thoroughly consolidate concrete and grout around each post, free of voids and finished to form a dome. Allow concrete and grout to cure for 72 hours prior to attachment of any item to the posts. Group II line posts may be mechanically driven, for temporary fence construction only, if rock is not encountered. Set driven posts to a minimum depth of 3 feet and protect with drive caps when setting.

c. Test fence post rigidity by applying a 50 pound force on the post, perpendicular to the fabric, at 5 feet above ground. Ensure post movement measured at the point where the force is applied is less than or equal to 3/4 inch from the relaxed position. Test every tenth post for rigidity. When a post fails this test, make further tests on the next four posts on either side of the failed post. Remove, replace, and retest all failed parts at the Contractor's expense.

3.2.3.2 Concrete Slabs and Walls

When installed in concrete slabs or walls, set posts in zinc-coated sleeves, to a minimum depth of 12 inches. Fill sleeve joint with nonshrink grout, or other approved material.

3.2.4 Rails

Bolt bottom rail to double rail ends and securely fasten double rail ends to the posts. Peen bolts to prevent easy removal. Install bottom rail before chain link fabric.

3.2.5 Fabric

a. Set fabric height as shown.

b. Install chain link fabric on the side of the post indicated. Attach fabric to terminal posts with stretcher bars and tension bands. Space bands at approximately 15 inch intervals. Install fabric and pull taut to provide a smooth and uniform appearance free from sag, without permanently distorting the fabric diamond or reducing the fabric height. Fasten fabric to line posts at approximately 15 inch intervals and fastened to all rails and tension wires at approximately 24 inch intervals.

c. Cut fabric by untwisting and removing pickets. Accomplish splicing by weaving a single picket into the ends of the rolls to be joined. Install the bottom of the fabric 1 plus or minus 1/2 inch above the ground.

d. After the fabric installation is complete, exercise the fabric by applying a 50 pound push-pull force at the center of the fabric between posts; use a 30 pound pull at the center of the panel to ensure fabric deflection of not more than 2.5 inches when pulling fabric from the post side of the fence. Every second fence panel is required to meet this requirement. Resecure and retest all failed panels at the Contractor's expense.

3.2.6 Supporting Arms

Install barbed wire supporting arms and barbed wire as indicated on the drawings and as recommended by the manufacturer. Anchor supporting arms with 3/8 inch diameter plain pin rivets or, at the Contractor's option, with studs driven by low-velocity explosive-actuated tools for steel, wrought iron, ductile iron, or malleable iron. Do not use explosive-actuated tool to drive studs into gray iron or other material that can be fractured. Use a minimum of two studs per support arm. Pull barbed wire taut and attach to the arms with clips or other means that will prevent easy removal.

3.2.7 Gate Installation

a. Install gates at the locations shown. Mount gates to swing as indicated. Install latches, stops, and keepers as required. Install Slide gates as recommended by the manufacturer.

b. Attach padlocks to gates or gate posts with chains. Weld or otherwise secure hinge pins, and hardware assembly to prevent removal.

c. Submit 6 copies of operating and maintenance instructions. Outline the step-by-step procedures required for system startup, operation, and shutdown. Include the manufacturer's name, model number, service manual, parts list, and brief description of all equipment and their basic operating features. Include in the maintenance instructions routine maintenance procedures, possible breakdowns and repairs, and troubleshooting guide. Also include the general gate layout, equipment layout and simplified wiring and control diagrams of the system as installed.

3.2.8 Grounding

a. Ground fencing as indicated on drawings and specified.

b. Ground fences on each side of all gates, at each corner, at the closest approach to each building located within 50 feet of the fence, and where the fence alignment changes more than 15 degrees. Ensure grounding locations are located no more than 650 feet apart. Bond each gate panel with a flexible bond strap to its gate post.

d. Provide ground conductor consisting of No. 8 AWG solid copper wire. Use grounding electrodes that measures 3/4 inch by 10 foot long and

are a copper-clad steel rod. Drive electrodes into the earth so that the top of the electrode is at least 6 inches below the grade. Where driving is impracticable, bury electrodes a minimum of 12 inches deep and radially from the fence. Install the top of the electrode to be less than 2 feet or more than 8 feet from the fence. Clamp ground conductor to the fence and electrodes with bronze grounding clamps to create electrical continuity between fence posts, fence fabric, and ground rods. Measure total resistance of the fence to ground and ensure it is not greater than 25 ohms.

3.3 CLOSEOUT ACTIVITIES

3.3.1 Cleanup

Remove waste fencing materials and other debris from the work site each workday.

-- End of Section --

SECTION 32 92 19

SEEDING
08/17

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D4972	(2013) pH of Soils

U.S. DEPARTMENT OF AGRICULTURE (USDA)

AMS Seed Act	(1940; R 1988; R 1998) Federal Seed Act
DOA SSIR 42	(1996) Soil Survey Investigation Report No. 42, Soil Survey Laboratory Methods Manual, Version 3.0

1.2 DEFINITIONS

1.2.1 Stand of Turf

95 percent ground cover of the established species.

1.3 RELATED REQUIREMENTS

Section 31 00 00 EARTHWORK, applies to this section for pesticide use and plant establishment requirements, with additions and modifications herein.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Fertilizer

Include physical characteristics, and recommendations.

SD-06 Test Reports

Topsoil Composition Tests (reports and recommendations).

SD-07 Certificates

State Certification and Approval for Seed

SD-08 Manufacturer's Instructions

Erosion Control Materials

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

1.5.1.1 Seed Protection

Protect from drying out and from contamination during delivery, on-site storage, and handling.

1.5.1.2 Fertilizer Delivery

Deliver to the site in original, unopened containers bearing manufacturer's chemical analysis, name, trade name, trademark, and indication of conformance to state and federal laws. Instead of containers, fertilizer may be furnished in bulk with certificate indicating the above information.

1.5.2 Storage

1.5.2.1 Seed and Fertilizer Storage

Store in cool, dry locations away from contaminants.

1.5.2.2 Topsoil

Prior to stockpiling topsoil, treat growing vegetation with application of appropriate specified non-selective herbicide. Clear and grub existing vegetation three to four weeks prior to stockpiling topsoil.

1.5.2.3 Handling

Do not drop or dump materials from vehicles.

1.6 TIME RESTRICTIONS AND PLANTING CONDITIONS

1.6.1 Restrictions

Do not plant when the ground is frozen, snow covered, muddy, or when air temperature exceeds 90 degrees Fahrenheit.

1.7 TIME LIMITATIONS

1.7.1 Seed

Apply seed within twenty four hours after seed bed preparation.

PART 2 PRODUCTS

2.1 SEED

2.1.1 Classification

Provide State-certified seed of the latest season's crop delivered in original sealed packages, bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weedseed content, and inert

material. Label in conformance with AMS Seed Act and applicable state seed laws. Wet, moldy, or otherwise damaged seed will be rejected. Field mixes will be acceptable when field mix is performed on site in the presence of the Contracting Officer.

2.1.2 Planting Dates

Planting Season	Planting Dates
Spring	March 7 - May 14
Fall	Aug 21 - Oct 21

2.1.3 Seed Purity

Common Name	Minimum Percent Pure Seed	Minimum Percent Germination and Hard Seed	Maximum Percent Weed Seed
Hard Fescue	95	90	0.5
Chewings Fescue	95	90	0.5
Strong Creeping Red Fescue	95	90	0.5
Perennial Rye Grass	95	90	0.5

2.1.4 Seed Mixture

From the following List:
a. Apague II.
b. Chinook.
c. Crossfire II.
d. Dominion.
e. Genesis.
f. Heritage.
g. Masterpiece.
h. Millennium.
i. Plantation.
j. Rebel 2000, 3D or III.
k. Renegade.
l. Shenandoah.
m. Titan.
n. Trailblaze II.

Contractor shall submit substitutions to this list to the Contracting Officer for approval prior to ordering.

2.2 TOPSOIL

2.2.1 On-Site Topsoil

Surface soil stripped and stockpiled on site and modified as necessary to meet the requirements specified for topsoil in paragraph COMPOSITION. When available topsoil must be existing surface soil stripped and stockpiled on-site in accordance with Section 31 00 00 EARTHWORK.

2.2.2 Off-Site Topsoil

Conform to requirements specified in paragraph COMPOSITION. Additional topsoil must be furnished by the Contractor.

2.2.3 Composition

Containing from 5 to 10 percent organic matter as determined by the topsoil composition tests of the Organic Carbon, 6A, Chemical Analysis Method described in DOA SSIR 42. Maximum particle size, 3/4 inch, with maximum 3 percent retained on 1/4 inch screen. The pH must be tested in accordance with ASTM D4972. Topsoil must be free of sticks, stones, roots, and other debris and objectionable materials. Other components must conform to the following limits:

Silt	7 to 17 percent
Clay	10-30 percent
Sand	20-35 percent
pH	5.5 to 7.0
Soluble Salts	600 ppm maximum

2.3 FERTILIZER

2.3.1 Granular Fertilizer

Synthetic, granular controlled release fertilizer containing the following minimum percentages, by weight, of plant food nutrients:

10 percent available nitrogen
20 percent available phosphorus
10 percent available potassium

2.4 WATER

Source of water must be approved by Contracting Officer and of suitable quality for irrigation, containing no elements toxic to plant life.

2.5 EROSION CONTROL MATERIALS

Erosion control material must conform to the following:

2.5.1 Erosion Control Blanket

70 percent agricultural straw/30 percent coconut fiber matrix stitched with a degradable nettings, designed to degrade within 12 months.

2.5.2 Erosion Control Material Anchors

Erosion control anchors must be as recommended by the manufacturer.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 EXTENT OF WORK

Provide soil preparation prior to planting (including soil conditioners as required), fertilizing, seeding, and surface topdressing of all newly graded finished earth surfaces, unless indicated otherwise, and at all areas inside or outside the limits of construction that are disturbed by the Contractor's operations.

3.1.1.1 Topsoil

Provide 4 inches of on-site topsoil to meet indicated finish grade. After areas have been brought to indicated finish grade, incorporate fertilizer into soil a minimum depth of 4 inches by disking, harrowing, tilling or other method approved by the Contracting Officer. Remove debris and stones larger than 3/4 inch in any dimension remaining on the surface after finish grading. Correct irregularities in finish surfaces to eliminate depressions. Protect finished topsoil areas from damage by vehicular or pedestrian traffic.

3.1.1.2 Fertilizer Application Rates

Apply fertilizer at rates as determined by laboratory soil analysis of the soils at the job site. For bidding purposes only apply at rates for the following:

Synthetic Fertilizer 500 pounds per acre

3.2 SEEDING

3.2.1 Seed Application Seasons and Conditions

Immediately before seeding, restore soil to proper grade. Do not seed when ground is muddy frozen, snow covered or in an unsatisfactory condition for seeding. If special conditions exist that may warrant a variance in the above seeding dates or conditions, submit a written request to the Contracting Officer stating the special conditions and proposed variance. Apply seed within twenty four hours after seedbed preparation. Sow seed by approved sowing equipment. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing.

3.2.2 Seed Application Method

Seeding method must be broadcasted and drop seeding.

3.2.2.1 Broadcast and Drop Seeding

Seed must be uniformly broadcast at the rate of 6.25 pounds per 1000 square feet. Use broadcast or drop seeders. Sow one-half the seed in one direction, and sow remainder at right angles to the first sowing. Cover seed uniformly to a maximum depth of 1/4 inch in clay soils and 1/2 inch

in sandy soils by means of spike-tooth harrow, cultipacker, raking or other approved devices.

3.2.3 Erosion Control Material

Install in accordance with manufacturer's instructions, where indicated or as directed by the Contracting Officer.

3.2.4 Watering

Start watering areas seeded as required by temperature and wind conditions. Apply water at a rate sufficient to insure thorough wetting of soil to a depth of 2 inches without run off. During the germination process, seed is to be kept actively growing and not allowed to dry out.

3.3 PROTECTION OF TURF AREAS

Immediately after turfing, protect area against traffic and other use.

3.4 RESTORATION

Restore to original condition existing turf areas which have been damaged during turf installation operations at the Contractor's expense. Keep clean at all times at least one paved pedestrian access route and one paved vehicular access route to each building. Clean other paving when work in adjacent areas is complete.

-- End of Section --

SECTION 32 01 13.63

GILSONITE MODIFIED ASPHALT EMULSION-HEAVY SEAL COATS
02/16, CHG 1: 08/16

PART 1 GENERAL

1.1 MEASUREMENT AND PAYMENT PROCEDURES

The measured quantity of gilsonite modified asphalt emulsion seal coat with aggregate, including cost for preparing the surface to receive the seal coat, will be paid for an included in the lump sum contract price.

1.2 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C88/C88M	(2024) Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C117	(2023) Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing
ASTM C128	(2022) Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Fine Aggregate
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C566	(2019) Standard Test Method for Total Evaporable Moisture Content of Aggregate by Drying
ASTM C1252	(2017) Standard Test Methods for Uncompacted Void Content of Fine Aggregate (as Influenced by Particle Shape, Surface Texture, and Grading)
ASTM C1895	(2020) Standard Test Method for Determination of Mohs Scratch Hardness
ASTM D5/D5M	(2020) Standard Test Method for Penetration of Bituminous Materials
ASTM D36/D36M	(2014; R 2020) Standard Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)
ASTM D75/D75M	(2019) Standard Practice for Sampling Aggregates

ASTM D113/D113M	(2017; R 2023) Standard Test Method for Ductility of Asphalt Materials
ASTM D140/D140M	(2016) Standard Practice for Sampling Asphalt Materials
ASTM D1250	(2019; E 2020) Standard Guide for Use of the Joint API and ASTM Adjunct for Temperature and Pressure Volume Correction Factors for Generalized Crude Oils, Refined Products, and Lubricating Oils: API MPMS Chapter 11.1
ASTM D2007	(2019) Standard Test Method for Characteristic Groups in Rubber Extender and Processing Oils and Other Petroleum-Derived Oils by the Clay-Gel Absorption Chromatographic Method
ASTM D2042	(2022) Standard Test Method for Solubility of Asphalt Materials in Trichloroethylene
ASTM D2216	(2019) Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D2995	(2023) Determining Application Rate of Bituminous Distributors
ASTM D4402/D4402M	(2023) Standard Test Method for Viscosity Determination of Asphalt at Elevated Temperatures Using a Rotational Viscometer
ASTM D6084/D6084M	(2021) Standard Test Method for Elastic Recovery of Asphalt Materials by Ductilometer
ASTM D6930	(2019) Standard Test Method for Settlement and Storage Stability of Emulsified Asphalts
ASTM D6933	(2022) Standard Test Method for Oversized Particles in Emulsified Asphalts (Sieve Test)
ASTM D6934	(2022) Standard Test Method for Residue by Evaporation of Emulsified Asphalt
ASTM D6997	(2012; R 2020) Standard Test Method for Distillation of Emulsified Asphalt
ASTM D7175	(2023) Standard Test Method for Determining the Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer
ASTM D7402	(2009; R 2017) Standard Practice for Identifying Cationic Emulsified Asphalts

ASTM D7428	(2015) Standard Test Method for Resistance of Fine Aggregate to Degradation by Abrasion inthe Micro-Deval Apparatus

1.3 DEFINITIONS

1.3.1 Seal Coat

The terms seal coat, asphalt sealer, and asphalt material are interchangeable throughout this section.

1.3.2 Asphalt

The term asphalt means natural and refined asphalt materials in this section.

1.4 ADMINISTRATIVE REQUIREMENTS

1.4.1 Worker Safety

Obtain Safety Data Sheet (SDS) for both the asphalt emulsion product and sand. Require workers to follow the manufacturer's recommended safety precautions.

1.4.2 Sequencing

Remove pavement markings as presented in the Contract documents prior to placing seal coat material. Remove pavement markings in accordance with Section 32 17 23 PAVEMENT MARKINGS.

1.4.3 Scheduling

Provide notice to the Government a minimum of seven days prior to starting seal coat operations.

1.5 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Qualifications; G

Distributor Radar Or Distance Measurement Instrument (DMI) Calibration; G

SD-03 Product Data

Manufacturer Representative’s Experience

Inspection Reports; G

Equipment And Tools; G

SD-04 Samples

Gilsonite Modified Asphalt Emulsion

Aggregate; G

SD-06 Test Reports

Manufacturer's Certificate of Compliance for Aggregates

Recommendation by contractor/manufacturer from results of test section application.

Any additional testing as requested by Contracting Officer

Asphalt Materials; G

Manufacturer's Certificate Of Analysis for Polymer; G

Manufacturer's Certificate Of Analysis For Emulsified Asphalt; G

Aggregate Spreader Calibration; G

Distributor Calibration; G

Abbreviated Distributor Calibration; G

1.6 QUALITY CONTROL

1.6.1 Qualifications

Provide documentation of experience applicators, personnel and equipment, all of which to have made three (3) applications similar to this project in past two (2) years. Include details of previous work, schedule adherence, quality of workmanship, materials and name and work phone of contracting officer's points of contact.

1.6.2 Manufacturer's Representation

The liquid asphalt manufacturer's representative, using knowledge of the material, procedures, and equipment described in this specification section, assists the Contractor and Government in determining the appropriate application rates, as well as recommendations for proper preparation and start-up of seal coat applications. Provide documentation of the manufacturer representative’s experience and knowledge for applying the seal coat product to the Contracting Officer a minimum of 10 work days prior to placement of the test sections. The manufacturer's representative must be on site during the test section and first full day of production. Include the cost of the manufacturer’s representative in the bid price.

1.6.3 Aggregate Source

Select sources from which aggregates are to be obtained and notify the Contracting Officer within 15 days after the award of the Contract. Perform tests for the evaluation of aggregates by using an approved commercial laboratory at no expense to the Government. Determine the suitability of the aggregate by testing the gradation in accordance with

ASTM C136/C136M, and ASTM C117 and Mohs hardness of ASTM C1895. Test results must be within the last six months. Independent laboratory testing is required for all new aggregate sources.

1.6.4 Gilsonite Modified Asphalt Emulsion Source

The Contractor must furnish the vendor's certified test reports for asphalt materials, in its concentrated form, to the Contracting Officer, showing that the material meets the properties of Table 1. Asphalt materials must meet the properties of Table 2 and Table 3.

1.7 DELIVERY, STORAGE, AND HANDLING

Deliver gilsonite modified asphalt emulsion to the site in a homogenous and undamaged condition. Inspect the materials for contamination and damage. Unload and store the materials with a minimum of handling. The aggregate is commonly delivered in large bags. As the aggregate is delivered, keep the aggregate in the bags until placed in the aggregate spreader. Protect the aggregates from rain and other sources of moisture. Replace defective or damaged materials. The asphalt material storage and handling temperature must be between 50 deg F - 160 deg F and the material must be protected from freezing, or whenever outside temperature drops below 40 deg F for prolonged time periods.

1.8 PROJECT/SITE CONDITIONS

1.8.1 Environmental Requirements

Apply the coating when the existing surface is dry, and when the weather is not foggy, rainy, or when the wind velocity will prevent the uniform application of the material. Suspend application of the material when dust or aggregate is blowing or when rain is anticipated within four hours of application completion. Apply seal coat only when both the atmospheric temperature and the pavement surface temperature are at or above 60 degrees F and rising, unless otherwise directed. Do not apply the the material when the pavement surface temperatures are expected to exceed160 degrees F within the subsequent 72 hours if traffic will be opened on pavement within those 72 hours. During application, account for wind drift.

PART 2 PRODUCTS

2.1 EQUIPMENT AND TOOLS

Furnish all equipment, tools, and machinery necessary for the performance of the work. Provide equipment which is adequate and has the capability of producing the results specified. Maintain the equipment in satisfactory working condition at all times.

2.1.1 Combination Syncronous Asphalt Distributor and Aggregate Spreader (Heavy)

Provide an application machine for spreading the emulsion and the aggregate. Provide a truck-mounted self propelled application machine, designed to apply the emulsion and the fine-aggregate in a single-pass operation, with the aggregate being applied within less than 3 feet of the emulsion spray, and capable of spreading the fine aggregate via a computer rate-controlled aggregate distribution apparatus that is integral to the asphalt distributor truck and is designed specifically for fine-aggregate

distribution. Equip the application machine with individual nozzle control to distribute the emulsion uniformly on variable widths of surface, zero to 15 feet wide, at readily determined and controlled rates from 0.10 to 0.30 gallons of liquid per square yard of surface, and2 to 4 pounds of fine aggregate per square yard of surface. Include an apparatus for computer rate-control of liquid, full circulation spray bars, pump rpm gauge, volume measuring device, integral heater (thermostatically controlled), and a hand hose attachment suitable for application of the emulsion manually to cover areas inaccessible to the distributor truck. Equip the machine with a means to circulate and heat the emulsion within the tank.

Equip the machine with an aggregate spreader with a variable control system and proper fine-aggregate gate-controlled apparatus capable of uniformly distributing the fine-aggregate at the specified rate at varying application widths and speeds. The capacity of the aggregate spreader will have a minimum hopper capacity of at least 20,000 pounds of the specified fine-aggregate.

Provide equipment in good working order that contain no contaminants or diluents in the tank. Spray bar nozzles must be clean, free of burrs, and of a size to maintain an even distribution of the emulsion. The apparatus shall maintain predetermined flow rates and constant pressure during the application process with application speeds under8 miles per hour or 700 feet per minute. Test the equipment under pressure for leaks and to ensure proper set-up before use. Provide verification of truck set-up (via a test-shot area), including but not limited to, nozzle tip size appropriate for application per nozzle manufacturer, spray-bar height and pressure and pump speed appropriate for the viscosity and temperature of sealer material, evidence of triple-overlap spray pattern, lack of leaks, and any other factors relevant to ensure the truck is in good working order before use.

Calibrate the aggregate spreader in the presence of the Government per paragraph AGGREGATE SPREADER CALIBRATION and to ensure acceptable uniformity of spread. The aggregate spreader will be re-calibrated each time the aggregate rate is changed either during the application of test strips or production. The Contractor may consult the seal coat manufacturer representative for procedure and guidance. Push-type hand sanders will be allowed for use around lights, signs and other obstructions, if necessary.

2.1.2 Sampling Device

Equip the asphalt distributor and transport tanks with a spigot-type sampling device.

2.1.3 Temperature Sensing Device

Equip the asphalt distributor and transport tanks with a minimum of2-inch dial type thermometer with a temperature range of 50 degrees F to 500 degrees F. Locate the thermometer near the midpoint of the tank's length and within the middle third of the tank's height, or as specified by the manufacturer. Enclose the thermometer in a well with a protective window or by other means as necessary to keep the instrument clean and in the proper working condition.

2.1.4 Power Broom and Power Blower

Provide a power broom or power blower for removing loose material from the surface to be treated.

2.1.5 Equipment Calibration

After the equipment arrives onsite and within 96 hours prior to the test sections, calibrate the asphalt distributor and aggregate spreader in accordance with ASTM D2995 Option B. Provide calibration results to the Government for approval prior to the test sections.

2.2 ASPHALT SEALING MATERIAL

Provide a copy of the Manufacturer's Certificate of Analysis for Emulsified Asphalt delivered to the project. The certification must also show the shipment number, refinery, consignee, destination, contract number and date of shipment. If the asphalt emulsion is diluted at other than the manufacturer's facility, provide a supplemental certificate of analysis from an independent laboratory verifying the asphalt emulsion properties. Provide the test reports and certification prior to using the material. Do not interpret the furnishing of the vendor's certified test report for the asphalt material as a basis for final acceptance. The manufacturer's certificate of analysis may be subject to verification by testing the material delivered for use on the project.

2.3 GILSONITE MODIFIED ASPHALT EMULSION

2.3.1 Emulsion Sampling

Sample the gilsonite modified asphalt emulsion at the point of storage in the presence of the Government in accordance with ASTM D140/D140M. Provide a 1 quart sample which will be retained by the Government.

2.3.2 Asphalt Emulsion

The concentrate cationic asphalt emulsion (undiluted, no Polymer) must be a gilsonite modified asphalt emulsion. The material must meet the following requirements of the applicable portions of Table 1, and 2:

Table 1

Concentrated Asphalt Emulsion Properties

Properties	Specification	Limits
Saybolt Furol Viscosity at 77 deg F	ASTM D7496	20-100 seconds
Residue by Distillation or Evaporation	ASTM D6997 or ASTM D6934	56 percent minimum
Sieve Test	ASTM D6933	0.1 percent maximum
24-hour Stability	ASTM D6930	1 percent maximum
5-day Settlement Test	ASTM D6930	5.0 percent maximum

Table 1		
Concentrated Asphalt Emulsion Properties		
Properties	Specification	Limits
Particle Charge pH, cationic(1)	ASTM D7402	Positive, 5.5 percent maximum pH
(1) pH may be used in lieu of the particle charge test which is sometimes inconclusive in slow setting, asphalt emulsions.		

Provide the asphalt base residue containing not less than 20 percent gilsonite, or uintaite. No tall oil pitch or tar oil residue is allowed. Provide material containing not less than 5 percent polymer, by volume, to the warm emulsion and circulate for 5 to 15 minutes. Provide this statement on the Manufacturer's Certificate of Compliance for Asphalt Materials. Provide material which is compatible with asphaltic concrete, and having a 3-year minimum proven performance record at airports with similar climatic conditions.

Table 2		
Tests on Polymer Modified Residue from Distillation or Evaporation(1)		
Properties	Specification	Limits
Viscosity at 275 deg F, cPs, maximum	ASTM D7175ASTM D4402/D4402M	800 - 1,600 cts2000 cPs M
Solubility in 1, 1, 1 trichloroethylene (TCE)	ASTM D2042	97.5 minimum
Softening Point	ASTM D36/D36M	50 minimum
Penetration at 77 degrees F, dmm	ASTM D5/D5M	50 maximum15 - 50
Elastic Recovery at 77 deg F (percent)	ASTM D6084/D6084M	25 - 75
Ductility at 77 degrees F (cm)	ASTM D113/D113M	10 - 50
Chemical Composition per ASTM D2007(2)		
Asphaltenes	ASTM D2007	15 - 25 percent
Saturates	ASTM D2007	15 percent maximum
Polar Resin Compounds	ASTM D2007	25 percent minimum
Aromatics	ASTM D2007	15 percent minimum

Table 2		
Tests on Polymer Modified Residue from Distillation or Evaporation(1)		
Properties	Specification	Limits
(1)Residue can be recovered via ASTM D6934, ASTM D6997, ASTM D7994 or ASTM D7403 Method B.		
(2)ASTM D2007/D4124 Alternate method for SARA analysis: asphaltenes and maltenes separated in n-heptane, maltene fractions determined via TLC-FID (Iatroscan).		

Provide a copy of the Manufacturer's Certificate of Analysis for Emulsified Asphalt delivered to the project. The certification must also show the shipment number, refinery, consignee, destination, contract number and date of shipment. If the asphalt emulsion is diluted at other than the manufacturer's facility, provide a supplemental certificate of analysis from an independent laboratory verifying the asphalt emulsion properties. Provide the test reports and certification prior to using the material. Do not interpret the furnishing of the vendor's certified test report for the asphalt material as a basis for final acceptance. The manufacturer's certificate of analysis may be subject to verification by testing the material delivered for use on the project.

2.4 AGGREGATE

2.4.1 Aggregate Samples

Sample aggregates in accordance with ASTM D75/D75M.

2.4.2 Aggregate Characteristics

Select sources from which aggregates are to be obtained and notify the Contracting Officer within 15 days after the award of the Contract. Perform tests for the evaluation of aggregates by using an approved commercial laboratory at no expense to the Government. Hire an independent laboratory to perform aggregate testing no sooner than 6 months prior to the test section. Provide aggregate that is dry, clean, dust and dirt free, sound, durable, angular shaped manufactured specialty sand (aggregate), such as that used as an abrasive.

Table 4		
Aggregate Properties		
Properties	Specification	Limits
Fractured Faces		100 Percent
SiO_2 Content		55 Percent Minimum
CaO		3 Percent Maximum

Table 4

Aggregate Properties

Properties	Specification	Limits
Sand Equivelency		Greater than 85
Micro-Deval	ASTM D7428	15 Percent Maximum
Magnesium Sulfate Soundness	ASTM C88/C88M	5 Percent Maximum
Aggregate Angularity	ASTM C1252, Method A	42 Percent Maximum
Moisture Content	ASTM C566	2 Percent Maximum
Bulk Specific Gravity	ASTM C128	2.6 - 3.0
Absorption	ASTM D2216	3 Percent Maximum
Mohs Hardness	ASTM C1895	7 Minimum

Table 5

Aggregate Material Gradation Requirements(1)

Sieve Size, inch	Percentage Passing by Weight
No. 8	100
No. 14	95-100
No. 16	85-100
No. 30	15-45
No. 50	0-5
No. 70	0 - 2
No. 100	0- 1

(1)Test aggregate gradation in accordance with ASTM C136/C136M and ASTM C117

Submit gradation showing particle size analysis and properties of the material delivered for use on the project. and manufacturer's specification for review at or prior to the pre bid for approval. The gradations in the chart represent the limits in determining aggregate source suitability for use in the asphalt surface treatment.

2.5 POLYMER

Use polymers approved by the manufacturer of the asphalt material for compatibility meeting the requirements provided in Table 5. Submit the Manufacturer's Certificate of Analysis for Polymer that will be used in the seal coat.

Table 5		
Polymer Properties		
Properties	Specification	Limits
Solids Content		47 - 65 percent by weight
Weight		8.0 - 9.6 pounds per gallon
pH		3.0 - 5.5
Particle Charge		Cationic
Mechanical Stability		Excellent
Film Forming Temperature		32 degrees F, minimum
Tg		71.6 deg F, maximum+++10degC max in 608H+++

2.6 WATER

No additional water/dilution is required.

PART 3 EXECUTION

3.1 EXAMINATION

Provide Inspection Reports of; air and surface temperature during application of seal coat, emulsion temperature and rate of application, dilution rate used, adequacy of surface cleaning and preparation, aggregate rate of application, and protection of site facilities as applicable, each day of application.

Repair and patch all major pavement defects in accordance with Section 32 01 17.61 SEALING CRACKS IN ASPHALT PAVING. Seal all cracks with a joint sealant compatible with the emulsion prior to application of the emulsion.

3.1.1 Protection of Site Facilities

Cover existing buildings, structures, runway edge lights, taxiway edge lights, informational signs, retro-reflective marking and in-pavement duct markers as necessary to protect against overspray before applying the material. Should material get on any light or marker fixture, promptly clean the fixture. If cleaning is not satisfactory to the Government, replace any light, sign or marker with equivalent at no cost to the Government.

3.1.2 Surface Preparation

Prepare the existing asphalt pavements that are to be treated with the seal coat as follows:

a. Patch asphalt pavement surfaces that have been softened by

petroleum derivatives or as indicated on the drawings.

b. Repair joints and cracks in accordance with Section 32 01 17.61 SEALING CRACKS IN ASPHALT PAVING.

c. Remove oil or grease that has not softened the asphalt pavement by scrubbing with a detergent and washing thoroughly with clean water. After cleaning, these these areas with an oil spot primer.

d. Clean pavement surface immediately prior to placing the surface treatment so that is is free of dust, dirt, grease, vegetation, oil or any type of objectionable surface film. Remove oil or grease from the asphalt pavement by scrubbing with a detergent, washing thoroughly with clean water, and treating these area with the oil spot primer.

3.2 PREPARATION OF ASPHALT STORAGE AND asphalt DISTRIBUTOR

Thoroughly clean the asphalt emulsion storage and asphalt distributor if previous asphalt emulsion used is non-compatible with cationic emulsions. Ensure asphalt material is at the recommended application temperature and it has been thoroughly cycled through the distributor bar. Test the asphalt distributor under pressure by means of a test shot area (outside the project limits) and prior to the distributor calibration to ensure there are no leaks or dripping from the nozzles after shut-off.

3.3 ASPHALT EMULSION CERTIFICATE OF COMPLIANCE

Obtain Manufacturer's Certificate of Compliance for emulsion and aggregates. Obtain samples at time of delivery to the field as necessary to satisfy the requirements herein.

3.4 EMULSION MIXING

If the polymer is added to the emulsion mix by the manufacturer, submit verification to the Contracting Officer. As an option, the polymer may be added to the emulsion mix at the job site provided the polymer is added while the circulating pump is running. If the Polymer will be added on site, then add minimum 5.0 percent polymer latex, by volume, to the warm emulsion and circulate from 5 to 15 minutes.

3.5 COMPOSITION AND APPLICATION RATE

3.5.1 Distributor Calibration

Furnish all equipment, materials, and labor necessary to calibrate the asphalt distributor per the following guidance. Each distributor truck proposed for use on the project will be calibrated for each material type proposed for use. Submit Distributor Radar Or Distance Measurement Instrument (DMI) Calibration prior to beginning work. Perform the distributor calibration after the distributor arrives on the project and at least 24 hours prior to use for application of seal coat. Calibrate the distributor in accordance with ASTM D2995 Option B. Provide pads made from berber carpet (or other approved durable absorpent pad) measuring 12 inches by 12 inches that spans the maximum length and width of the proposed area to be sprayed. For ASTM D2995 Option B, unless otherwise approved, provide the pads with rubber or waterproof backing for ease of transport and use in the oven.

Measure the transverse and longitudinal application rates with all nozzles inserted in the distributor bar. Submit the results for the Distributor Calibration in the longitudinal direction and the transverse direction to the Government identifying at a minimum the following items:

a. Project name, Contract number, testing date.

b. Emulsion Material

c. Distributor make, model and serial number.

d. Distributor setup at time of calibration including target application rate (shot rate as shown on the computer control system), spray bar height, and distributor truck speed or motor RPM.

e. Dry weight of each pad prior to application.

f. Wet weight of each pad immediately after application.

g. For emulsions, oven dry each pad until constant mass. Constant mass is defined as less than 0.05% loss in mass between consective 15-min intervals.

h. Residual asphalt rate for each pad and average residual asphalt rate.

For the distributor calibration to be acceptable, provide the average residual asphalt rate in compliance with Table 7 and no individual pad residual rate is to vary more than 10 percent from the average. Perform the determination of the Estimation of Application Rate and Residual Application Rate of asphalt Distributors in the presence of the project QC Manager and the Government. If the distributor calibration fails to meet the listed requirements, make adjustments to the distributor setup and re-perform the distributor calibration until the results are within an acceptable range. Do not modify the distributor setup after calibration without approval by the Government. Determine the Estimation of Application Rate and Residual Application Rate of Bituiminous Distributors using ASTM D2995 a minimum of every 14 days of production or as determined necessary by the Government.

3.5.2 Production Distributor Calibration

Following acceptable results as outlined in paragraph INITIAL DISTRIBUTOR CALIBRATION, perform production distributor calibration on a daily basis when the distributor is in use and provide results daily during execution. Determine the production distributor calibration as a check to ensure the application rates are still in compliance with Table 7. The production distributor calibration will utilize the volume method of determination as follows:

a. Determine the total distance to be sprayed

b. Calculate the area sprayed

c. Calculate the gallons of material applied by subtracting the beginning volume by the ending volume. Utilizing the dipstick which has been provided with the distributor truck or the onboard meter.

d. Correct for temperature back to 60 degrees F in accordance with ASTM D1250 using a coefficient of expansion of 0.00025 per degree F.

e. Calculate residual asphalt by accounting for the water in the undiluted emulsion.

f. Calculate residual asphalt emulsion application rate, which is the gallons of residual emulsion applied divided by the area of application.

3.5.3 Abbreviated Distributor Calibration

Following acceptable results as outlined in paragraph DISTRIBUTOR CALIBRATION, perform abbreviated distributor calibration at least twice per day when the distributor is in use and provide results daily during execution. Determine the abbreviated distributor calibration as a check to ensure the application rates are still in compliance with Table 7. The production distributor calibration will utilize the volume method of determination as follows:

a. Determine the total distance to be sprayed.

b. Calculate the area sprayed.

c. Calculate the gallons of material applied by subtracting the beginning volume by the ending volume. Utilizing the dipstick which has been provided with the distributor truck or the onboard meter.

d. Correct for temperature back to 60 degrees F by applying correction factor as provided in ASTM D1250.

e. Calculate residual asphalt by accounting for the water in the undiluted emulsion and any additional dilution. Obtain asphalt residue percentage from the manufacturer/supplier, otherwise assume emulsion proportions of 33 percent water and 67 percent asphalt residue.

f. Calculate residual asphalt emulsion application rate, which is the gallons of residual emulsion applied divided by the area of application.

3.5.4 APPLICATION RATE CORRECTION

If the daily abbreviated distributor calibration application rate varies by more than 0.01 gallon per square yard from the rate established during distributor calibration that met Table 7, immediately reperform the distributor calibration in accordance with paragraph DISTRIBUTOR CALIBRATION.

3.5.5 Aggregate Spreader Calibration

Calibrate aggregate spreaders no more than 96 hours prior to the test sections. Provide a minimum of two 3 foot by 3 foot canvas pads or tarps laid across a smooth surface within the full width of the spreader. Spread aggregate over the pads or tarps. Subtract the weight of the tarp from the total weight of the tarp and dry aggregate. Recalibrate spreader after 7 calendar days after start of project application. Ensure the aggregate spread rate is in compliance with Table 7. Submit calibration measurements, aggregate spread rates, and spreader speed to the Government.

3.5.6 Application Rate Ranges

Provide the approximate amounts of material per square yard for the asphalt surface treatment as provided in Table 7 for the treatment areas at the specified dilution rates as shown on the Drawings. Determine the actual amounts to be used from the results of the test section program as directed by the Government. Pavements with more progressive deterioration issues may require heavier than normal application rates for emulsion and aggregate. In such cases, the on-site manufacturer's representative should be consulted as directed by the Government.

Table 7

Application Rate (Emulsion)

Dilution Rate	Gilsonite Modified Asphalt Emulsion gal/yd^2	Quantity of Aggregate lbs/yd^2
Gilsonite Modified Heavy	0.15-0.26	2.0 - 3.5

3.5.7 Application of Asphalt Sealer

Use the pressure distributor to apply the asphalt emulsion upon the properly prepared, clean and dry surface at the application rate recommended by the manufacturer's representative and approved by the Government. The application rate will be determined from the test section evaluation for each designated treatment area. The emulsion temperature must be at a temperature between 130 deg F and 160 deg F or in accordance with the manufacturer's recommendation. Pavement with excessive surface grade may need to be treated in two applications to achieve the specified application rate. Perform each additional application after the prior application of material has cured. If truck starts and stops or low spots and depressions greater than 1/2 inch in depth in the pavement surface cause ponding or puddling of the applied materials, lightly broom or use a brush to squeegee the pavement surface until the surface is free from any pools of excess material. During all applications, the surfaces of adjacent structures must be protected in such manner as to prevent being spattered or marred. Do not discharge asphalt materials into borrow pits or gutters or within the airport area.

3.5.8 Application of Aggregate Material

In a single pass, uniformly spread the aggregate over the emulsion at the rate specified for each designated application area using the aggregate spreader specified. Spread the aggregate in the same width of application as the asphalt material. Do not apply the aggregate in such thickness as to cause overspreading. Sprinkling of additional aggregate material, and spraying additional asphalt material over areas that show up having insufficient cover or asphalt material, is allowed to be done by hand, whenever necessary. In areas where hand work is necessitated, add aggregate before the emulsion begins to break. Minimize aggregate from being broadcast and accumulating on the untreated pavement adjacent to an application pass. Clean up areas of excess or loose aggregate prior to the

next application pass. Dispose of excess or removed aggregate from the project site.

3.6 TEST SECTIONS

Prior to production application, appropriate application rates from test sections will be approved by the Government. Accomplish the test section with the same surface preparation, personnel, equipment and methods that is proposed for use during production.

On-site attendance of the manufacturer's representative is mandatory to assist the Contractor in applying test section(s) to determine the appropriate application rate of both emulsion and aggregate for final approval by the Government.

Apply test sections for each differing asphalt pavement surface identified in the project. Use the test sections to determine the material application rate(s) of both emulsion and aggregate prior to full production. Apply the test sections within the project area. Perform test sections to determine the application rates of the asphalt emulsion and aggregate.

a. For taxiway, taxilane, apron, shoulder, and overrun surfaces, place a minimum of 2 test areas at varying application rates as recommended by the manufacturer's representative and as deemed acceptable to the Government to determine appropriate application rates. Locate the test sections on representative sections of the pavement to receive the asphalt surface treatment. If the test section should prove to be unsatisfactory, provide necessary adjustments to the application rate, placement operations, and equipment. Do not start full production until the test section is accepted by the Government.

3.7 FIELD QUALITY CONTROL - SEAL COAT

3.7.1 Aggregate Characteristics

Provide the manufacturer's certification for the aggregate with each shipment for acceptance. The certification will attest compliance with Table 4.

3.7.2 Application Inspection

Inspect application of seal coat for uniformity. Furnish a written report within 24 hours of testing citing air and surface temperature during application, emulsion temperature during application, dilution rate, and rate of emulsion application determined from testing compared to the approved production rates as determined at the test section for each pavement type.

3.8 TRAFFIC CONTROL

Protect freshly placed surface treatments from damage by traffic. Provide sufficient warning signs and barricades to prevent traffic over freshly treated surfaces. Protect treated areas from traffic for at least 24 hours after final application of seal coat material, or for such time as necessary to prevent picking up. Immediately prior to opening for

subsequent construction operations (markings) or traffic, broom and vacuum to remove loose material only after material has completely cured. Provide low profile barricades for proper traffic control in accordance with the drawings.

3.9 TEMPORARY PAVEMENT MARKINGS

Provide temporary pavement marking as identified in the Contract documents. Apply temporary pavement markings in accordance with section 32 17 23 AIRFIELD PAVEMENT MARKINGS.

-- End of Section --

SECTION 32 01 17.61

SEALING CRACKS IN ASPHALT PAVING
05/22

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C131/C131M	(2020) Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C509	(2006; R 2021) Standard Specifiaction for Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM D36/D36M	(2014; R 2020) Standard Test Method for Softening Point of Bitumen (Ring-and-Ball Apparatus)
ASTM D789	(2015) Determination of Relative Viscosity and Moisture Content of Polyamide (PA)
ASTM D3111	(2019) Standard Practice for Flexibility Determination for Hot-Melt Adhesivesby Mandrel BendTest
ASTM D5329	(2016) Standard Test Methods for Sealants and Fillers, Hot-Applied, for Joints and Cracks in Asphalt Pavements and Portland Cement Concrete Pavements
ASTM D6690	(2015) Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
ASTM D8260	(2020) Standard Specification for Hot-Applied Asphalt Aggregate-Filled Mastic

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Equipment, Tools, And Machines; G

SD-03 Product Data

Manufacturer's Instructions; G

Crack Sealant; G

Backer Rod; G

Mastic Sealant

SD-06 Test Reports

Laboratory Tests; G

SD-07 Certificates

Mastic Certification; G, RO

SD-08 Manufacturer's Instructions

Installing Hot Poured Sealant; G

Installing Mastic Material; G

1.3 QUALITY ASSURANCE

Test the crack sealant, mastic and backup materials for conformance with the referenced applicable material specification. Perform testing of the materials in an approved, independent laboratory; submit certified copies of the test reports for approval 30 days prior to the use of the materials at the job site. Submit reports of all tests. Samples will be retained by the Government for possible future testing, if the materials appear defective during or after application. Furnish samples of materials, in sufficient quantity to be tested by the Government upon request. Conformance with the test requirements of the laboratory tests specified will not constitute final acceptance of the materials. Final acceptance will be based on the performance of materials that have been satisfactorily installed.

1.4 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to the job site for defects; unload, and store them with a minimum of handling to avoid damage. Provide storage facilities at the job site to protect materials from weather and maintain them at the temperatures recommended by the manufacturer.

1.5 ENVIRONMENTAL REQUIREMENTS

Apply the materials only when the ambient air temperature and the pavement temperature within the joint wall are at least 40 degrees F and rising. Do not apply sealant if moisture is observed in the crack.

1.6 ACCEPTANCE

1.6.1 Crack Sealant

Inspect the crack sealant for proper cure and rate of set, tack free

surface, bonding to the bituminous pavement, cohesive separation within the sealant, reversion to liquid, and entrapped air and voids. Remove sealants exhibiting any of these deficiencies, at any time prior to the final acceptance of the project, and replace as specified herein.

1.6.2 Test Section

Prior to the cleaning and sealing of the cracks for the entire project, construct a test section at least 200 feet long using the specified materials and approved equipment to demonstrate the proposed preparation and sealing of all cracks of the project. Construct one test section using mastic materail and one test section using hot poured joint sealant. Following the completion of the test section and before any other crack is sealed, inspect the test section to determine that the materials and installation meet the requirements specified. If materials or installation do not meet requirements, remove the materials and reclean and reseal the cracks. When the test section meets the requirements, it can be incorporated into the permanent work and accepted for payment. Seal all other cracks in the manner approved and successfully completed for sealing the test section.

PART 2 PRODUCTS

2.1 SEALANTS

Provide crack sealant conforming to ASTM D6690, Type II or III to seal all cracks less than 3/4 inches wide.

2.2 MASTIC

Provide mastic sealant conforming to ASTM D8260, Type 2 and the table below and is specifically manufactured for sealing cracks in asphalt pavement for all cracks 1 1/2 inches or wider.

MASTIC BINDER PROPERTIES		
	Test Method	Requirement
Penetration @ 77 degrees F	ASTM D5329	80 dmm Max.
Penetration @ 122 degrees F	ASTM D5329	140 dmm Max.
Flexibility @ -18 degrees F, 1" mandrel, 90 degree bend, 2 sec	ASTM D3111	Bend Without Cracking
Softening Point (R&B)	ASTM D36/D36M	200 degree F Min.
PROPERTIES OF BLENDED MASTIC PRODUCT		
Flexibility @ 32 degrees F	ASTM D5329	Pass
Adhesion @ 63 degrees F	ASTM D5329	25 psi, Min.
Flexibility @ -18 degrees F, 1" mandrel, 90 degree bend, 2 sec	ASTM D3111	Bend Without Cracking

MASTIC BINDER PROPERTIES		
Application Temperature		370-400 degrees F

2.3 MASTIC AGGREGATES

Provide aggregates with no more than 35% loss when subjected to the Los Angeles abrasion test in accordance with ASTM C131/C131M Grading "C".

2.4 BACKER ROD MATERIALS

Provide backer rod material that is a compressible, nonshrinking, nonstaining, nonabsorptive material and nonreactive with the crack sealant. Use backer rod with a melting point temperature of at least 5 degrees F greater than the maximum pouring temperature of the sealant being used, when tested in accordance with ASTM D789. Use material that has a water absorption of not more than 5 percent by weight when tested in accordance with ASTM C509. Use backer rod material that is 25 percent (plus or minus 5 percent) larger in diameter than the nominal width of the crack.

2.5 EQUIPMENT, TOOLS, AND MACHINES

Equipment, tools, and machines used in performance of the work are subject to approval by the Government. Maintain in a satisfactory working condition at all times.

2.5.1 Routing Equipment

Provide routing equipment which is a self-powered machine operating a power driven tool or bit specifically designed for routing bituminous pavements. Use a bit rotating about a vertical axis at sufficient speed to cut a smooth vertical-walled reservoir in the pavement surface and maintain accurate cutting without damaging the sides or top edges of the reservoir. Provide a router capable of following the trace of the crack without deviation. The use of rotary impact routing devices can be permitted if vertical-sided carbide tipped bits are used.

2.5.2 Saw

Provide a self-propelled power saw, with water-cooled diamond or abrasive saw blades, for cutting existing sealed joints to the depths and widths specified, widening, or deepening existing joints as specified without damaging the sides, bottom, or top edge of joints. Permit single or gang type blades with one or more blades mounted in tandem for fast cutting. Select saw adequately powered and sized to cut specified opening with not more than two passes of the saw through the joint.

2.5.3 Air Compressor

Provide air compressor capable of furnishing not less than 150 cubic feet per minute and maintaining a line pressure of not less than 90 psi at the nozzle. Equip the compressor with filters that maintain the compressed air free of oil and water.

2.5.4 Heat Lance

Provide a heat lance operating with propane and compressed air in combination to provide flame-free tmeperatures between 750 dgrees F and 3000 degrees F with exit velocities between 650 feet per second and 3000 feet per second.

2.5.5 Hand Tools

Hand tools can be used, when approved, for removing defective sealant from cracks and repairing or cleaning the crack faces.

2.5.6 Crack Sealing Equipment

Provide unit applicators, used for heating and installing the hot-poured crack sealant materials, that are mobile and equipped with a double-boiler, agitator-type kettle with an oil medium in the outer space for heat transfer; a direct-connected pressure-type extruding device with a nozzle shaped for inserting in the prepared crack to be filled; positive temperature devices for controlling the temperature of the transfer oil and sealant; and a recording type thermometer for indicating the temperature of the sealant. Allow the sealant to circulate through the delivery hose and return to the inner kettle when not in use.

2.5.7 Mastic Equipment

Provide unit applicators, used for heating and installing the mastic materials, that are mobile and equipped with a double-boiler, agitator-type kettle with an oil medium in the outer space for heat transfer; positive temperature devices for controlling the temperature of the transfer oil and mastic; and a recording type thermometer for indicating the temperature of the mastic. The agitator will be capable of mixing and suspending materials, filled with aggregates having a specific grafvity as high as 3.0.

PART 3 EXECUTION

3.1 PREPARATION OF CRACKS

Immediately before the installation of the crack sealant, thoroughly dry and clean the cracks to remove oxidized pavement, loose aggregate and foreign debris. Prepare cracks as follows:

3.1.1 Cracks

3.1.1.1 Hairline Cracks

Cracks that are less than 1/4 inch wide do not need to be sealed.

3.1.1.2 Small Cracks

Route existing unsealed cracks that are 1/4 to 3/4 inches wide to a nominal width 1/8 inch greater than the existing nominal width and to a depth not greater than 3/4 inch. Sawcut existing sealed cracks that are 1/4 to 3/4 inches wide to a nominal width 1/8 inch greater than the existing nominal width and to a depth not greater than 3/4 inch.Clean and dry using compressed air.

3.1.1.3 Medium Cracks

Route existing unsealed cracks that are 3/4 to 1 1/2 inches wide to a uniform width of 1 1/2 inches and to a minimum depth of 2 inches. Sawcut existing sealed cracks that are 3/4 to 1 1/2 inches wide to a uniform width of 1 1/2 inches and to a minimum depth of 2 inches. Clean and dry using compressed air.

3.1.1.4 Large Cracks

Route existing unsealed cracks that are greater than 1 1/2 inches wide to a nominal width 1/8 inch greater than the existing nominal width and to a depth not greater than 2 inches. Sawcut existing sealed cracks that are greater than 1 1/2 inches wide to a nominal width 1/8 inch greater than the existing nominal width and to a depth not greater than 2 inches. Clean and dry using compressed air.

3.1.2 Existing Sealant Removal

Cut loose the in-place sealant from both crack faces and to a depth shown on the drawings. Remove sealant to a depth sufficient to accommodate any backer rod material that is required to maintain the depth of new sealant to be installed. Prior to further cleaning operations, remove all old loose sealant remaining in the crack opening by blowing with compressed air.

3.1.3 Sawing of Existing Cracks

3.1.3.1 Refacing Sealed Cracks

Accomplish facing of existing sealed cracks using a saw as specified in paragraph EQUIPMENT to remove residual old sealant and a minimum amount of asphalt from the crack to provide exposure of newly cleaned asphalt, and to enlarge the crack opening to the width and depth shown on the drawings.

Accomplish facing of unsealed cracks using routing equipment as specified in paragraph EQUIPMENT to saw through joints to loosen and remove material until the joint is clean and open to the full specified width and depth.

3.1.3.2 Refacing of Random Sealed Cracks

Accomplish sawing of the cracks using a power-driven saw as specified in paragraph EQUIPMENT. Use a saw blade 6 in or less in diameter to enable the saw to follow the trace of the crack. Stiffen the blade with dummy (or used) blades or washers. Immediately following the sawing operation, clean the crack opening using a water jet to remove saw cuttings and debris.

3.1.4 Routing

Perform routing of cracks that do not have existing joint sealant installed using a rotary router with a bit that is at least 1/8 inch wider than the nominal width of the crack to remove all residual old sealant (resealing), oxidized pavement and any loose aggregate in the crack wall.

3.1.5 Cleaning

Use compressed air or a heat lance to clean the crack faces and the pavement surfaces extending a minimum of 1/2 inch from the crack edges. Use a multiple-pass technique until the surfaces are free of dust, dirt, old sealant residue, moisture, or foreign debris that might prevent the sealant material from bonding to the asphalt pavement. Use a heat lance when pavement temperature is less than 40 degrees F. Do not burn the pavement, a slight darkening is acceptable. Immediately follow the heat lance with the sealing operation.

3.1.6 Backer Rod Material

When required, use backer rod material in all cracks that otherwise would require excessive sealant or exceed the sealant reservoir depth. Insert the backer rod material into the lower portion of the crack as shown on the drawings. Place the backer rod so that the top of the backer rod is a maximum of 3/4 inch and a minimum width to depth ratio of 1 below the top of the pavement. Ensure that the backer rod material is placed evenly at the specified depth and is not stretched or twisted during installation.

3.1.7 Rate of Progress of Crack Preparation

Limit the stages of crack preparation, which include routing or sawcutting, air pressure or heat lance cleaning and placing of the backer rod material, to only that linear footage that can be sealed during the same day.

3.2 PREPARATION OF SEALANT

Do not heat hot-poured sealants in excess of the safe heating temperature recommended by the manufacturer, as shown on the sealant containers. Withdraw and waste sealant that has been overheated or subjected to application temperatures for over 4 hours or that has remained in the applicator at the end of the day's operation.

3.3 INSTALLATION OF SEALANT

Submit manufacturer's instructions 30 days prior to the use of the material on the project. Installation of the material will not be allowed until the instructions are received. Submit Manufacturer's instructions for Installing Mastic Material. Submit Mastic certification by the manufacturer that the mastic installers have received the required training and certification to install the asphalt repair mastic. Submit Manufacturer's instructions for Installing Hot Poured Sealant.

3.3.1 Time of Application

Seal cracks immediately following final cleaning and drying of the crack walls and following the placement of the backer rod material (when required). Place sealant only when cracks are dry. Reclean cracks that cannot be sealed under the conditions specified, or when rain interrupts sealing operations, and allow to dry or dry by mechanical means prior to installing the sealant.

3.3.2 Sealing the Crack with Joint Sealant

Immediately preceding, but not more than 50 feet ahead of the crack sealing operations, perform a final cleaning and drying with a heat

lance. This distance can be increased if demonstrated and approved during the test section. Fill the cracks with joint sealant from the bottom of reservoir formed by the routing or the top of the backer rod up to 1/4 inch below the milled pavement surface and up to 1/8 inch below finished pavement surface. Remove excess or spilled sealant from the pavement by approved methods and discard it. Install the sealant in a manner which prevents the formation of voids and entrapped air. Make multiple passes with the applicator wand as necessary to obtain the specified sealant depth from the pavement surface. Do not use gravity methods or pouring pots to install the sealant material. Do not permit traffic over newly sealed pavement until authorized. Check sealed cracks frequently to ensure that the newly installed sealant is cured to a tack-free condition within 3 hours.

3.3.3 Sealing the Crack with Mastic

Heat the asphalt repair mastic in a thermostatically controlled mastic mixer that utilizes oil as a heat transfer medium. The mastic mixer must be equipped with a full sweep horizontal agitator capable of gently lifting the material from the bottom of the reservoir and turning the material over and over. The agitator will be capable of mixing and suspending materials filled with ggregates having specific gravity as high as 3.0.

Immediately preceding, but not more than 50 feet ahead of the crack sealing operations, perform a final cleaning and drying with a heat lance. This distance can be increased if demonstrated and approved during the test section. Dispense the heated asphalt repair mastic onto the properly perpared pavement recess from the bottom up. Use a heated hand squeegee or other approved device specifically manufactured for smoothing and leveling out asphalt repair mastic to level and smooth the repair mastic with the surrounding pavement surface until the material has formed a durable, well bonded repair. Keep the device free of materail buildup to ensure a smooth, quality finish. Do not permit traffic over newly sealed pavement until authorized. Check sealed cracks frequently to ensure that the newly installed sealant is cured to a tack-free condition within 3 hours.

3.4 CLEANUP

Upon completion of the project, remove unused materials from the site and leave the pavement in a clean condition.

3.5 QUALITY CONTROL PROVISIONS

3.5.1 Crack Cleaning

Provide quality control provisions during the crack cleaning process to correct improper equipment and cleaning techniques that damage the bituminous pavement in any manner.

3.5.2 Crack Seal Application Equipment

Inspect the application equipment to ensure conformance to temperature requirements and proper installation. If evidence of bubbling, improper installation, and failing to cure or set are identified, suspend operations until causes of the deficiencies are determined and corrected.

3.5.3 Mastic Material Verification

Submit Mastic certification from the manufacturer for each shipment of material. Include a statement of the asphalt repair mastic material quantity and quality control for each pallet of material received.

-- End of Section --

SECTION 32 01 29.61

PARTIAL DEPTH PATCHING OF RIGID PAVING
05/17, CHG 1: 08/17

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM C31/C31M	(2022) Standard Practice for Making and Curing Concrete Test Specimens in the Field
ASTM C33/C33M	(2018) Standard Specification for Concrete Aggregates
ASTM C39/C39M	(2021) Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
ASTM C94/C94M	(2022a) Standard Specification for Ready-Mixed Concrete
ASTM C136/C136M	(2019) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C143/C143M	(2020) Standard Test Method for Slump of Hydraulic-Cement Concrete
ASTM C150/C150M	(2022) Standard Specification for Portland Cement
ASTM C192/C192M	(2019) Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory
ASTM C231/C231M	(2022) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C260/C260M	(2010a; R 2016) Standard Specification for Air-Entraining Admixtures for Concrete
ASTM C267	(2020) Standard Test Methods for Chemical Resistance of Mortars, Grouts, and Monolithic Surfacings and Polymer Concretes
ASTM C469/C469M	(2022) Standard Test Method for Static Modulus of Elasticity and Poisson's Ratio of Concrete in Compression
ASTM C494/C494M	(2019; E 2022) Standard Specification for Chemical Admixtures for Concrete

ASTM C531	(2018) Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, and Monolithic Surfacings, and Polymer Concretes
ASTM C579	(2018) Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
ASTM C580	(2018) Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
ASTM C595/C595M	(2021) Standard Specification for Blended Hydraulic Cements
ASTM C617/C617M	(2015) Standard Practice for Capping Cylindrical Concrete Specimens
ASTM C618	(2022) Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
ASTM C666/C666M	(2015) Resistance of Concrete to Rapid Freezing and Thawing
ASTM C685/C685M	(2017) Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
ASTM C882/C882M	(2020) Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear
ASTM C884/C884M	(2016) Standard Test Method for Thermal Compatibility between Concrete and Epoxy-Resin Overlay
ASTM C1581/C1581M	(2018) Standard Test Method for Determining Age at Cracking and Induced Tensile Stress Characteristics of Mortar and Concrete under Restrained Shrinkage
ASTM C1602/C1602M	(2022) Standard Specification for Mixing Water Used in Production of Hydraulic Cement Concrete
ASTM D75/D75M	(2019) Standard Practice for Sampling Aggregates
ASTM D1751	(2018) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)

ASTM D1752	(2018) Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
ASTM D5023	(2015) Standard Test Method for Plastics: Dynamic Mechanical Properties: In Flexure (Three-Point Bending)

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 300	(1990) Specifications for Membrane-Forming Compounds for Curing Concrete

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards

1.2 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

SD-03 Product Data

Concrete Mix Design; G, DO

Rigid Proprietary Repair Products; G, DO

Polymeric Proprietary Repair Products; G, DO

Pigmented Liquid Membrane-Forming Compound; G, DO

Aggregate Service Record; G, DO

SD-04 Samples

Absorbent Curing Material; G, DO

Joint Filler; G, DO

Joint Sealant; G, DO

SD-05 Design Data

Concrete Mix Design; G, DO

SD-06 Test Reports

Laboratory Test Results

Aggregate Gradation

Cement

Concrete Slump

Concrete Air Content

Concrete Compressive Strength (cylinder)

Mixer Calibration and Efficiency

Concrete Uniformity

Bond Strength

Polymeric Proprietary Repair Products; G, DO

SD-07 Certificates

Cement

Aggregate

Admixtures

Absorbent curing material

Pigmented Liquid Membrane-Forming Compound

Joint Filler

Joint Sealant

1.3 QUALITY ASSURANCE

1.3.1 Preconstruction Testing Of Materials

Submit proposed concrete mix design at least 60 days prior to placement. Provide mix design evaluation and certification by a Government approved engineering testing laboratory, and indicate the weight of each ingredient of the mixture, aggregate gradation, slump, air content, water-cement ratio, time of trafficking and 3-day and 28-day compressive strength test results. Include a complete list of materials including admixtures and applicable reference specifications. Place no concrete prior to Government approval of the proposed mix design. No deviation from the approved mix design is permitted without prior Contracting Officer approval.

Within 24 hours of physical completion of laboratory testing, submit copies of laboratory test results for Contracting Officer approval.

1.3.1.1 Cement

Test cement as prescribed in the referenced specification under which it is furnished. Cement may be accepted on the basis of mill tests and the manufacturer's certification of compliance with the specification.

1.3.1.2 Aggregate

Take aggregate gradation samples for laboratory testing in conformance with ASTM D75/D75M.

1.3.1.3 Proprietary Repair Products

At least 30 days before the repair material is used, submit certified copies of test results for the specific lots or batches to be used on the project, not more than 6 months old prior to use in the work.

Manufacturer's certifications may be submitted rather than laboratory test results for proprietary repair products. Include in the submittals details for substrate preparation, mixing, placing, finishing, curing and testing of the material, as applicable. Include a minimum of three case histories documenting the use of the product in a similar freeze-thaw environment and pavement condition. Certify compliance with the appropriate specification referenced herein. Place no materials without prior approval from the Contracting Officer.

1.3.2 Equipment; Approval, Maintenance, and Safety

Provide and use only dependable and well maintained equipment that is appropriate to accomplish the work specified. Allow sufficient time for assembly of equipment requiring such at the work site to permit thorough inspection, calibration of weighing and measuring devices, adjustment of parts, and the making of any repairs that may be required prior to the start of work.

a. Submit volumetric mixer calibration and efficiency test results in accordance with the requirements of ASTM C685/C685M within 6 months of concrete placement. If applicable, submit concrete uniformity test data for the first load of the ready-mixed concrete to be used as the repair material.

b. Provide Safety Data Sheets (SDS) and Personal Protection Equipment (PPE) per 29 CFR 1910.

1.4 DELIVERY, STORAGE, AND HANDLING

1.4.1 Cement

Deliver cement in bulk or in suitable bags used for packaging cements and store in a manner to prevent absorption of moisture.

1.4.2 Aggregate

Deliver, handle, and store aggregates in a manner to avoid breakage, segregation, inter-mingling or contamination by foreign materials.

1.4.3 Other Materials

Deliver epoxy-resin, chemical admixtures and proprietary repair products to the site in such manner as to avoid damage or loss. Provide storage areas in a windowless and weatherproof, but ventilated, insulated noncombustible building, with provision nearby for conditioning the material to 70 to 85 degrees F for a period of 48 hours prior to use. Keep the ambient temperature in the storage area no higher than 100 degrees F.

1.5 Project/Site Conditions

Do not place concrete or other repair products when weather conditions detrimentally affect the quality of the finished product. Do not place concrete when the air temperature is below 40 degrees F in the shade. When air temperature is likely to exceed 90 degrees F, provide concrete having a temperature not exceeding 90 degrees F when deposited. Keep the surface of placed concrete damp with a water fog until the approved curing medium is applied. Take similar precautions for placing other repair products, as directed by the product vendor's instructions. Do not place concrete or other repair products if the weather forecast indicates that the air temperature is expected to drop below 40 degrees F over the next 7 days.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Coarse Aggregate

2.1.1.1 Composition

Provide coarse aggregate consisting of gravel, crushed gravel, crushed stone, or a combination thereof.

2.1.1.2 Quality

Coarse aggregates shall meet the requirements for coarse aggregates as required in Section 32 13 14.13 - CONCRETE PAVING FOR AIRFIELDS AND OTHER HEAVY DUTY PAVEMENTS.

2.1.1.3 Particle Shape

Provide spherical or cubical shaped coarse aggregate particles. Remove all course aggregates with the largest dimension that is equal to or larger than three times the smallest dimension.

2.1.1.4 Gradation

The maximum nominal size of the coarse aggregate is 1/2 inch. Provide well graded coarse aggregate conforming to gradation size 7 in Table 3 of ASTM C33/C33M when tested in accordance with ASTM C136/C136M as delivered to the batching hoppers.

2.1.1.5 Alkali Silica Reactivity

Evaluate and test coarse aggregate, to be used in all concrete, for alkali-silica reactivity in accordance with Section 32 13 14.13 paragraph: Alkali-Silica Reactivity, with mitigation of reactive aggregate in accordance with the referenced paragraph.

Evaluate coarse aggregate in accordance with Section 32 13 14.13, paragraph: Alkali-Silica Reactivity, with mitigation of reactive aggregate in accordance with the referenced paragraph.

For proprietary repair products, provide documentation from the supplier that the repair product combination with the aggregates selected will not

exhibit alkali-silica reactivity.

2.1.2 Fine Aggregate

2.1.2.1 Composition

Fine aggregates shall meet the requirements for fine aggregates as required in Section 32 13 14.13 - CONCRETE PAVING FOR AIRFIELDS AND OTHER HEAVY DUTY PAVEMENTS.

2.1.2.2 Particle Shape

Ensure particles of the fine aggregate are generally spherical or cubical in shape.

2.1.2.3 Grading

Provide fine aggregate, as delivered to the mixer, with a grading that conforms to the requirements of ASTM C33/C33M and having a fineness modulus of not less than 2.50 nor more than 3.40. For fine aggregate supplied as a combination of sources, determine the fineness modulus on a composite sample.

2.1.2.4 Alkali Silica Reactivity

Evaluate and test fine aggregate, to be used in all concrete, for alkali-silica reactivity in accordance with Section 32 13 14.13 paragraph: Alkali-Silica Reactivity, with mitigation of reactive aggregate in accordance with the referenced paragraph.

2.1.3 Admixtures

2.1.3.1 Air-Entraining Admixtures

Provide air-entraining admixtures conforming to ASTM C260/C260M.

2.1.3.2 Chemical Admixtures

ASTM C494/C494M. Where not shown or specified, the use of admixtures is subject to written approval of the Contracting Officer.

2.1.4 Cement

Provide portland cement conforming to ASTM C150/C150M, Type I or II, including the Optional Physical Requirements for early stiffening.

or

Provide blended cement conforming to ASTM C595/C595M, Type IP, IS, or IL. Provide pozzolan added to the Type IP blend consisting of ASTM C618 Class F or Class N and that is interground with the cement clinker. Include a written statement from the manufacturer that the amount of pozzolan in the finished cement does not vary more than plus or minus 5 mass percent of the finished cement from lot to lot or within a lot. Provide limestone added to the Type IL blend that is interground with the cement clinker.

Include a written statement from the manufacturer that the amount of limestone in the finished cement does not vary more than plus or minus 2.5 mass percent of the finished cement from lot to lot or within a lot. Limit the percent of slag, pozzolan, or limestone to a maximum of IS(50), IP(35) or IL(15). The percentage and type of mineral admixture used in the blend is not allowed to change from that submitted for the aggregate evaluation and mixture proportioning.

2.1.4.1 Portland Cement Concrete Mix Design

Design the concrete mixture to produce a minimum compressive strength of 3,000 psi at 72 hrs from the time the material is screeded and finished in the repair area and a minimum compressive strength of 5,000 psi at 28 days of age, determined in conformance with ASTM C39/C39M and ASTM C192/C192M, using standard 150 by 300 mm 6 by 12 inch cylinder specimens; and providing an air content by volume of 5 percent, plus or minus 1.5 percent, based on measurements made on concrete immediately after discharge from the mixer in conformance with ASTM C231/C231M.

The allowable range of slump is 1/2 to 2 inches when tested in accordance with ASTM C143/C143M.

2.1.5 Curing Materials

2.1.5.1 Pigmented Liquid Membrane-Forming Compound

Provide pigmented liquid membrane-forming compound conforming to COE CRD-C 300.

2.1.6 Joint Sealant

Provide joint sealant as indicated on the drawings.

2.1.7 Joint Filler

Provide joint filler material conforming to ASTM D1751 or ASTM D1752, Type II.

2.1.8 Water

Test water that is not approved by Public Health authorities for domestic consumption in accordance with ASTM C1602/C1602M and only use water that meets the acceptance criteria of Table 1 or 2 of ASTM C1602/C1602M or provide documentation that the water does meet the acceptance criteria of Table 2 of ASTM C1602/C1602M.

2.1.9 Rigid Proprietary Repair Products

A rigid proprietary repair product is defined as a rigid material in its hardened state with an elastic modulus greater than 1,000,000 psi. For partial depth repairs do not extend the product with aggregates that are or can be retained on a 3/4 inch sieve. Test the product in accordance with the following test series. Replicate each test on three specimens. Report all three results for each test and use the average value for comparison with the specification requirements. Report the curing conditions for each test type. A listing of preapproved proprietary repair products is provided as an attachment to this specification. Only those products indicated with an "X" for Permanent Airfield Repairs, Primary Runways and Taxiways, Spall repair may be selected. If not

selecting a preapproved proprietary repair product from the list, the contractor shall submit case history for the proposed repair product.

2.1.9.1 Compressive Strength

Cast 3 by 6 inch cylinder specimens in accordance with ASTM C192/C192M and test in accordance with ASTM C39/C39M, using bonded or unbonded caps, after 3 day curing period. Use only materials with a minimum compressive strength of =3,000 psi at dthree days age.

2.1.9.2 Bond Strength

Cast 3 by 6 inch cylinder specimens and test in accordance with ASTM C882/C882M. Cast the candidate material against a 30-degree wedge specimen consisting of the candidate material itself or an ordinary portland cement mixture. Test specimens, using bonded caps, after 1 day curing period. For a bond consisting of the candidate material bonded to OPC mortar, a minimum bond strength of 850 psi is required at 1 day of age. For a bond consisting of the candidate material bonded to itself, a minimum bond strength of 1,000 psi is required at 1 day of age.

2.1.9.3 Modulus of Elasticity

Cast 6 by 12 inch cylinder specimens in accordance with ASTM C192/C192M and test in accordance with ASTM C469/C469M, using bonded caps, after 3 day curing period. A maximum chord modulus of elasticity of 4,000,000 psi is required at 3 days of age.

2.1.9.4 Coefficient of Thermal Expansion

Cast 1 by 1 by 10-inches prismatic bar specimens and test in accordance with ASTM C531, after 3 days curing period. Use repair product with a coefficient not exceeding 7 by 10^{-6} inch per inch per degree F at 3 days of age. Also, determine the coefficient of thermal expansion of the existing pavement concrete by testing a core or by estimating based on material composition. Use a repair product with a coefficient of expansion within 20 percent of the coefficient of the existing pavement concrete.

2.1.9.5 Shrinkage Potential

Cast 13 inch I.D. by 16 inch O.D. by 6 inch tall restrained toroidal specimens and test in accordance with ASTM C1581/C1581M. Start measuring strain after completion of casting. Use repair products with shrinkage not exceeding 40 microstrain is required at 14 days of age. No cracking is permitted at 28 days of age.

2.1.9.6 Freeze-Thaw Resistance

Use aggregate with a satisfactory service record in freezing and thawing environments of at least 5 years of sucessful service in three concrete paving projects. Provide aggregate service record certified by an independent third party professional engineer, petrographer, or concrete materials engineer along with their resume. Otherwise, cast prismatic specimens in accordance with ASTM C192/C192M and test in accordance with ASTM C666/C666M, Procedure A. Begin freeze-thaw testing after specimens have been immersed in saturated lime-water for 3 days. Report the Durability Factor (DF) and the number of cycles to failure.

2.1.10 Polymeric Proprietary Repair Products

Polymeric repair materials include epoxies, methacrylates, and urethanes with or without aggregate. Use only materials that have not reached the manufacturer's published shelf life for the material lot. Ship and store materials in areas with temperature, humidity, solar exposure and packaging integrity in accordance with manufacturer's recommendations. Use and apply primers, bond agents or bond adhesives, in accordance with manufacturer's recommendations. Procure, prepare and use aggregates and fillers in accordance with manufacturer's recommendations. A listing of preapproved proprietary repair products is provided as an attachment to this specification. Only those products indicated with an "X" for Permanent Airfield Repairs, Primary Runways and Taxiways, Spall repair may be selected.

2.1.10.1 Chemical Reistance

Prepare two sets of three 2-inch cubes cured at 73 Degrees F for seven days. Measure and weigh the specimens before submerging the test solvent, JP8 fuel at 150 Degrees F for 24 hours in accordance with ASTM C267 one set of three specimen. Test compressive strength of the other three specimens for comparison. Measure, test, record and report the weight change and loss of compressive strength. Use only materials that have less than or equal to a 20 percent reduction in the average compressive strength of the three immersed sample compared to the average compressive strength of the non-immersed samples. Use only materials that have a change in weight of 10 percent or less.

2.1.10.2 Compressive Strength

Determine, record and report the compressive strength of the material using procedures contained in ASTM C579. Prepare three sets of three samples, one set per curing interval. Prepare the sample so that no sample dimension is less 2 in or 5 times the maximum aggregate size. The maximum aggregate size is the smallest standard sieve size through which 100 percent or the aggregate will pass. Cure the samples at 73 Degrees F. Test the first set of specimens after a curing period of one hour and a second set after a curing period of four hours. Test the third set of samples at the manufacturer’s published cure or trafficability time for the product at 73 Degrees F. Use only those materials which exceed 500 psi at the time of trafficking of the repair.

2.1.10.3 Flexural Strength and Modulus of Elasticity

Determine, record and report the Flexural strength and tangent modulus of elasticity of the material using procedures contained in ASTM C580 using three-point bending. Prepare three sets of three beam samples, one set per curing interval. Prepare the sample so that no sample dimension is less 2 in or 5 times the maximum aggregate size. The maximum aggregate size is the smallest standard sieve size through which 100 percent of the aggregate will pass. Cure the samples at 73 Degrees F. Test the first set of specimens after a curing period of one hour and a second set after a curing period of four hours. Test the third set of samples at the manufacturer’s published cure or trafficability time for the product at C 73 Degrees F. Use only those materials with a flexural strength which exceeds 350 psi and a tangent modulus greater than 5,000 psi at the time of trafficking of the repair.

2.1.10.4 Bond Strength by Slant Shear

Test, determine, record and report the material bond strength using ASTM C882/C882M, with the following modification. In lieu of the specified testing using a layer of material sandwiched between two PCC dummies, prepare samples which contain one PCC dummy that represents half of the specimen with repair material use to produce the other half of the sample. Cast 3 by 6 inch cylinder specimens by casting the polymeric repair material against a 30-degree wedge specimen consisting of an ordinary portland cement mixture. Prepare three sets of three cylinder samples, one set per curing interval. Cure the samples at 73 Degrees F. After curing, cap the cylinders according to ASTM C617/C617M. Test the composite cylinder in compression causing a shear failure at the bond line. Test one set of specimens after a curing period of four hours. Test another set after a curing period of 24 hours. Test the other set of samples at the manufacturer's published cure or trafficability time for the product at 73 Degrees F. Use only those materials with a calculated bond strength in excess of 500 psi at the time of traffic.

2.1.10.5 Thermal Compatibility

In accordance with ASTM C884/C884M, prepare two samples by first casting and curing for 28 days two PCC blocks, each measuring 12 in x 12 in x 3 in. After 28 days of curing, apply an overlay of the repair material on each of these two PCC blocks measuring 0.5 in thick. Cure each block for seven days at 73 Degrees F. Expose the composite specimens to five freeze–thaw cycles, each cycle consisting of exposure to -6 Degrees F for 24 hours then 73 Degrees F for 24 hours. Use only those materials that do not have any signs of delamination in either specimen.

2.1.10.6 Dynamic Mechanical Analysis (DMA)

Prepare three sample in accordance with ASTM D5023 using the largest samples that will fit in the test apparatus. Prepare the sample without aggregates if possible. Test, determine, record and report the change in Modulus of Elasticity as a function of temperature at intervals of 5 Degrees C 10 Degrees F . Report any melting of the repair material over the selected temperature range. Test the pavement repair material from -60 Degrees F to 400 Degrees F. Use a sinusoidal three-point bending load on the specimen at a frequency of 0.1 second with a maximum strain of 0.01 percent. Increase the temperature linearly at a rate of 3 Degrees C per minute. Record the storage modulus (modulus of elasticity), loss modulus, and tangent delta as a function of temperature. Test the specimens after curing the specimens for seven days at 73 Degrees F. Report the temperature at which the storage modulus value decreases to 50 percent of the modulus value at 73 Degrees F. Report if the sample melts or combusts at temperatures less than or equal to 400 Degrees F. Use only materials which have 50 percent reduction in modulus at temperatures in excess of 150 Degrees F. Use only materials which do not melt or combust at temperatures less than or equal to 400 Degrees F.

2.1.11 Sand-Cement Mortar for Filling Small Popouts

Sand-cement mortars are not permitted for spall repair. For small popouts, an approved epoxy may the used as the repair material.

PART 3 EXECUTION

3.1 PATCH MATERIAL SELECTION

Use Portland cement concrete (PCC) or approved proprietary product for repair areas more than 600 cubic inches in volume after unsound concrete is removed. Use Portland cement mortar for cavities between 50 and 600 cubic inches in size after unsound concrete is removed.

3.2 BATCHING, MIXING AND PROPORTIONING OF CONCRETE REPAIR MATERIAL

Provide facilities and equipment for the accurate measurement and control of each of the materials entering the concrete, mortar, and grout. Provide free access for the Contracting Officer to the batching and mixing plant at all times. Provide mixing equipment capable of combining the aggregate, cement, admixture, and water into a uniform mixture and discharging this mixture without segregation. The concrete mixing equipment is to meet the applicable requirements of ASTM C94/C94M.

The use of volumetric batching and continuous mixing is acceptable, provided all operations are in accordance with ASTM C685/C685M.

3.2.1 Equipment

Assemble dependable and operable equipment, allowing time for thorough inspection, calibration of weighing and measuring devices, adjustment of parts, and the making of any repairs that may be required prior to final approval and the commencement of work. Maintain the equipment in good working condition. Use only equipment that can ensure the water to cement ratio is within 2 percent of required.

3.2.2 Conveying

Convey concrete from mixer to repair area as rapidly as practical by methods which prevent segregation or loss of ingredients.

3.2.3 Facilities for Sampling

Provide facilities for readily obtaining representative samples of aggregate and concrete for test purposes. Furnish necessary platforms, tools, and equipment for obtaining samples.

3.2.4 Concrete Mix Proportions

Use proportions of concrete materials entering into the concrete mixture in accordance with the approved mix design. Revise the mix design whenever necessary to maintain the workability, strength, and standard of quality required, and to meet the varying conditions encountered during the construction; however, make no changes without prior approval. The water to cement ratio cannot exceed 0.45 at any time.

3.2.5 Measurement

Provide equipment necessary to measure and control the amount of each material in each batch of concrete. Weigh bulk cement. Cement in unopened bags as packed by the manufacturer may be used without weighing. One bag of portland cement is considered as weighing kg 94 pounds.

Measure mixing water and air-entraining admixtures by volume or by

weight. Consider one gallon of water as weighing 8.33 pounds.

Use only equipment, sensors and measurement controls that ensure the water to cement ratio is accurately controlled within 2 percent of required.

3.2.6 Workability

Maintain the slump of the concrete at the lowest practicable value, not exceeding the value specified in Paragraph PORTLAND CEMENT CONCRETE MIX DESIGN or the manufacturer's recommendation when proprietary repair materials are used.

3.3 PREPARATION OF EXISTING PAVEMENT

3.3.1 Preparation of Existing Surfaces

In the area to be patched, remove existing concrete to a minimum depth of 4 inches below the pavement surface adjacent to spalls and to such additional depth where necessary to expose a surface of sound, unweathered, and non-delaminated concrete that is not contaminated by sealants, oils, greases, or deicing salts or solutions. Make a vertical perimeter saw cut at least 2 inches deep and at least 2 inches outside of the area needing repair. Accomplish concrete removal in spalled areas with light, hand-held, high-frequency chipping hammers weighing not more than 30 pounds or other approved hand tools. Do not use jack hammers weighing more than 30 pounds and do not use pavement breaker devices mounted on or pulled by mobile equipment. Use of milling devices such as a cold planer are allowed but require augmentation with concrete saws and jack hammers to generate the required vertical surfaces on edges of the repair which are milled at the curvature of the drum.

Clean the repair area surface by waterblasting, blowing with compressed air, sweeping, and vacuums. Use waterblasting to remove all traces of sealer, oils, grease, rust, and other contaminants.

3.3.2 Reinforcement

Clean to bare metal by sandblasting any existing reinforcement exposed in the repair area. Remove any reinforcement that cannot be properly re-embedded in the new repair concrete. Cut and remove at the joint not less than 2 inches of existing exposed reinforcement that is continuous through the repair area and is embedded in the adjacent slab.

3.3.3 Preparation of Joints Adjacent to Spalls

Remove existing joint sealing and joint filler materials. Saw as indicated and install insert board, cut to appropriate dimensions, to prevent contact between new patch material and existing concrete at the adjacent joint face. Use insert board with a thickness equal to or slightly larger than the joint width (groove) adjacent to the repair material, as indicated on the drawings. Install a bead of approved caulking material to preclude new patching material from getting around insert and into the joint from the sides and bottom of the insert. Clean up any caulking material accidentally deposited on the prepared spall surface. Repair any sawcut overcuts with an approved epoxy repair material.

3.3.4 Disposal of Debris

Sweep pavement surface to remove excess joint material, dirt, water, sand, and other debris using vacuum sweepers or hand brooms. Remove the debris immediately outside the limits of Government-controlled land.

3.3.5 Bonding Agent, Adhesive or Coat

Prior to placing concrete, wash the previously prepared surfaces with a high pressure water jet followed by an air jet to remove free water on the repair surface.

3.3.5.1 Epoxy-Resin

Limit epoxy-resin bonding coat to use on patches with a surface area of less than 2 feet square. Coat the clean and dry surface, including sawed faces, with a 20 to 40 mil thick film of the epoxy-resin bonding coat Place the epoxy-resin bonding coat in one application, just prior to concrete placement, with the use of mechanical combination, mixing and spraying equipment, or two coat application with stiff brushes. Scrub the first brush coat into the concrete surface, followed by an additional brush coat to obtain the required thickness. Apply the final coat just prior to placement of the concrete.

3.3.5.2 Proprietary Repair Products

Apply in accordance with the manufacturer's written instructions.

3.4 PLACING

3.4.1 Portland Cement Concrete

Place concrete within 45 minutes after the introduction of the mixing water to the cement and aggregate or the introduction of the cement to the aggregate and before the concrete has obtained its initial set. The temperature of the concrete, as deposited in the repair area, can not be not less than 50 degrees F nor more than 90 degrees F. Deposit concrete as to require a minimum of re-handling and in such a manner so as to least disturb the sand-cement grout. Place concrete as indicated to maintain existing joints and working cracks. Use an insert or other bond-breaking medium where the spalled area abuts a joint to prevent bond at the joint face and to allow movement of the slabs and to prevent stress concentrations. Do not allow new repair material to infiltrate or span existing joints and cracks indicated to remain. Place concrete continuously in each spall area. Do not allow workmen to walk on the damp repair surface or in the concrete during placing and finishing operations.

Consolidate the concrete by small spud vibrators not greater than one inch in diameter, except that repair areas less than 4 inches deep or one square foot in area may be consolidated by hand tamping or other approved means. To avoid pulling material away from patch edge and to maximize bond strength, work the finishing screed from the center of the patch out to the patch boundary. Fill all saw kerfs extending beyond the repair area with grout. Start finishing operations immediately after placement of the concrete. Match finished surface grade of patched areas to the existing surface grade of the adjacent undisturbed pavement. Keep screeding, floating, or troweling of patch material onto adjacent

pavements to a minimum and remove loose or poorly bonded patch material from adjacent surfaces. Before the concrete becomes non-plastic, finish the surface with a burlap drag to approximately match the surface finish of existing adjacent concrete pavement. Remove repair materials for surfaces adjacent to but outside the repair surface.

Spalls, both with a maximum dimension less than 6 inches, and not within 4 inches of a joint or working crack, may be prepared by drilling a core 2 inches in diameter greater than the size of the defect, centered over the defect, and 2 inches deep or 1/2 inch into sound concrete, whichever is greater. Repair the core hole as specified above for other spalls.

3.4.2 Epoxy-Resin Concrete and Mortar

Limit epoxy-resin bonding coat to use on patches with a surface area of less than 2 feet square. Place the epoxy resin materials in layers not over 2 inches thick. Make the time interval between placement of additional layers such that the temperature of the epoxy resin material does not exceed 140 degrees F at any time during hardening. Use mechanical vibrators and hand tampers to consolidate the concrete or mortar. Remove any repair material on the surrounding surfaces of the existing concrete before it hardens.

Place the repair material as indicated to maintain existing joints and working cracks. Use an insert or other bond-breaking medium where the spalled area abuts a joint to prevent bond at the joint face. Do not allow new repair material to infiltrate or span existing joints and cracks indicated to remain. Place the repair material continuously in each spall area. Finish the repair material to match the grade of the adjacent concrete surface.

Spalls not adjacent to joints and popouts, both less than 6 inches in maximum dimension, may be prepared by drilling a core 2 inches in diameter greater than the size of the defect, centered over the defect, and 2 inches deep or 1/2 inch into sound concrete, whichever is greater. Repair the core hole as specified above for other spalls.

3.4.3 Proprietary Repair Products

Perform placing, consolidating, finishing, and curing operations in accordance with the manufacturer's written instructions.

Place the repair material as indicated to maintain existing joints and working cracks. Use an insert or other bond-breaking medium where the spalled area abuts a joint to prevent bond at the joint face. Do not allow new repair material to infiltrate or span existing joints and cracks. Place the repair material continuously in each spall area. Finish the repair material to match the grade of the adjacent concrete surface.

3.5 CURING

Cure the repair concrete by protection against loss of moisture and rapid temperature changes for a period of not less than 3 days from the beginning of the curing operation. Protect unhardened concrete from rain and flowing water. Provide all equipment needed for adequate curing and protection of the concrete on hand and ready to install before actual concrete placement begins. Cure proprietary repair products in accordance with manufacturer's recommendations. Failure to comply with curing requirements will be cause for immediate suspension of concreting

operations.

3.5.1 Membrane-Forming Curing Compound

Apply membrane -forming curing compound immediately to exposed concrete surfaces. Apply the curing compound with an overlapping coverage that will give a two-coat application at a coverage of not more than 200 square feet per gallon for both coats. When application is made by hand-operated sprayers, apply the second coat in a direction approximately at right angles to the first coat.

Cure concrete properly at joints, but do not allow absorbent curing compound to enter joints that are to be sealed with a joint-sealing compounds. Provide a uniform, continuous, cohesive compound film that will not check, crack, or peel, and that will be free from pinholes and other imperfections. Respray concrete surfaces that are subjected to heavy rainfall within 3 hours after the curing compound has been applied at the coverage specified above and at no additional cost to the Government. Respray areas covered with absorbent curing material that are damaged by pedestrian and vehicular traffic or by subsequent construction operations within the specified curing period at no additional cost to the Government.

3.6 JOINT RE-ESTABLISHMENT

For joint spall repairs, after the repair material has cured, saw a reservoir for the joint sealant to the dimensions required for other joints. Thoroughly clean and seal the reservoir with the sealer and backer rod specified for the joints. Construct new joints as detailed on the drawings and align with existing joints.

3.7 FINISH TOLERANCE

Provide finished surfaces of patched areas meeting the grade of the adjoining pavements without deviations more than 1/8 inch from a true plan surface within the patched area or at the interface with the adjoining pavement.

3.8 REPAIR AREA PROTECTION

Protect the patched areas against damage prior to final acceptance of the work by the Government. Exclude traffic from the patched areas by erecting and maintaining barricades and signs until the completion of the curing period of the concrete or the curing period of proprietary repair products as per the manufacturer's instructions.

3.9 FIELD QUALITY CONTROL

3.9.1 General Requirements

Test proprietary products in accordance with the manufacturer's written instructions.

3.9.2 Testing for Strength, Slump, and Air Content

Sample concrete in the field and test to determine the slump, air content, and strength of the concrete.

Make cylinders for each shift of placed concrete. Mold each group of test

cylinders from the same batch of concrete, consisting of a sufficient number of specimens to provide two compressive-strength tests at each test age. Make one group of specimens during the first half of the shift, and the other during the last portion of the shift. However, at the start of paving operations and each time the aggregate source, aggregate characteristic, or mix design is changed, make one additional set of test cylinders. Mold and cure test cylinders at the site for the first 24 hours or until the testing is required if less than 24 hours of curing is required and later in the laboratory in conformance with ASTM C31/C31M. Test cylinders in accordance with ASTM C39/C39M.

Determine the air content and slump in accordance with ASTM C231/C231M and ASTM C143/C143M, respectively.

3.9.2.1 Test Results

Remove concrete not meeting strength, consistency, and air content requirements and provide concrete that meets the requirements of this specification. The removal and replacement method or methods are subject to approval of the Contracting Officer.

3.9.2.2 Acceptance

Within 30 days of spall repair or prior to final acceptance, any spall repair material that cracks, or delaminates, or loses bond partly or completely as indicated by soundings, or causes spalling of adjacent portland cement concrete, or is not separated properly from adjacent slabs at joints, or fails to cure uniformly and completely, or is otherwise defective will be rejected by the Government.

Remove all unacceptable repairs, including new damaged areas adjacent to new spall patches, and provide new repairs meeting the specifications.

-- End of Section --

SECTION 33 40 00

STORM DRAINAGE UTILITIES
02/10

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM A48/A48M	(2003; R 2021) Standard Specification for Gray Iron Castings
ASTM A536	(1984; R 2019; E 2019) Standard Specification for Ductile Iron Castings
ASTM A929/A929M	(2018) Standard Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe
ASTM B 26/B 26M	(2009) Standard Specification for Aluminum-Alloy Sand Castings
ASTM C 139	(2010) Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes
ASTM C 270	(2010) Standard Specification for Mortar for Unit Masonry
ASTM C 443	(2010) Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
ASTM C 76	(2010a) Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
ASTM C231/C231M	(2022) Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
ASTM C990	(2009; R 2019) Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM D 1557	(2009) Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3) (2700 kN-m/m3)

ASTM D 1751	(2004; R 2008) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(2004a; R 2008) Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion
ASTM D 2167	(2008) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 4586	(2007) Asphalt Roof Cement, Asbestos-Free
ASTM D 6938	(2010) Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.2 SUBMITTALS

Government approval is required for submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data
Placing Pipe; G, RO

Concrete Pipe; G, DO

SD-07 Certificates

Determination of Density
Frame and Cover for Gratings

1.3 DELIVERY, STORAGE, AND HANDLING

1.3.1 Delivery and Storage

Materials delivered to site shall be inspected for damage, unloaded, and stored with a minimum of handling. Materials shall not be stored directly on the ground. The inside of pipes and fittings shall be kept free of dirt and debris. Before, during, and after installation, plastic pipe and fittings shall be protected from any environment that would result in damage or deterioration to the material. Keep a copy of the manufacturer's instructions available at the construction site at all times and follow these instructions unless directed otherwise by the Contracting Officer.

1.3.2 Handling

Materials shall be handled in a manner that ensures delivery to the trench in sound, undamaged condition. Pipe shall be carried to the trench, not dragged.

PART 2 PRODUCTS

2.1 PIPE FOR STORM DRAINS

Pipe for storm drains shall be of the sizes indicated and shall conform to the requirements specified.

2.1.1 Concrete Pipe

Manufactured in accordance with and conforming to ASTM C 76, Class III.

2.2 DRAINAGE STRUCTURES

2.2.1 Flared End Sections

Sections shall be of a standard design fabricated from zinc coated steel sheets meeting requirements of ASTM A929/A929M.

2.3 MISCELLANEOUS MATERIALS

2.3.1 Concrete

Unless otherwise specified, concrete and reinforced concrete shall conform to the requirements for 4,000 psi concrete under Section 03 30 53 MISCELLANEOUS CAST-IN-PLACE CONCRETE. The concrete mixture shall have air content by volume of concrete, based on measurements made immediately after discharge from the mixer, of 5 to 7 percent when maximum size of coarse aggregate exceeds 1-1/2 inches. Air content shall be determined in accordance with ASTM C231/C231M. The concrete covering over steel reinforcing shall not be less than 1 inch thick for covers and not less than 1-1/2 inches thick for walls and flooring. Concrete covering deposited directly against the ground shall have a thickness of at least 3 inches between steel and ground. Expansion-joint filler material shall conform to ASTM D 1751, or ASTM D 1752, or shall be resin-impregnated fiberboard conforming to the physical requirements of ASTM D 1752.

2.3.2 Mortar

Mortar for pipe joints, connections to other drainage structures, and brick or block construction shall conform to ASTM C 270, Type M, except that the maximum placement time shall be 1 hour. The quantity of water in the mixture shall be sufficient to produce a stiff workable mortar but in no case shall exceed 5 gallons of water per sack of cement. Water shall be clean and free of harmful acids, alkalies, and organic impurities. The mortar shall be used within 30 minutes after the ingredients are mixed with water. The inside of the joint shall be wiped clean and finished smooth. The mortar head on the outside shall be protected from air and sun with a proper covering until satisfactorily cured.

2.3.3 Precast Concrete Segmental Blocks

Precast concrete segmental block shall conform to ASTM C 139, not more than 8 inches thick, not less than 8 inches long, and of such shape that joints can be sealed effectively and bonded with cement mortar.

2.3.4 Frame and Cover for Gratings

Submit certification on the ability of frame and cover or gratings to carry the imposed live load. Frame and cover for gratings shall be cast

gray iron, ASTM A48/A48M, Class 35B; cast ductile iron, ASTM A536, Grade 65-45-12; or cast aluminum, ASTM B 26/B 26M, Alloy 356.OT6. The letter "D" shall be stamped or cast into covers so that it is plainly visible.

2.3.5 Joints

PART 3 EXECUTION

3.1 EXCAVATION FOR PIPE CULVERTS, STORM DRAINS, AND DRAINAGE STRUCTURES

Excavation of trenches, and for appurtenances and backfilling for culverts and storm drains, shall be in accordance with the applicable portions of Section 31 00 00 EARTHWORK and the requirements specified below.

3.1.1 Trenching

The width of trenches at any point below the top of the pipe shall be not greater than the outside diameter of the pipe plus 8 inches to permit satisfactory jointing and thorough tamping of the bedding material under and around the pipe. Sheeting and bracing, where required, shall be placed within the trench width as specified, without any overexcavation. Where trench widths are exceeded, redesign with a resultant increase in cost of stronger pipe or special installation procedures will be necessary. Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Government.

3.1.2 Removal of Rock

Rock in either ledge or boulder formation shall be replaced with suitable materials to provide a compacted earth cushion having a thickness between unremoved rock and the pipe of at least 8 inches or 1/2 inch for each foot of fill over the top of the pipe, whichever is greater, but not more than three-fourths the nominal diameter of the pipe. Where bell-and-spigot pipe is used, the cushion shall be maintained under the bell as well as under the straight portion of the pipe. Rock excavation shall be as specified and defined in Section 31 00 00 EARTHWORK.

3.1.3 Removal of Unstable Material

Where wet or otherwise unstable soil incapable of properly supporting the pipe, as determined by the Contracting Officer, is unexpectedly encountered in the bottom of a trench, such material shall be removed to the depth required and replaced to the proper grade with select granular material, compacted as provided in paragraph BACKFILLING. When removal of unstable material is due to the fault or neglect of the Contractor while performing shoring and sheeting, water removal, or other specified requirements, such removal and replacement shall be performed at no additional cost to the Government.

3.2 BEDDING

The bedding surface for the pipe shall provide a firm foundation of uniform density throughout the entire length of the pipe.

3.2.1 Concrete Pipe Requirements

Bedding material and placement shall be as detailed on the drawings. Bell holes and depressions for joints shall be removed and formed so entire

barrel of pipe is uniformly supported. The bell hole and depressions for the joints shall be not more than the length, depth, and width required for properly making the particular type of joint.

3.3 PLACING PIPE

Submit printed copies of the manufacturer's recommendations for installation procedures of the material being placed, prior to installation.

Each pipe shall be thoroughly examined before being laid; defective or damaged pipe shall not be used. Pipelines shall be laid to the grades and alignment indicated. Proper facilities shall be provided for lowering sections of pipe into trenches. Lifting lugs in vertically elongated metal pipe shall be placed in the same vertical plane as the major axis of the pipe. Pipe shall not be laid in water, and pipe shall not be laid when trench conditions or weather are unsuitable for such work. Diversion of drainage or dewatering of trenches during construction shall be provided as necessary.

3.3.1 Concrete Pipe

Laying shall proceed upgrade with spigot ends of bell-and-spigot pipe and tongue ends of tongue-and-groove pipe pointing in the direction of the flow.

3.4 JOINTING

3.4.1 Concrete

3.4.1.1 Rubber Gasket Joints

The design of joints and the physical requirements for rubber gaskets shall conform to ASTM C 443. Rubber gaskets shall comply with the oil resistant gasket requirements of ASTM C 443. Certified copies of test results shall be delivered to the Contracting Officer before gaskets or jointing materials are installed. Gaskets shall have not more than one factory-fabricated splice, except that two factory-fabricated splices of the rubber-type gasket are permitted if the nominal diameter of the pipe being gasketed exceeds 54 inches.

3.4.1.2 Preformed Flexible Joint Sealants

reformed flexible joint sealant shall consist of bitumen or butyl rubber sealants in extruded rope form conforming to ASTM C990.

3.4.1.3 Cold-Applied Mastic Joint Compound

Cold-applied mastic joint compound shall consist of refined asphalt dissolved in a suitable solvent and stiffened with a mineral filler and shall conform to ASTM D 4586.

3.5 DRAINAGE STRUCTURES

3.5.1 Manholes and Inlets

Construction shall be of reinforced concrete, plain concrete, brick, precast reinforced concrete, precast concrete segmental blocks, prefabricated corrugated metal, or bituminous coated corrugated metal;

complete with frames and covers or gratings; and with fixed galvanized steel ladders where indicated. Pipe studs and junction chambers of prefabricated corrugated metal manholes shall be fully bituminous-coated and paved when the connecting branch lines are so treated.

3.5.2 Walls and Headwalls

Construction shall be as indicated.

3.6 BACKFILLING

3.6.1 Backfilling Pipe in Trenches

After the pipe has been properly bedded, selected material from excavation or borrow, at a moisture content that will facilitate compaction, shall be placed along both sides of pipe in layers not exceeding 6 inches in compacted depth. The backfill shall be brought up evenly on both sides of pipe for the full length of pipe. The fill shall be thoroughly compacted under the haunches of the pipe. Each layer shall be thoroughly compacted with mechanical tampers or rammers. This method of filling and compacting shall continue until the fill has reached an elevation equal to the midpoint (spring line) of RCP or has reached an elevation of at least 12 inches above the top of the pipe for flexible pipe. The remainder of the trench shall be backfilled and compacted by spreading and rolling or compacted by mechanical rammers or tampers in layers not exceeding 8 inches. Tests for density shall be made as necessary to ensure conformance to the compaction requirements specified below. Where it is necessary, in the opinion of the Contracting Officer, that sheeting or portions of bracing used be left in place, the contract will be adjusted accordingly. Untreated sheeting shall not be left in place beneath structures or pavements.

3.6.2 Backfilling Pipe in Fill Sections

For pipe placed in fill sections, backfill material and the placement and compaction procedures shall be as specified below. The fill material shall be uniformly spread in layers longitudinally on both sides of the pipe, not exceeding 6 inches in compacted depth, and shall be compacted by rolling parallel with pipe or by mechanical tamping or ramming. Prior to commencing normal filling operations, the crown width of the fill at a height of 12 inches above the top of the pipe shall extend a distance of not less than twice the outside pipe diameter on each side of the pipe or 12 feet, whichever is less. After the backfill has reached at least 12 inches above the top of the pipe, the remainder of the fill shall be placed and thoroughly compacted in layers not exceeding 8 inches. Use select granular material for this entire region of backfill for flexible pipe installations.

3.6.3 Movement of Construction Machinery

When compacting by rolling or operating heavy equipment parallel with the pipe, displacement of or injury to the pipe shall be avoided. Movement of construction machinery over a culvert or storm drain at any stage of construction shall be at the Contractor's risk. Any damaged pipe shall be repaired or replaced.

3.6.4 Compaction

3.6.4.1 General Requirements

Cohesionless materials include gravels, gravel-sand mixtures, sands, and gravelly sands. Cohesive materials include clayey and silty gravels, gravel-silt mixtures, clayey and silty sands, sand-clay mixtures, clays, silts, and very fine sands. When results of compaction tests for moisture-density relations are recorded on graphs, cohesionless soils will show straight lines or reverse-shaped moisture-density curves, and cohesive soils will show normal moisture-density curves.

3.6.4.2 Minimum Density

Backfill over and around the pipe and backfill around and adjacent to drainage structures shall be compacted at the approved moisture content to the following applicable minimum density, which will be determined as specified below.

a. Under airfield and heliport pavements, paved roads, streets, parking areas, and similar-use pavements including adjacent shoulder areas, the density shall be not less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material, up to the elevation where requirements for pavement subgrade materials and compaction shall control.

b. Under unpaved or turfed traffic areas, density shall not be less than 90 percent of maximum density for cohesive material and 95 percent of maximum density for cohesionless material.

c. Under nontraffic areas, density shall be not less than that of the surrounding material.

3.6.5 Determination of Density

Testing is the responsibility of the Contractor and performed at no additional cost to the Government. Testing shall be performed by an approved commercial testing laboratory or by the Contractor subject to approval. Tests shall be performed in sufficient number to ensure that specified density is being obtained. Laboratory tests for moisture-density relations shall be made in accordance with ASTM D 1557 except that mechanical tampers may be used provided the results are correlated with those obtained with the specified hand tamper. Field density tests shall be determined in accordance with ASTM D 2167 or ASTM D 6938. When ASTM D 6938 is used, the calibration curves shall be checked and adjusted, if necessary, using the sand cone method as described in paragraph Calibration of the referenced publications. ASTM D 6938 results in a wet unit weight of soil and ASTM D 6938 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall be checked along with density calibration checks as described in ASTM D 6938. Test results shall be furnished the Contracting Officer. The calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed.

-- End of Section --

SECTION 33 71 02

UNDERGROUND ELECTRICAL DISTRIBUTION
02/26

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO HB-17	(2002; Errata 2003; Errata 2005, 17th Edition) Standard Specifications for Highway Bridges

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 318M	(2019; Errata 2022) Building Code Requirements for Structural Concrete & Commentary
ACI MNL-66	(2020) ACI Detailing Manual

AMERICAN WELDING SOCIETY (AWS)

AWS D1.1/D1.1M	(2025) Structural Welding Code - Steel

ASSOCIATION OF EDISON ILLUMINATING COMPANIES (AEIC)

AEIC CS8	(2013) Specification for Extruded Dielectric Shielded Power Cables Rated 5 Through 46 kV

ASTM INTERNATIONAL (ASTM)

ASTM B1	(2013) Standard Specification for Hard-Drawn Copper Wire
ASTM B3	(2013; R 2024) Standard Specification for Soft or Annealed Copper Wire
ASTM B8	(2023) Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
ASTM B496	(2016; R 2021) Standard Specification for Compact Round Concentric-Lay-Stranded Copper Conductors
ASTM C32	(2023) Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale)

ASTM C309	(2025) Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
ASTM C478	(2018) Standard Specification for Circular Precast Reinforced Concrete Manhole Sections
ASTM C857	(2016) Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
ASTM C990	(2009; R 2019) Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
ASTM F2160	(2022a) Standard Specification for Solid Wall High Density Polyethylene (HDPE) Conduit Based on Controlled Outside Diameter (OD)

INSTITUTE OF ELECTRICAL AND ELECTRONICS ENGINEERS (IEEE)

IEEE 48	(2020) Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV through 500 kV
IEEE 81	(2025) IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth
IEEE 400.2	(2024) Guide for Field Testing of Shielded Power Cable Systems Using Very Low Frequency (VLF)
IEEE 404	(2012) Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2500 V to 500,000 V
IEEE C2	(2023) National Electrical Safety Code
IEEE Stds Dictionary	(2009) IEEE Standards Dictionary: Glossary of Terms & Definitions

INSULATED CABLE ENGINEERS ASSOCIATION (ICEA)

ICEA S-94-649	(2021) Concentric Neutral Cables Rated 5 Through 46 KV

INTERNATIONAL ELECTRICAL TESTING ASSOCIATION (NETA)

NETA ATS	(2025) Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION (NEMA)

ANSI C119.1	(2023) Electric Connectors - Sealed Insulated Underground Connector Systems Rated 600 Volts
ANSI/NEMA WC 71/ICEA S-96-659	(2014; R 2022) Standard for Nonshielded Cables Rated 2001-5000 Volts for use in the Distribution of Electric Energy
NEMA RN 1	(2018) Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit
NEMA TC 2	(2020) Standard for Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TC 7	(2021) Smooth-Wall Coilable and Straight Electrical Polyethylene Conduit
NEMA TC 9	(2020) Standard for Fittings for Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installation
NEMA WC 74/ICEA S-93-639	(2022) 5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 70	(2026; TIA 26-1; ERTA 26-1; TIA 26-2; TIA 26-3; TIA 26-4; TIA 26-5; TIA 26-6; TIA 26-7; ERTA 26-2; ERTA 26-3) National Electrical Code

SOCIETY OF CABLE TELECOMMUNICATIONS ENGINEERS (SCTE)

ANSI/SCTE 77	(2013) Specification for Underground Enclosure Integrity

TELECOMMUNICATIONS INDUSTRY ASSOCIATION (TIA)

TIA-758	(2012b) Customer-Owned Outside Plant Telecommunications Infrastructure Standard

U.S. DEPARTMENT OF AGRICULTURE (USDA)

RUS Bull 1751F-644	(2002) Underground Plant Construction

U.S. GENERAL SERVICES ADMINISTRATION (GSA)

CID A-A-60005	(Basic; Notice 2) Frames, Covers, Gratings, Steps, Sump And Catch Basin, Manhole

UL SOLUTIONS (UL)

UL 6	(2022) UL Standard for Safety Electrical Rigid Metal Conduit-Steel

UL 83	(2017; Reprint Oct 2025) UL Standard for Safety Thermoplastic-Insulated Wires and Cables
UL 94	(2023; Reprint Jan 2024) UL Standard for Safety Tests for Flammability of Plastic Materials for Parts in Devices and Appliances
UL 467	(2022) UL Standard for Safety Grounding and Bonding Equipment
UL 486A-486B	(2025) UL Standard for Safety Wire Connectors
UL 510	(2020; Dec 2022) UL Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
UL 514A	(2024) UL Standard for Safety Metallic Outlet Boxes
UL 514B	(2012; Reprint Mar 2024) UL Standard for Safety Conduit, Tubing and Cable Fittings
UL 651	(2011; Reprint Jan 2026) UL Standard for Safety Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings
UL 854	(2020; Reprint Jul 2024) Standard for Service-Entrance Cables
UL 1072	(2006; Reprint Oct 2024) Medium-Voltage Power Cables
UL 1242	(2025) UL Standard for Safety for Electrical Intermediate Metal Conduit – Steel

1.2 RELATED REQUIREMENTS

Section 26 08 00 APPARATUS INSPECTION AND TESTING applies to this section, with the additions and modifications specified herein.

1.3 DEFINITIONS

a. Unless otherwise specified or indicated, electrical and electronics terms used in these specifications, and on the drawings, are as defined in IEEE Stds Dictionary.

b. In the text of this section, the words conduit and duct are used interchangeably and have the same meaning.

c. In the text of this section, "medium voltage cable splices," and "medium voltage cable joints" are used interchangeably and have the same meaning.

d. Underground structures subject to aircraft loading are indicated on

the drawings.

1.4 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Precast Underground Structures; G, RO

SD-03 Product Data

Medium Voltage Cable; G, RO

Medium Voltage Cable Joints; G, RO

Medium Voltage Cable Terminations; G, RO

Precast Concrete Structures; G, RO

Sealing Material

Pulling-In Irons

Manhole Frames and Covers; G, RO

Handhole Frames and Covers; G, RO

Frames and Covers for Airfield Facilities; G, RO

Composite/Fiberglass Handholes; G, RO

Cable Supports (racks, arms and insulators); G, RO

Manhole Immersion Heater; G, RO

SD-06 Test Reports

Medium Voltage Cable Qualification and Production Tests; G, RO

Field Acceptance Checks and Tests; G, RO

Arc-proofing Test for cable fireproofing tape; G, RO

Cable Installation Plan and Procedure; G, RO

SD-07 Certificates

Cable splicer/terminator; G, RO

Cable Installer Qualifications; G, RO

1.5 QUALITY ASSURANCE

1.5.1 Precast Underground Structures

Submittal required for each type used. Provide calculations and drawings for precast manholes and handholes bearing the seal of a registered professional engineer including:

a. Material description (i.e., f'c and Fy)

b. Manufacturer's printed assembly and installation instructions

c. Design calculations

d. Reinforcing shop drawings in accordance with ACI MNL-66

e. Plans and elevations showing opening and pulling-in iron locations and details

1.5.2 Certificate of Competency for Cable Splicer/Terminator

The cable splicer/terminator must have a certification from the National Cable Splicing Certification Board (NCSCB) in the field of splicing and terminating shielded medium voltage (5 kV to 35 kV) power cable using pre-manufactured kits (pre-molded, heat-shrink, cold shrink). Submit "Proof of Certification" for approval, for the individuals that will be performing cable splicer and termination work, 30 days before splices or terminations are to be made.

1.5.3 Cable Installer Qualifications

Provide at least one onsite person in a supervisory position with a documentable level of competency and experience to supervise all cable pulling operations. Provide a resume showing the cable installers' experience in the last three years, including a list of references complete with points of contact, addresses and telephone numbers. Cable installer must demonstrate experience with a minimum of three medium voltage cable installations. The Contracting Officer reserves the right to require additional proof of competency or to reject the individual and call for an alternate qualified cable installer.

1.5.4 Regulatory Requirements

In each of the publications referred to herein, consider the advisory provisions to be mandatory, as though the word, "must" had been substituted for "should" wherever it appears. Interpret references in these publications to the "authority having jurisdiction," or words of similar meaning, to mean the Contracting Officer. Equipment, materials, installation, and workmanship must be in accordance with the mandatory and advisory provisions of IEEE C2 and NFPA 70 unless more stringent requirements are specified or indicated.

1.5.5 Standard Products

Provide materials and equipment which are products of manufacturers regularly engaged in the production of such products which are of equal material, design and workmanship. Products must have been in satisfactory commercial or industrial use for 2 years prior to bid opening. The 2-year period must include applications of equipment and materials under similar

circumstances and of similar size. The product must have been for sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period. Where two or more items of the same class of equipment are required, these items must be products of a single manufacturer; however, the component parts of the item need not be the products of the same manufacturer unless stated in this section.

1.5.5.1 Alternative Qualifications

Products having less than a 2-year field service record will be acceptable if a certified record of satisfactory field operation for not less than 6000 hours, exclusive of the manufacturers' factory or laboratory tests, is furnished.

1.5.5.2 Material and Equipment Manufacturing Date

Products manufactured more than 3 years prior to date of delivery to site are not acceptable, unless specified otherwise.

PART 2 PRODUCTS

2.1 CONDUIT, DUCTS, AND FITTINGS

2.1.1 Rigid Metal Conduit

UL 6.

2.1.1.1 Rigid Metallic Conduit, PVC Coated

NEMA RN 1, Type A40, except that hardness must be nominal 85 Shore A durometer, dielectric strength must be minimum 400 volts per mil at 60 Hz, and tensile strength must be minimum 3500 psi.

2.1.2 Intermediate Metal Conduit

UL 1242.

2.1.2.1 Intermediate Metal Conduit, PVC Coated

NEMA RN 1, Type A40, except that hardness must be nominal 85 Shore A durometer, dielectric strength must be minimum 400 volts per mil at 60 Hz, and tensile strength must be minimum 3500 psi.

2.1.3 Plastic Conduit for Direct Burial and Riser Applications

UL 651 and NEMA TC 2, EPC-80.

2.1.4 Plastic Duct for Concrete Encasement

Provide Type EPC-40 in accordance with UL 651 and NEMA TC 2.

2.1.5 High Density Polyethylene (HDPE) Electrical Conduit for Directional Boring

Smoothwall, approved/listed for directional boring, minimum Schedule 80, ASTM F2160, NEMA TC 7.

2.1.6 Duct Sealant

UL 94, Class HBF. Provide high-expansion urethane foam duct sealant that expands and hardens to form a closed, chemically and water resistant, rigid structure. Sealant must be compatible with common cable and wire jackets and capable of adhering to metals, plastics and concrete. Sealant must be capable of curing in temperature ranges of 35 degrees F to 95 degrees F. Cured sealant must withstand temperature ranges of -20 degrees F to 200 degrees F without loss of function.

2.1.7 Fittings

2.1.7.1 Metal Fittings

UL 514B.

2.1.7.2 PVC Conduit Fittings

UL 514B, UL 651.

2.1.7.3 PVC Duct Fittings

NEMA TC 9.

2.1.7.4 Outlet Boxes for Steel Conduit

Outlet boxes for use with rigid or flexible steel conduit must be cast-metal cadmium or zinc-coated if of ferrous metal with gasketed closures and must conform to UL 514A.

2.2 LOW VOLTAGE INSULATED CONDUCTORS AND CABLES

Insulated conductors must be rated 600 volts and conform to the requirements of NFPA 70, including listing requirements. Wires and cables manufactured more than 24 months prior to date of delivery to the site are not acceptable. Service entrance conductors must conform to UL 854, type USE.

2.2.1 Conductor Types

Cable and duct sizes indicated are for copper conductors and THHN/THWN unless otherwise noted. Conductors No. 10 AWG and smaller must be solid. Conductors No. 8 AWG and larger must be stranded. All conductors must be copper.

2.2.2 Conductor Material

Unless specified or indicated otherwise or required by NFPA 70, wires in conduit, other than service entrance, must be 600-volt, Type THWN/THHN conforming to UL 83. Copper conductors must be annealed copper complying with ASTM B3 and ASTM B8.

2.2.3 Jackets

Provide multiconductor cables with an overall PVC outer jacket.

2.2.4 In Duct

Cables must be single-conductor cable. Cables in factory-installed,

coilable-plastic-duct assemblies must conform to NEMA TC 7.

2.2.5 Cable Marking

Insulated conductors must have the date of manufacture and other identification imprinted on the outer surface of each cable at regular intervals throughout the cable length.

Identify each cable by means of a fiber, laminated plastic, or non-ferrous metal tags in each manhole, handhole, junction box, and each terminal. Each tag must contain the following information; cable type, conductor size, circuit number, circuit voltage, cable destination and phase identification.

Color code conductors. Provide conductor identification within each enclosure where a tap, splice, or termination is made. Conductor identification must be by color-coded insulated conductors, plastic-coated self-sticking printed markers, colored nylon cable ties and plates, heat shrink type sleeves,or colored electrical tape. Properly identify control circuit terminations. Color must be green for grounding conductors and white for neutrals; except where neutrals of more than one system are installed in same raceway or box, other neutrals may be white with a different colored (not green) stripe for each. Color of ungrounded conductors in different voltage systems are as follows:

a. 208/120 volt, three-phase

(1) Phase A - black

(2) Phase B - red

(3) Phase C - blue

b. 480/277 volt, three-phase

(1) Phase A - brown

(2) Phase B - orange

(3) Phase C - yellow

c. 120/240 volt, single phase: Black and red

2.3 LOW VOLTAGE WIRE CONNECTORS AND TERMINALS

Provide a uniform compression over the entire conductor contact surface. Use solderless terminal lugs on stranded conductors.

a. For use with copper conductors: UL 486A-486B.

2.4 LOW VOLTAGE SPLICES

Provide splices in conductors with a compression connector on the conductor and by insulating and waterproofing using one of the following methods which are suitable for continuous submersion in water and comply with ANSI C119.1.

2.4.1 Heat Shrinkable Splice

Provide heat shrinkable splice insulation by means of a thermoplastic adhesive sealant material applied in accordance with the manufacturer's written instructions.

2.4.2 Cold Shrink Rubber Splice

Provide a cold-shrink rubber splice which consists of EPDM rubber tube which has been factory stretched onto a spiraled core which is removed during splice installation. The installation must not require heat or flame, or any additional materials such as covering or adhesive. It must be designed for use with inline compression type connectors, or indoor, outdoor, direct-burial or submerged locations.

2.5 MEDIUM VOLTAGE CABLE

Cable (conductor) sizes are designated by American Wire Gauge (AWG) and Thousand Circular Mils (Kcmil). Conductor and conduit sizes indicated are for copper conductors unless otherwise noted. Insulated conductors must have the date of manufacture and other identification imprinted on the outer surface of each cable at regular intervals throughout cable length. Wires and cables manufactured more than 24 months prior to date of delivery to the site are not acceptable. Provide single conductor type cables unless otherwise indicated.

2.5.1 Cable Configuration

Provide Type MV cable, conforming to NEMA WC 74/ICEA S-93-639 and UL 1072. Provide cables manufactured for use in duct applications. Cable must be rated 5 kV with 133 percent insulation level.

2.5.2 Conductor Material

Provide concentric-lay-stranded, Class B compact round conductors. Provide soft drawn copper cables complying with ASTM B3 and ASTM B8 for regular concentric and compressed stranding or ASTM B496 for compact stranding.

2.5.3 Insulation

Provide ethylene-propylene-rubber (EPR) insulation conforming to the requirements of ANSI/NEMA WC 71/ICEA S-96-659 and ICEA S-94-649.

2.5.4 Shielding

Cables rated for 2 kV and above must have a semiconducting conductor shield, a semiconducting insulation shield, and an overall copper wire shield for each phase.

2.5.5 Neutrals

Neutral conductors must be copper, employing the same insulation and jacket materials as phase conductors, except that a 600-volt insulation rating is acceptable.

2.6 MEDIUM VOLTAGE CABLE TERMINATIONS

IEEE 48 Class 1; of the molded elastomer, prestretched elastomer, or

heat-shrinkable elastomer. Acceptable elastomers are track-resistant silicone rubber or track-resistant ethylene propylene compounds, such as ethylene propylene rubber or ethylene propylene diene monomer. Separable insulated connectors may be used for apparatus terminations, when such apparatus is provided with suitable bushings. Provide terminations, where required, with mounting brackets suitable for the intended installation and with grounding provisions for the cable shielding, metallic sheath, or armor. Provide terminations in a kit, including: skirts, stress control terminator, ground clamp, connectors, lugs, and complete instructions for assembly and installation. Terminations must be the product of one manufacturer, suitable for the type, diameter, insulation class and level, and materials of the cable terminated. Do not use separate parts of copper or copper alloy in contact with aluminum alloy parts in the construction or installation of the terminator.

2.6.1 Cold-Shrink Type

Terminator must be a one-piece design, utilizing the manufacturer's latest technology, where high-dielectric constant (capacitive) stress control is integrated within a skirted insulator made of silicone rubber. Termination must not require heat or flame for installation. Termination kit must contain all necessary materials (except for the lugs). Design termination for installation in low or highly contaminated indoor and outdoor locations and must resist ultraviolet rays and oxidative decomposition.

2.6.2 Heat Shrinkable Type

Terminator must consist of a uniform cross section heat shrinkable polymeric construction stress relief tubing and environmentally sealed outer covering that is nontracking, resists heavy atmospheric contaminants, ultra violet rays and oxidative decomposition. Provide heat shrinkable sheds or skirts of the same material. Design termination for installation in low or highly contaminated indoor or outdoor locations.

2.7 MEDIUM VOLTAGE CABLE JOINTS

Provide joints (splices) in accordance with IEEE 404 suitable for the rated voltage, insulation level, insulation type, and construction of the cable. Joints must be certified by the manufacturer for waterproof, submersible applications. Upon request, supply manufacturer's design qualification test report in accordance with IEEE 404. Connectors for joint must be tin-plated electrolytic copper, having ends tapered and having center stops to equalize cable insertion.

2.7.1 Heat-Shrinkable Joint

Consists of a uniform cross-section heat-shrinkable polymeric construction with a linear stress relief system, a high dielectric strength insulating material, and an integrally bonded outer conductor layer for shielding. Replace original cable jacket with a heavy-wall heat-shrinkable sleeve with hot-melt adhesive coating.

2.7.2 Cold-Shrink Rubber-Type Joint

Joint must be of a cold shrink design that does not require any heat source for its installation. Splice insulation and jacket must be of a one-piece factory formed cold shrink sleeve made of black EPDM rubber. Splice should be packaged three splices per kit, including complete

installation instructions.

2.8 TAPE

2.8.1 Insulating Tape

UL 510, plastic insulating tape, capable of performing in a continuous temperature environment of 80 degrees C.

2.8.2 Buried Warning and Identification Tape

Provide detectable tape in accordance with Section 31 00 00 EARTHWORK.

2.8.3 Fireproofing Tape

Provide tape composed of a flexible, conformable, unsupported intumescent elastomer. Tape must be not less than .030 inch thick, noncorrosive to cable sheath, self-extinguishing, noncombustible, adhesive-free, and must not deteriorate when subjected to oil, water, gases, salt water, sewage, and fungus.

2.9 PULL ROPE

Plastic or flat pull line (bull line) having a minimum tensile strength of 200 pounds.

2.10 GROUNDING AND BONDING

2.10.1 Driven Ground Rods

Provide copper-clad steel ground rods conforming to UL 467 not less than 3/4 inch in diameter by 10 feet in length. Sectional type rods may be used for rods 20 feet or longer.

2.10.2 Grounding Conductors

Stranded-bare copper conductors must conform to ASTM B8, Class B, soft-drawn unless otherwise indicated. Solid-bare copper conductors must conform to ASTM B1 for sizes No. 8 and smaller. Insulated conductors must be of the same material as phase conductors and green color-coded, except that conductors must be rated no more than 600 volts. Aluminum is not acceptable.

2.11 CAST-IN-PLACE CONCRETE

Provide concrete in accordance with Section 03 30 53 MISCELLANEOUS CAST-IN-PLACE CONCRETE. In addition, provide concrete for encasement of underground ducts with 3000 psi minimum 28-day compressive strength. Concrete associated with electrical work for other than encasement of underground ducts must be 4000 psi minimum 28-day compressive strength unless specified otherwise.

2.12 UNDERGROUND STRUCTURES

Provide precast concrete underground structures or standard type cast-in-place manhole types as indicated, conforming to ASTM C857 and ASTM C478. Top, walls, and bottom must consist of reinforced concrete. Walls and bottom must be of monolithic concrete construction. Locate duct entrances and windows near the corners of structures to facilitate cable

racking. Covers must fit the frames without undue play. Form steel and iron to shape and size with sharp lines and angles. Castings must be free from warp and blow holes that may impair strength or appearance. Exposed metal must have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. Install a pulling-in iron in the wall opposite each duct line entrance. Cable racks, including rack arms and insulators, must be adequate to accommodate the cable.

2.12.1 Cast-In-Place Concrete Structures

Concrete must conform to Section 03 30 53 MISCELLANEOUS CAST-IN-PLACE CONCRETE. Construct walls on a footing of cast-in-place concrete except that precast concrete base sections may be used for precast concrete manhole risers.

2.12.2 Precast Concrete Structures, Risers and Tops

Precast concrete underground structures may be provided in lieu of cast-in-place subject to the requirements specified below. Precast units must be the product of a manufacturer regularly engaged in the manufacture of precast concrete products, including precast manholes.

2.12.2.1 General

Precast concrete structures must have the same accessories and facilities as required for cast-in-place structures. Likewise, precast structures must have plan area and clear heights not less than those of cast-in-place structures. Concrete materials and methods of construction must be the same as for cast-in-place concrete construction, as modified herein. Slope in floor may be omitted provided precast sections are poured in reinforced steel forms. Concrete for precast work must have a 28-day compressive strength of not less than 4000 psi. Structures may be precast to the design and details indicated for cast-in-place construction, precast monolithically and placed as a unit, or structures may be assembled sections, designed and produced by the manufacturer in accordance with the requirements specified. Structures must be identified with the manufacturer's name embedded in or otherwise permanently attached to an interior wall face.

2.12.2.2 Design for Precast Structures

ACI 318M. In the absence of detailed on-site soil information, design for the following soil parameters/site conditions:

a. Angle of Internal Friction (phi) = 30 degrees

b. Unit Weight of Soil (Dry) = 110 pcf, (Saturated) = 130 pcf

c. Coefficient of Lateral Earth Pressure (Ka) = 0.33

d. Ground Water Level = 3 feet below ground elevation

e. Vertical design loads must include full dead, superimposed dead, and live loads including a 30 percent magnification factor for impact. Live loads must consider all types and magnitudes of vehicular (automotive, industrial, or aircraft) traffic to be encountered. The minimum design vertical load must be for H20 highway loading in

accordance with AASHTO HB-17.

f. Horizontal design loads must include full geostatic and hydrostatic pressures for the soil parameters, water table, and depth of installation to be encountered. Also, horizontal loads imposed by adjacent structure foundations, and horizontal load components of vertical design loads, including impact, must be considered, along with a pulling-in iron design load of 6000 pounds.

g. Each structural component must be designed for the load combination and positioning resulting in the maximum shear and moment for that particular component.

h. Design must also consider the live loads induced in the handling, installation, and backfilling of the manholes. Provide lifting devices to ensure structural integrity during handling and installation.

2.12.2.3 Construction

Provide a uniform thickness for structure top, bottom, and wall not less than 6 inches. Thin-walled knock-out panels for designed or future duct bank entrances are not permitted. Provide quantity, size, and location of duct bank entrance windows as directed, and cast completely open by the precaster. Size of windows must exceed the nominal duct bank envelope dimensions by at least 12 inches vertically and horizontally to preclude in-field window modifications made necessary by duct bank misalignment. However, the sides of precast windows must be a minimum of 6 inches from the inside surface of adjacent walls, floors, or ceilings. Form the perimeter of precast window openings to have a keyed or inward flared surface to provide a positive interlock with the mating duct bank envelope. Provide welded wire fabric reinforcing through window openings for in-field cutting and flaring into duct bank envelopes. Provide additional reinforcing steel comprised of at least two No. 4 bars around window openings. Provide drain sumps a minimum of 12 inches in diameter and 4 inches deep for precast structures.

2.12.2.4 Joints

Provide tongue-and-groove joints on mating edges of precast components. Shiplap joints are not allowed. Design joints to firmly interlock adjoining components and to provide waterproof junctions and adequate shear transfer. Seal joints watertight using preformed plastic strip conforming to ASTM C990. Install sealing material in strict accordance with the sealant manufacturer's printed instructions. Provide waterproofing at conduit/duct entrances into structures, and where access frame meets the top slab, provide continuous grout seal.

2.12.3 Manhole Frames and Covers

Provide cast iron frames and covers for manholes conforming to CID A-A-60005. Cast the words "AIRFIELD LIGHTING" in the top face of airfield lighting manhole covers.

2.12.3.1 Manhole Immersion Heater

Industrial over-the-side immersion heater application: freeze proetection for ADF/stormwater vault (target temp: 40 degrees F). See site sheets for location.

a. Mechanical and Material Specifications:
- Sheath Material: 316 stainless steel (elements and all wetted parts) to withstand propylene/ethylene glycol and corrosive stormwater runoff.
- Terinal Enclosure: NEMA 4x (watertight and corrosion-resistant (mounted above the high water line.
- Mounting: Over-the-side hanging bracket.
- Sludge Leg (Cold Riser): Minimum 6-inch unheated lower zone to prevent element burnout when submerged in accumulated vault grit/sludge.

b. Controls and Safety Features:
- Thermostat: Integrated mechanical thermostst field-adjustable (range approx. 0 to 100 degrees F). Factory set to activate at 40 degrees F.
- Safety Cutoff (Critical): Must include a built-in low-liquid level cutoff switch or over-temperature thermal cutoff to immediately disconnect power if the element is exposed to open air.

2.12.4 Handhole Frames and Covers

Frames and covers of steel must be welded by qualified welders in accordance with standard commercial practice. Provide rolled-steel floor plate covers having an approved antislip surface. Hinges must be of stainless steel with bronze hinge pin , 5 by 5 inches by approximately 3/16 inch thick, without screw holes, and must be for full surface application by fillet welding. Hinges must have nonremovable pins and five knuckles. The surfaces of plates under hinges must be true after the removal of raised antislip surface, by grinding or other approved method.

2.12.5 Frames and Covers for Airfield Facilities

Fabricate frames and covers for airfield use of standard commercial grade steel welded by qualified welders in accordance with AWS D1.1/D1.1M. Provide rolled steel floor plate covers having an approved anti-slip surface. Steel frames and covers must be hot dipped galvanized after fabrication.

2.12.6 Brick for Manhole Collar

Provide sewer and manhole brick conforming to ASTM C32, Grade MS.

2.12.7 Composite/Fiberglass Handholes and Covers

ANSI/SCTE 77. Provide handholes and covers of polymer concrete, reinforced with heavy weave fiberglass with a design load (Tier rating) appropriate for or greater than the intended use. All covers are required to have the Tier level rating embossed on the surface which must not exceed the design load of the box.

2.13 CABLE SUPPORTS (RACKS, ARMS, AND INSULATORS)

Zinc coat the metal portion of racks and arms after fabrication.

2.13.1 Cable Rack Stanchions

The wall bracket or stanchion must be 4 inches by approximately 1-1/2 inch by 3/16 inch channel steel, or 4 inches by approximately 1 inch glass-reinforced nylon with recessed bolt mounting holes, 48 inches long

(minimum) in manholes. Space slots for mounting cable rack arms at 8 inch intervals.

2.13.2 Rack Arms

Cable rack arms must be steel or malleable iron or glass reinforced nylon and must be of the removable type. Rack arm length must be a minimum of 8 inches and a maximum of 12 inches.

2.13.3 Insulators

Insulators for metal rack arms must be dry-process glazed porcelain. Insulators are not required for nylon arms.

2.14 CABLE TAGS IN MANHOLES

Provide polyethylene tags for each power cable located in manholes. Do not provide handwritten letters. The first position on the power cable tag denotes the voltage. The second through sixth positions on the tag identifies the circuit. The next to last position denotes the phase of the circuit and include the Greek "phi" symbol. The last position denotes the cable size. As an example, a tag could have the following designation: "11.5 NAS 1-8(Phase A)500," denoting that the tagged cable is on the 11.5kV system circuit number NAS 1-8, underground, Phase A, sized at 500 kcmil.

2.14.1 Polyethylene Cable Tags

Provide tags of polyethylene having an average tensile strength of 3250 pounds per square inch; and that are 0.08 inch thick (minimum), non-corrosive non-conductive; resistive to acids, alkalis, organic solvents, and salt water; and distortion resistant to 170 degrees F. Provide 0.05 inch (minimum) thick black polyethylene tag holder. Provide a one-piece nylon, self-locking tie at each end of the cable tag, having a minimum loop tensile strength of 175 pounds and black block letters, numbers, and symbols one inch high on a yellow background. Letters, numbers, and symbols must not fall off or change positions regardless of the cable tags' orientation.

2.15 SOURCE QUALITY CONTROL

2.15.1 Arc-Proofing Test for Cable Fireproofing Tape

Manufacturer must test one sample assembly consisting of a straight lead tube 12 inches long with a 2 1/2 inch outside diameter, and a 1/8 inch thick wall, and covered with one-half lap layer of arc and fireproofing tape in accordance with manufacturer's instructions. The arc and fireproofing tape must withstand extreme temperature of a high-current fault arc 13,000 degrees K for 70 cycles as determined by using an argon directed plasma jet capable of constantly producing and maintaining an arc temperature of 13,000 degrees K. Temperature (13,000 degrees K) of the ignited arc between the cathode and anode must be obtained from a dc power source of 305 (plus or minus 5) amperes and 20 (plus or minus 1) volts. Direct the arc toward the sample assembly accurately positioned 5 (plus or minus 1) millimeters downstream in the plasma from the anode orifice by fixed flow rate of argon gas (0.18 g per second). Test each sample assembly at three unrelated points. Start time for tests must be taken from recorded peak current when the specimen is exposed to the full test temperature. Surface heat on the specimen prior to that time must be

minimal. The end point is established when the plasma or conductive arc penetrates the protective tape and strikes the lead tube. Submittals for arc-proofing tape must indicate that the test has been performed and passed by the manufacturer.

2.15.2 Medium Voltage Cable Qualification and Production Tests

Results of AEIC CS8 qualification and production tests as applicable for each type of medium voltage cable.

PART 3 EXECUTION

3.1 INSTALLATION

Install equipment and devices in accordance with the manufacturer's published instructions and with the requirements and recommendations of NFPA 70 and IEEE C2 as applicable. In addition to these requirements, install telecommunications in accordance with TIA-758 and RUS Bull 1751F-644.

3.2 CABLE INSPECTION

Inspect each cable reel for correct storage positions, signs of physical damage, and broken end seals prior to installation. If end seal is broken, remove moisture from cable prior to installation in accordance with the cable manufacturer's recommendations.

3.3 CABLE INSTALLATION PLAN AND PROCEDURE

Obtain from the manufacturer an installation manual or set of instructions which addresses such aspects as cable construction, insulation type, cable diameter, bending radius, cable temperature limits for installation, lubricants, coefficient of friction, conduit cleaning, storage procedures, moisture seals, testing for and purging moisture, maximum allowable pulling tension, and maximum allowable sidewall bearing pressure. Prepare a checklist of significant requirements, perform pulling calculations and prepare a pulling plan and submit along with the manufacturer's instructions in accordance with SUBMITTALS. Install cable strictly in accordance with the cable manufacturer's recommendations and the approved installation plan.

Calculations and pulling plan must include:

a. Site layout drawing with cable pulls identified in numeric order of expected pulling sequence and direction of cable pull.

b. List of cable installation equipment.

c. Lubricant manufacturer's application instructions.

d. Procedure for resealing cable ends to prevent moisture from entering cable.

e. Cable pulling tension calculations of all cable pulls.

f. Cable percentage conduit fill.

g. Cable sidewall bearing pressure.

h. Cable minimum bend radius and minimum diameter of pulling wheels used.

i. Cable jam ratio.

j. Maximum allowable pulling tension on each different type and size of conductor.

k. Maximum allowable pulling tension on pulling device.

3.4 UNDERGROUND STRUCTURE CONSTRUCTION

Provide standard type cast-in-place construction as specified herein and as indicated, or precast construction as specified herein. Horizontal concrete surfaces of floors must have a smooth trowel finish. Cure concrete by applying two coats of white pigmented membrane forming-curing compound in strict accordance with the manufacturer's printed instructions, except that precast concrete may be steam cured. Curing compound must conform to ASTM C309. Locate duct entrances and windows in the center of end walls (shorter) and near the corners of sidewalls (longer) to facilitate cable racking and splicing. Covers for underground structures must fit the frames without undue play. Form steel and iron to shape and size with sharp lines and angles. Castings must be free from warp and blow holes that may impair strength or appearance. Exposed metal must have a smooth finish and sharp lines and arises. Provide necessary lugs, rabbets, and brackets. Set pulling-in irons and other built-in items in place before depositing concrete. Manhole locations, as indicated, are approximate. Coordinate exact manhole locations with other utilities and finished grading and paving.

3.4.1 Cast-In-Place Concrete Structures

Construct walls on a footing of cast-in-place concrete except that precast concrete base sections may be used for precast concrete manhole risers.

3.4.2 Precast Concrete Construction

Set commercial precast structures on 6 inches of level, 90 percent compacted granular fill, 3/4 inch to 1 inch size, extending 12 inches beyond the structure on each side. Compact granular fill by a minimum of four passes with a plate type vibrator. Installation must additionally conform to the manufacturer's instructions.

3.4.3 Pulling-In Irons

Provide steel bars bent as indicated, and cast in the walls and floors. Alternatively, pipe sleeves may be precast into the walls and floors where required to accept U-bolts or other types of pulling-in devices possessing the strengths and clearances stated herein. The final installation of pulling-in devices must be made permanent. Cover and seal exterior projections of thru-wall type pulling-in devices with an appropriate protective coating. In the floor, locate the irons a minimum of 6 inches from the edge of the sump, and in the walls, locate the irons within 6 inches of the projected center of the duct bank pattern or precast window in the opposite wall. However, the pulling-in iron must not be located within 6 inches of an adjacent interior surface, or duct or precast window located within the same wall as the iron. If a pulling-in iron cannot be located directly opposite the corresponding duct bank or precast window due to this clearance limitation, locate the iron directly above or below the projected center of the duct bank pattern or precast window the

minimum distance required to preserve the 6 inch clearance previously stated. In the case of directly opposing precast windows, pulling-in irons consisting of a 3 foot length of No. 5 reinforcing bar, formed into a hairpin, may be cast-in-place within the precast windows simultaneously with the end of the corresponding duct bank envelope. Irons installed in this manner must be positioned directly in line with, or when not possible, directly above or below the projected center of the duct bank pattern entering the opposite wall, while maintaining a minimum clear distance of 3 inches from any edge of the cast-in-place duct bank envelope or any individual duct. Pulling-in irons must have a clear projection into the structure of approximately 4 inches and must be designed to withstand a minimum pulling-in load of 6000 pounds. Hot-dip galvanize irons after fabrication.

3.4.4 Cable Racks, Arms and Insulators

Cable racks, arms and insulators must be sufficient to accommodate the cables. Space racks in power manholes not more than 3 feet apart, and provide each manhole wall with a minimum of two racks. Space racks in signal manholes not more than 16 1/2 inches apart with the end rack being no further than 12 inches from the adjacent wall. Methods of anchoring cable racks are as follows:

a. Provide a 5/8 inch diameter by 5 inch long anchor bolt with 3 inch foot cast in structure wall with 2 inch protrusion of threaded portion of bolt into structure. Provide 5/8 inch steel square head nut on each anchor bolt. Coat threads of anchor bolts with suitable coating immediately prior to installing nuts.

b. Provide concrete channel insert with a minimum load rating of 800 pounds per foot. Insert channel must be steel of the same length as "vertical rack channel;" and cast flush in structure wall. Provide 5/8 inch steel nuts in channel insert to receive 5/8 inch diameter by 3 inch long steel, square head anchor bolts.

c. Provide concrete "spot insert" at each anchor bolt location, cast flush in structure wall. Each insert must have minimum 800 pound load rating. Provide 5/8 inch diameter by 3 inch long steel, square head anchor bolt at each anchor point. Coat threads of anchor bolts with suitable coating immediately prior to installing bolts.

3.4.5 Field Painting

Clean cast-iron frames and covers not buried in concrete or masonry of mortar, rust, grease, dirt and other deleterious materials, and coat with bituminous paint.

3.5 UNDERGROUND CONDUIT AND DUCT SYSTEMS

3.5.1 Requirements

Run conduit in straight lines except where a change of direction is necessary. Provide numbers and sizes of ducts as indicated. Provide a 4/0 AWG bare copper grounding conductor above medium-voltage distribution duct banks. Bond bare copper grounding conductor to ground rings (loops) in all manholes and to ground rings (loops) at all equipment slabs (pads). Route grounding conductor into manholes with the duct bank (sleeving is not required). Ducts must have a continuous slope downward toward underground structures and away from buildings, laid with a minimum

slope of 4 inches per 100 feet. Depending on the contour of the finished grade, the high-point may be at a terminal, a manhole, a handhole, or between manholes or handholes. Terminate all PVC conduit end points in utility holes, switching cabinets, transform handholes and buildings with end bells. The bell end of the conduits that enter manholes and handholes must be flush with the wall.

Perform changes in ductbank direction as follows:

a. Short-radius manufactured 90-degree duct bends may be used only for pole or equipment risers, unless specifically indicated as acceptable.

b. The minimum manufactured bend radius must be 18 inches for ducts of less than 3 inch diameter, and 36 inches for ducts 3 inches or greater in diameter.

c. As an exception to the bend radius required above, provide field manufactured longsweep bends having a minimum radius of 25 feet for a change of direction of more than 5 degrees, either horizontally or vertically, using a combination of curved and straight sections. Maximum manufactured curved sections allowed for use in field manufactured longsweep bend: 30 degrees.

3.5.2 Treatment

Keep ducts clean of concrete, dirt, or foreign substances during construction. Make field cuts requiring tapers with proper tools and match factory tapers. Use a coupling recommended by the duct manufacturer whenever an existing duct is connected to a duct of different material or shape. Store ducts to avoid warping and deterioration with ends sufficiently plugged to prevent entry of any water or solid substances. Thoroughly clean ducts before being laid. Store plastic ducts on a flat surface and protected from the direct rays of the sun.

3.5.3 Conduit Cleaning

As each conduit run is completed, for conduit sizes 3 inches and larger, draw a flexible testing mandrel approximately 12 inches long with a diameter less than the inside diameter of the conduit through the conduit. After which, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs. For conduit sizes less than 3 inches, draw a stiff bristle brush through until conduit is clear of particles of earth, sand and gravel; then immediately install conduit plugs.

3.5.4 Galvanized Conduit Concrete Penetrations

Galvanized conduits which penetrate concrete (slabs, pavement, and walls) in wet locations must be PVC coated and extend from at least 2 inches within the concrete to the first coupling or fitting outside the concrete (minimum of 6 inches from penetration).

3.5.5 Multiple Conduits

Separate multiple conduits by a minimum distance of 3 inches, except that light and power conduits must be separated from control, signal, and telephone conduits by a minimum distance of 12 inches. Stagger the joints of the conduits by rows (horizontally) and layers (vertically) to strengthen the conduit assembly. Provide plastic duct spacers that

interlock vertically and horizontally. Spacer assembly must consist of base spacers, intermediate spacers, ties, and locking device on top to provide a completely enclosed and locked-in conduit assembly. Install spacers in accordance with manufacturer's instructions, but provide a minimum of two spacer assemblies per 10 feet of conduit assembly.

3.5.6 Conduit Plugs and Pull Rope

Provide new conduit indicated as being unused or empty with plugs on each end. Plugs must contain a weephole or screen to allow water drainage. Provide a plastic pull rope having 3 feet of slack at each end of unused or empty conduits.

3.5.7 Conduit and Duct Without Concrete Encasement

Depths to top of the conduit must be not less than 24 inches below finished grade. Provide not less than 3 inches clearance from the conduit to each side of the trench. Grade bottom of trench smooth; where rock, soft spots, or sharp-edged materials are encountered, excavate the bottom for an additional 3 inches, fill and tamp level with original bottom with sand or earth free from particles, that would be retained on a 1/4 inch sieve. The first 6 inch layer of backfill cover must be sand compacted as previously specified. The rest of the excavation must be backfilled and compacted in 3 to 6 inch layers. Provide color, type and depth of warning tape as specified in Section 31 00 00 EARTHWORK.

3.5.7.1 Encasement Under Roads and Structures

Under roads, paved areas, and railroad tracks, install conduits in concrete encasement of rectangular cross-section providing a minimum of 3 inch concrete cover around ducts. Extend concrete encasement at least 5 feet beyond the edges of paved areas and roads, and 12 feet beyond the rails on each side of railroad tracks. Depths to top of the concrete envelope must be not less than 24 inches below finished grade.

3.5.8 Duct Encased in Concrete

Construct underground duct lines of individual conduits encased in concrete. Depths to top of the concrete envelope must be not less than 18 inches below finished grade, except under roads and pavement, concrete envelope must be not less than 24 inches below finished grade. Do not mix different kinds of conduit in any one duct bank. Concrete encasement surrounding the bank must be rectangular in cross-section and provide at least 3 inches of concrete cover for ducts. Separate conduits by a minimum concrete thickness of 3 inches. Before pouring concrete, anchor duct bank assemblies, prevent floating during concrete pouring by driving reinforcing rods adjacent to duct spacer assemblies and attaching the rods to the spacer assembly. Provide color, type and depth of warning tape as specified in Section 31 00 00 EARTHWORK.

3.5.8.1 Connections to Manholes

Duct bank envelopes connecting to underground structures must be flared to have enlarged cross-section at the manhole entrance to provide additional shear strength. Dimensions of the flared cross-section must be larger than the corresponding manhole opening dimensions by no less than 12 inches in each direction. Perimeter of the duct bank opening in the underground structure must be flared toward the inside or keyed to provide a positive interlock between the duct bank and the wall of the structure. Use

vibrators when this portion of the encasement is poured to assure a seal between the envelope and the wall of the structure.

3.5.8.2 Connections to Existing Underground Structures

For duct bank connections to existing structures, break the structure wall out to the dimensions required and preserve steel in the structure wall. Cut steel and extend into the duct bank envelope. Chip the perimeter surface of the duct bank opening to form a key or flared surface, providing a positive connection with the duct bank envelope.

3.5.8.3 Connections to Existing Concrete Pads

For duct bank connections to concrete pads, break an opening in the pad out to the dimensions required and preserve steel in pad. Cut the steel and extend into the duct bank envelope. Chip out the opening in the pad to form a key for the duct bank envelope.

3.5.8.4 Connections to Existing Ducts

Where connections to existing duct banks are indicated, excavate the banks to the maximum depth necessary. Cut off the banks and remove loose concrete from the conduits before new concrete-encased ducts are installed. Provide a reinforced concrete collar, poured monolithically with the new duct bank, to take the shear at the joint of the duct banks. Remove existing cables which constitute interference with the work.

3.5.8.5 Partially Completed Duct Banks

During construction wherever a construction joint is necessary in a duct bank, prevent debris such as mud, and, and dirt from entering ducts by providing suitable conduit plugs. Fit concrete envelope of a partially completed duct bank with reinforcing steel extending a minimum of 2 feet back into the envelope and a minimum of 2 feet beyond the end of the envelope. Provide one No. 4 bar in each corner, 3 inches from the edge of the envelope. Secure corner bars with two No. 3 ties, spaced approximately one foot apart. Restrain reinforcing assembly from moving during concrete pouring.

3.5.8.6 Removal of Ducts

Where duct lines are removed from existing underground structures, close the openings to waterproof the structure. Chip out the wall opening to provide a key for the new section of wall.

3.5.9 Duct Sealing

Seal all electrical penetrations for radon mitigation, maintaining integrity of the vapor barrier, and to prevent infiltration of air, insects, and vermin.

3.6 CABLE PULLING

Test existing duct lines with a mandrel and thoroughly swab out to remove foreign material before pulling cables. Pull cables down grade with the feed-in point at the manhole or buildings of the highest elevation. Use flexible cable feeds to convey cables through manhole opening and into duct runs. Do not exceed the specified cable bending radii when installing cable under any conditions, including turnups into switches,

transformers, switchgear, switchboards, and other enclosures. Cable with tape or wire shield must have a bending radius not less than 12 times the overall diameter of the completed cable. If basket-grip type cable-pulling devices are used to pull cable in place, cut off the section of cable under the grip before splicing and terminating.

3.6.1 Cable Lubricants

Use lubricants that are specifically recommended by the cable manufacturer for assisting in pulling jacketed cables.

3.7 CABLES IN UNDERGROUND STRUCTURES

Do not install cables utilizing the shortest path between penetrations, but route along those walls providing the longest route and the maximum spare cable lengths. Form cables to closely parallel walls, not to interfere with duct entrances, and support on brackets and cable insulators. Support cable splices in underground structures by racks on each side of the splice. Locate splices to prevent cyclic bending in the spliced sheath. Install cables at middle and bottom of cable racks, leaving top space open for future cables, except as otherwise indicated for existing installations. Provide one spare three-insulator rack arm for each cable rack in each underground structure.

3.7.1 Cable Tag Installation

Install cable tags in each manhole as specified, including each splice. Tag wire and cable provided by this contract. Install cable tags over the fireproofing, if any, and locate the tags so that they are clearly visible without disturbing any cabling or wiring in the manholes.

3.8 CONDUCTORS INSTALLED IN PARALLEL

Group conductors such that each conduit of a parallel run contains one Phase A conductor, one Phase B conductor, one Phase C conductor, and one neutral conductor.

3.9 LOW VOLTAGE CABLE SPLICING AND TERMINATING

Make terminations and splices with materials and methods as indicated or specified herein and as designated by the written instructions of the manufacturer. Do not allow the cables to be moved until after the splicing material has completely set. Make splices in underground distribution systems only in accessible locations such as manholes, handholes, or aboveground termination pedestals.

3.10 MEDIUM VOLTAGE CABLE TERMINATIONS

Make terminations in accordance with the written instruction of the termination kit manufacturer.

3.11 MEDIUM VOLTAGE CABLE JOINTS

Provide power cable joints (splices) suitable for continuous immersion in water. Make joints only in accessible locations in manholes or handholes by using materials and methods in accordance with the written instructions of the joint kit manufacturer.

3.11.1 Joints in Shielded Cables

Cover the joined area with metallic tape, or material like the original cable shield and connect it to the cable shield on each side of the splice. Provide a bare copper ground connection brought out in a watertight manner and grounded to the manhole grounding loop as part of the splice installation. Ground conductors, connections, and rods must be as specified elsewhere in this section. Wire must be trained to the sides of the enclosure to prevent interference with the working area.

3.11.2 Joints in Armored Cables

Enclose armored cable joints in compound-filled, cast-iron or alloy splice boxes equipped with stuffing boxes and armor clamps of a suitable type and size for the cable being installed.

3.12 CABLE END CAPS

Cable ends must be sealed at all times with coated heat shrinkable end caps. Cables ends must be sealed when the cable is delivered to the job site, while the cable is stored and during installation of the cable. The caps must remain in place until the cable is spliced or terminated. Sealing compounds and tape are not acceptable substitutes for heat shrinkable end caps. Cable which is not sealed in the specified manner at all times will be rejected.

3.13 FIREPROOFING OF CABLES IN UNDERGROUND STRUCTURES

Fireproof (arc proof) wire and cables which will carry current at 2200 volts or more in underground structures.

3.13.1 Fireproofing Tape

Tightly wrap strips of fireproofing tape around each cable spirally in half-lapped wrapping. Install tape in accordance with manufacturer's instructions.

3.13.2 Tape-Wrap

Tape-wrap metallic-sheathed or metallic armored cables without a nonmetallic protective covering over the sheath or armor prior to application of fireproofing. Wrap must be in the form of two tightly applied half-lapped layers of a pressure-sensitive 10 mil thick plastic tape, and must extend not less than one inch into the duct. Even out irregularities of the cable, such as at splices, with insulation putty before applying tape.

3.14 GROUNDING SYSTEMS

NFPA 70 and IEEE C2, except provide grounding systems with a resistance to solid earth ground not exceeding 25ohms.

3.14.1 Grounding Electrodes

Provide cone pointed driven ground rods driven full depth plus 6 inches, installed to provide an earth ground of the appropriate value for the particular equipment being grounded.
If the specified ground resistance is not met, provide an additional ground rod in accordance with the requirements of NFPA 70 (placed not less

than 6 feet from the first rod). Should the resultant (combined) resistance exceed the specified resistance, measured not less than 48 hours after rainfall, notify the Contracting Officer immediately.

3.14.2 Grounding Connections

Make grounding connections which are buried or otherwise normally inaccessible, by exothermic weld or compression connector.

a. Make exothermic welds strictly in accordance with the weld manufacturer's written recommendations. Welds which are "puffed up" or which show convex surfaces indicating improper cleaning are not acceptable. Mechanical connectors are not required at exothermic welds.

b. Make compression connections using a hydraulic compression tool to provide the correct circumferential pressure. Tools and dies must be as recommended by the manufacturer. An embossing die code or other standard method must provide visible indication that a connector has been adequately compressed on the ground wire.

3.14.3 Grounding Conductors

Provide bare grounding conductors, except where installed in conduit with associated phase conductors. Ground cable sheaths, cable shields, conduit, and equipment with No. 6 AWG. Ground other noncurrent-carrying metal parts and equipment frames of metal-enclosed equipment. Ground metallic frames and covers of handholes and pull boxes with a braided, copper ground strap with equivalent ampacity of No. 6 AWG. Provide direct connections to the grounding conductor with 600 v insulated, full-size conductor for each grounded neutral of each feeder circuit, which is spliced within the manhole.

3.14.4 Ground Cable Crossing Expansion Joints

Protect ground cables crossing expansion joints or similar separations in structures and pavements by use of approved devices or methods of installation which provide the necessary slack in the cable across the joint to permit movement. Use stranded or other approved flexible copper cable across such separations.

3.14.5 Manhole Grounding

Loop a 4/0 AWG grounding conductor around the interior perimeter, approximately 12 inches above finished floor. Secure the conductor to the manhole walls at intervals not exceeding 36 inches. Connect the conductor to the manhole grounding electrode with 4/0 AWG conductor. Connect all incoming 4/0 grounding conductors to the ground loop adjacent to the point of entry into the manhole. Bond the ground loop to all cable shields, metal cable racks, and other metal equipment with a minimum 6 AWG conductor.

3.15 EXCAVATING, BACKFILLING, AND COMPACTING

Provide in accordance with NFPA 70 and Section 31 00 00 EARTHWORK.

3.15.1 Reconditioning of Surfaces

3.15.1.1 Unpaved Surfaces

Restore to their original elevation and condition unpaved surfaces disturbed during installation of duct . Preserve sod and topsoil removed during excavation and reinstall after backfilling is completed. Replace sod that is damaged by sod of quality equal to that removed. When the surface is disturbed in a newly seeded area, re-seed the restored surface with the same quantity and formula of seed as that used in the original seeding, and provide topsoiling, fertilizing, liming, seeding, sodding, sprigging, or mulching. Provide work in accordance with Section 32 92 19 SEEDING.

3.15.1.2 Paving Repairs

Where trenches, pits, or other excavations are made in existing roadways and other areas of pavement where surface treatment of any kind exists , restore such surface treatment or pavement the same thickness and in the same kind as previously existed, except as otherwise specified, and to match and tie into the adjacent and surrounding existing surfaces.

3.16 CAST-IN-PLACE CONCRETE

Provide concrete in accordance with Section 03 30 53 MISCELLANEOUSCAST-IN-PLACE CONCRETE.

3.16.1 Concrete Slabs (Pads) for Equipment

Unless otherwise indicated, the slab must be at least 8 inches thick, reinforced with a 6 by 6 - W2.9 by W2.9 mesh, placed uniformly 4 inches from the top of the slab. Place slab on a 6 inch thick, well-compacted gravel base. Top of concrete slab must be approximately 4 inches above finished grade with gradual slope for drainage. Edges above grade must have 1/2 inch chamfer. Slab must be of adequate size to project at least 8 inches beyond the equipment.

Stub up conduits, with bushings, 2 inches into cable wells in the concrete pad. Coordinate dimensions of cable wells with transformer cable training areas.

3.16.2 Sealing

When the installation is complete, seal all conduit and other entries into the equipment enclosure with an approved sealing compound. Seals must be of sufficient strength and durability to protect all energized live parts of the equipment from rodents, insects, or other foreign matter.

3.17 FIELD QUALITY CONTROL

3.17.1 Performance of Field Acceptance Checks and Tests

Perform in accordance with the manufacturer's recommendations, and include the following visual and mechanical inspections and electrical tests, performed in accordance with NETA ATS.

3.17.1.1 Medium Voltage Cables

Perform tests after installation of cable, splices, and terminators and

before terminating to equipment or splicing to existing circuits.

a. Visual and Mechanical Inspection

(1) Inspect exposed cable sections for physical damage.

(2) Verify that cable is supplied and connected in accordance with contract plans and specifications.

(3) Inspect for proper shield grounding, cable support, and cable termination.

(4) Verify that cable bends are not less than ICEA or manufacturer's minimum allowable bending radius.

(5) Inspect for proper fireproofing.

(6) Visually inspect jacket and insulation condition.

(7) Inspect for proper phase identification and arrangement.

b. Electrical Tests

(1) Perform a shield continuity test on each power cable by ohmmeter method. Record ohmic value, resistance values in excess of 10 ohms per 1000 feet of cable must be investigated and justified.

(2) Perform acceptance test on new cables before the new cables are connected to existing cables and placed into service, including terminations and joints. Perform maintenance test on complete cable system after the new cables are connected to existing cables and placed into service, including existing cable, terminations, and joints. Tests must be very low frequency (VLF) alternating voltage withstand tests in accordance with IEEE 400.2. VLF test frequency must be 0.05 Hz minimum for a duration of 60 minutes using a sinusoidal waveform. Test voltages must be as follows:

CABLE RATING AC TEST VOLTAGE for ACCEPTANCE TESTING	
5 kV	10kV rms(peak)
8 kV	13kV rms(peak)
15 kV	20kV rms(peak)
25 kV	31kV rms(peak)
35 kV	44kV rms(peak)

CABLE RATING AC TEST VOLTAGE for MAINTENANCE TESTING	
5 kV	7kV rms(peak)
8 kV	10kV rms(peak)
15 kV	16kV rms(peak)
25 kV	23kV rms(peak)
35 kV	33kV rms(peak)

3.17.1.2 Low Voltage Cables, 600-Volt

Perform tests after installation of cable, splices and terminations and before terminating to equipment or splicing to existing circuits.

a. Visual and Mechanical Inspection

(1) Inspect exposed cable sections for physical damage.

(2) Verify that cable is supplied and connected in accordance with contract plans and specifications.

(3) Verify tightness of accessible bolted electrical connections.

(4) Inspect compression-applied connectors for correct cable match and indentation.

(5) Visually inspect jacket and insulation condition.

(6) Inspect for proper phase identification and arrangement.

b. Electrical Tests

(1) Perform insulation resistance tests on wiring No. 6 AWG and larger diameter using instrument which applies voltage of approximately 1000 volts dc for one minute.

(2) Perform continuity tests to insure correct cable connection.

3.17.1.3 Grounding System

a. Visual and mechanical inspection

Inspect ground system for compliance with contract plans and specifications.

b. Electrical tests

Perform ground-impedance measurements utilizing the fall-of-potential method in accordance with IEEE 81. On systems consisting of interconnected ground rods, perform tests after interconnections are complete. On systems consisting of a single ground rod perform tests before any wire is connected. Take measurements in normally dry weather, not less than 48 hours after rainfall. Use a portable ground

resistance tester in accordance with manufacturer's instructions to test each ground or group of grounds. The instrument must be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground rod or grounding systems under test. Provide site diagram indicating location of test probes with associated distances, and provide a plot of resistance vs. distance.

3.17.2 Follow-Up Verification

Upon completion of acceptance checks and tests, show by demonstration in service that circuits and devices are in good operating condition and properly performing the intended function. As an exception to requirements stated elsewhere in the contract, the Contracting Officer must be given 5 working days advance notice of the dates and times of checking and testing.

.... -- End of Section --

SECTION 33 11 00

WATER UTILITY DISTRIBUTION PIPING
08/24

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B18.2.2	(2022) Nuts for General Applications: Machine Screw Nuts, and Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)

AMERICAN WATER WORKS ASSOCIATION (AWWA)

AWWA C111/A21.11	(2023) Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
AWWA C219	(2023) Bolted Sleeve-Type Couplings for Plain-End Pipe
AWWA C500	(2019) Metal-Seated Gate Valves for Water Supply Service
AWWA C509	(2023) Resilient-Seated Gate Valves for Water Supply Service
AWWA C515	(2020) Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service
AWWA C600	(2023) Installation of Ductile-Iron Mains and Their Appurtenances
AWWA C604	(2017) Installation of Buried Steel Water Pipe—4 In. (100 mm) and Larger
AWWA C605	(2021) Underground Installation of Polyvinyl Chloride (PVC) and Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe and Fittings
AWWA C651	(2023) Standard for Disinfecting Water Mains
AWWA C655	(2018) Field Dechlorination
AWWA M23	(2020) Manual: PVC Pipe - Design and Installation - Third Edition

ASTM INTERNATIONAL (ASTM)

ASTM A307	(2023) Standard Specification for Carbon

	Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
ASTM A536	(2024) Standard Specification for Ductile Iron Castings
ASTM A563/A563M	(2024) Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric)
ASTM C94/C94M	(2025a) Standard Specification for Ready-Mixed Concrete
ASTM F1674	(2018) Standard Test Method for Joint Restraint Products for Use with PVC Pipe
ASTM F3190	(2021) Standard Practice for Heat Fusion Equipment (HFE) Operator Qualification on Polyethylene (PE) and Polymide (PA) Pipe and Fittings

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION (ISO)

ISO 8678	(1998) Cup Head Square Neck Bolts with Small Head and Short Neck-Product Grade B

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 24	(2025) Standard for the Installation of Private Fire Service Mains and Their Appurtenances

UL SOLUTIONS (UL)

UL 262	(2004; Reprint Jul 2023) Gate Valves for Fire-Protection Service

1.2 DEFINITIONS

1.2.1 Water Mains

Water mains include water piping having diameters 4 through 14 inch, specific materials, methods of joining and any appurtenances deemed necessary for a satisfactory system.

1.2.2 Additional Definitions

For additional definitions refer to the definitions in the applicable referenced standard.

1.3 SUBMITTALS

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Connections; G

SD-03 Product Data

Pipe Restraint; G

Precast Concrete Thrust Blocks; G

Disinfection Procedures; G

SD-06 Test Reports

Bacteriological Samples; G

Leakage Test

Hydrostatic Test

SD-07 Certificates

Fusion Technician Qualifications; G

1.4 QUALITY CONTROL

1.4.1 Regulatory Requirements

Comply with NFPA 24 for materials, installation, and testing of fire main piping and components.

1.4.2 Qualifications

1.4.2.1 Fusion Technician Qualifications

Submit a certificate from the manufacturer of the fusible pipe that shows the fusion technician is fully qualified to install fusible pipe of the types and sizes being used. Qualification must be current as of the actual date of fusion performance on the project.

1.4.2.1.1 Fusion Technician Qualification on Polyethylene (PE) Pipe and Fittings

Provide certification for PE Pipe heat fusion in accordance with ASTM F3190.

1.5 HANDLING

1.5.1 Handling

Handle pipe, fittings, valves, and other accessories in accordance with applicable AWWA standard, manufacturer's instructions and in a manner to ensure delivery to the trench in sound undamaged condition. Avoid injury to coatings and linings on pipe and fittings; make repairs if coatings or linings are damaged. Do not place other material, hooks, or pipe inside a pipe or fitting after the coating has been applied. Inspect the pipe for defects before installation. Carry, do not drag pipe to the trench. Use of pinch bars and tongs for aligning or turning pipe will be permitted only on the bare ends of the pipe. Clean the interior of pipe and accessories of foreign matter before being lowered into the trench and keep them clean during laying operations by plugging. Replace defective material without additional expense to the Government. Store rubber gaskets, not immediately installed, under cover or out of direct sunlight.

Handle PVC pipe, fittings, and accessories in accordance with AWWA C605. Handle steel pipe, fittings and accessories in accordance with AWWA C604.

PART 2 PRODUCTS

2.1 ACCESSORIES

2.1.1 Pipe Restraint

2.1.1.1 Thrust Blocks

Use ASTM C94/C94M concrete having a minimum compressive strength of 2,500 psi at 28 days or use concrete of a mix not leaner than one part cement, two and one half parts sand, and five parts gravel, having the same minimum compressive strength.

2.1.1.2 Precast Thrust Blocks

Provide precast concrete thrust blocks.

2.1.1.3 Joint Restraint

Provide restrained joints in accordance with NFPA 24, Chapter 10 and in accordance with ASTM F1674.

Provide mechanical joint restraint.

2.1.2 Sleeve-Type Mechanical Couplings

Use AWWA C219 couplings to join plain-end piping by compression of a ring gasket at each end of the adjoining pipe sections. The coupling consists of one middle ring flared or beveled at each end to provide a gasket seat; two follower rings; two resilient tapered rubber gaskets; and bolts and nuts to draw the follower rings toward each other to compress the gaskets. Provide true circular middle ring and the follower rings sections free from irregularities, flat spots, and surface defects; provide for confinement and compression of the gaskets. For ductile iron and PVC pipe, use ASTM A536 ductile iron. Use gaskets for resistance to set after installation and to meet the requirements specified for gaskets for mechanical joint in AWWA C111/A21.11. Provide track-head type bolts ASTM A307, Grade A, with ASTM A563/A563M, Grade A nuts or round-head square-neck type ISO 8678 bolts with ASME B18.2.2 hex nuts. Provide 5/8 inch diameter bolts. Minimum number of bolts for each coupling is 4 for 6 inch pipe, . Shape bolt holes in follower rings to hold fast to the necks of the bolts used. Do not use mechanically coupled joints using a sleeve-type mechanical coupling as an optional method of jointing except where pipeline is adequately anchored to resist tension pull across the joint. Provide a tight flexible joint with mechanical couplings under reasonable conditions, such as pipe movements caused by expansion, contraction, slight settling or shifting in the ground, minor variations in trench gradients, and traffic vibrations. Match coupling strength to that of the adjoining pipeline.

2.1.3 Insulating Joints

Provide a rubber-gasketed insulating joint or dielectric coupling between pipe of dissimilar metals which will effectively prevent metal-to-metal contact between adjacent sections of piping.

2.1.4 Bonded Joints

For all ferrous pipe, provide a metallic bond at each joint, including joints made with flexible couplings, caulking, or rubber gaskets, of ferrous metallic piping to effect continuous conductivity. Provide Size 1/0 copper conductor thermal weld type bond wire designed for direct burial and shaped to stand clear of the joint.

2.1.5 Dielectric Fittings

Install dielectric fittings between threaded ferrous and nonferrous metallic pipe, fittings and valves, except where corporation stops join mains to prevent metal-to-metal contact of dissimilar metallic piping elements and compatible with the indicated working pressure.

2.1.6 Tracer Wire for Nonmetallic Piping

Provide a continuous bare copper or aluminum wire not less than 0.10 inch in diameter in sufficient length over each separate run of nonmetallic pipe.

PART 3 EXECUTION

3.1 PREPARATION

3.1.1 Connections to Existing System

Perform all connections to the existing water system in the presence of the Contracting Officer.

3.1.2 Operation of Existing Valves

Do not operate valves within or directly connected to the existing water system unless expressly directed to do so by the Contracting Officer.

3.1.3 Earthwork

Perform earthwork operations in accordance with Section 31 00 00 EARTHWORK.

3.2 INSTALLATION

Install all materials in accordance with the applicable reference standard, manufacturers instructions and as indicated herein.

3.2.1 Piping

3.2.1.1 General Requirements

Install pipe, fittings, joints and couplings in accordance with the applicable referenced standard, the manufacturer's instructions and as specified herein.

3.2.1.1.1 Pipe Laying and Jointing

Remove fins and burrs from pipe and fittings. Before placing in position, clean pipe, fittings, valves, and accessories, and maintain in a clean condition. Provide proper facilities for lowering sections of pipe into trenches. Under no circumstances is it permissible to drop or dump pipe,

fittings, valves, or other water line material into trenches. Cut pipe cleanly, squarely, and accurately to the length established at the site and work into place without springing or forcing. Inspect pipe and fittings prior to backfilling and repair as required. Replace a pipe or fitting that does not allow sufficient space for installation of jointing material. Blocking or wedging between bells and spigots is not permitted. Lay bell-and-spigot pipe with the bell end pointing in the direction of laying. Grade the pipeline in straight lines; avoid the formation of dips and low points. Support pipe at the design elevation and grade. Secure firm, uniform support. Wood support blocking is not permitted. Lay pipe so that the full length of each section of pipe and each fitting rests solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings. Provide anchors and supports for fastening work into place. Make provision for expansion and contraction of pipelines. Keep trenches free of water until joints have been assembled. At the end of each work day, close open ends of pipe temporarily with wood blocks or bulkheads. Do not lay pipe when conditions of trench or weather prevent installation. Provide a minimum of 5 feet depth of cover over top of pipe.

3.2.1.1.2 Tracer Wire

Install a continuous length of tracer wire for the full length of each run of nonmetallic pipe. Attach wire to top of pipe in such manner that it will not be displaced during construction operations.

3.2.1.1.3 Connections to Existing Water Lines

Make connections to existing water lines after coordination with the facility and with a minimum interruption of service on the existing line.

3.2.1.1.4 Sewer Manholes

No water piping is to pass through or come in contact with any part of a sewer manhole.

3.2.1.1.5 Water Piping Parallel With Sewer Piping

Where the location of the water line is not clearly defined by dimensions on the drawings, do not lay water line closer than 10 feet, horizontally, from any sewer line.

3.2.1.1.6 Water Piping Crossing Sewer Piping

Provide at least 18 inches above the top (crown) of the sewer piping and the bottom (invert) of the water piping whenever possible. Measure the distance edge-to-edge. Where water lines cross under gravity sewer lines, construct sewer line of AWWA compliant ductile iron water piping with rubber-gasketed joints and no joint located within 10 feet, horizontally, of the crossing.

3.2.1.1.7 Penetrations

Provide ductile-iron or Schedule 40 steel wall sleeves for pipe passing through walls of valve pits and structures. Fill annular space between walls and sleeves with rich cement mortar. Fill annular space between pipe and sleeves with mastic.

3.2.1.2 PVC Water Main Pipe

Unless otherwise specified, install pipe and fittings in accordance with the paragraph GENERAL REQUIREMENTS and with the requirements of AWWA C605 for laying of pipe, joining PVC pipe to fittings and accessories, setting of fire hydrants, valves, and fittings; and with the recommendations for pipe joint assembly and appurtenance installation in AWWA M23, Chapter 7, "Installation in Trenches and Embankments."

a. Jointing: Make push-on joints with the elastomeric gaskets specified for this type joint, using either elastomeric-gasket bell-end pipe or elastomeric-gasket couplings. For pipe-to-pipe push-on joint connections, use only pipe with push-on joint ends having factory-made bevel; for push-on joint connections to metal fittings, valves, and other accessories, cut spigot end of pipe off square and re-bevel pipe end to a bevel approximately the same as that on ductile-iron pipe used for the same type of joint. Use a lubricant recommended by the pipe manufacturer for push-on joints. Assemble push-on joints for pipe-to-pipe joint connections in accordance with the requirements of AWWA C605 for laying the pipe and the recommendations in AWWA M23, Chapter 7, "Installation in Trenches and Embankments," for pipe joint assembly. Assemble push-on joints for connection to fittings, valves, and other accessories in accordance with the requirements of AWWA C605 for joining PVC pipe to fittings and accessories and with the requirements of AWWA C600 for joint assembly. Make compression-type joints/mechanical joints with the gaskets, glands, bolts, nuts, and internal stiffeners previously specified for this type joint; assemble in accordance with the requirements of AWWA C605 for joining PVC pipe to fittings and accessories, with the requirements of AWWA C600 for joint assembly, and with the recommendations of Appendix A to AWWA C111/A21.11. Cut off spigot end of pipe for compression-type joint/mechanical-joint connections and do not re-bevel. Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer using internal stiffeners as previously specified for compression-type joints.

b. Joint Offset: Construct joint offset in accordance AWWA C605. Do not exceed the minimum longitudinal bending as indicated by AWWA C605.

c. Fittings: Install in accordance with AWWA C605.

3.2.2 Disinfection

Prior to disinfection, provide disinfection procedures, proposed neutralization and disposal methods of waste water from disinfection as part of the disinfection submittal. Disinfect new water piping and existing water piping affected by Contractor's operations in accordance with AWWA C651. Disinfect new water piping using the AWWA C651 . Ensure a free chlorine residual of not less than 10 parts per million after 24 hour holding period and prior to performing bacteriological tests.

3.2.3 Flushing

Perform bacteriological tests prior to flushing. Flush solution from the systems with domestic water until maximum residual chlorine content is within the range of 0.2 to 0.5 parts per million, the residual chlorine content of the distribution system, or acceptable for domestic use. Use AWWA C655 neutralizing chemicals.

3.2.4 Pipe Restraint

3.2.4.1 Concrete Thrust Blocks

Install concrete thrust blocks where indicated.

3.2.4.2 Restrained Joints

Install restrained joints in accordance with NFPA 24 where indicated. For metal harness use tie rods and clamps as shown in NFPA 24.

3.2.5 Valves

3.2.5.1 Gate Valves

Install gate valves, AWWA C500 and UL 262, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C500. Install gate valves, AWWA C509 or AWWA C515, in accordance with the requirements of AWWA C600 for valve-and-fitting installation and with the recommendations of the Appendix ("Installation, Operation, and Maintenance of Gate Valves") to AWWA C509 or AWWA C515. Install gate valves on PVC water mains in accordance with the recommendations for appurtenance installation in AWWA M23, Chapter 7, "Installation." Make and assemble joints to gate valves as specified for making and assembling the same type joints between pipe and fittings.

3.2.6 Fire Hydrants

Install fire hydrants in accordance with AWWA C600 for fire hydrant installation and as indicated. Make and assemble joints as specified for making and assembling the same type joints between pipe and fittings. Install fire hydrants with the 4 1/2 inch connections facing the adjacent paved surface. If there are two paved adjacent surfaces, install fire hydrants with the 4 1/2 inch connection facing the paved surface where the connecting main is located.

3.3 FIELD QUALITY CONTROL

3.3.1 Tests

Notify the Contracting Officer a minimum of five days in advance of hydrostatic testing. Coordinate the proposed method for disposal of waste water from hydrostatic testing. Perform field tests, and provide labor, equipment, and incidentals required for testing. Provide documentation that all items of work have been constructed in accordance with the Contract documents.

3.3.1.1 Hydrostatic Test

Test the water system in accordance with the applicable AWWA standard specified below. Where water mains provide fire service, test in accordance with the special testing requirements given in the paragraph SPECIAL TESTING REQUIREMENTS FOR FIRE SERVICE. Test steel water mains in accordance with applicable requirements of AWWA C600 for hydrostatic testing. The amount of leakage on steel pipelines with rubber-gasketed bell-and-spigot joints is not to exceed 20 gallons per 24 hours per inch of pipe diameter per mile of pipeline; no leakage will be allowed at

joints made by any other method. To stop leakage, repair welded joints only by welding. Test water service lines in accordance with requirements of AWWA C600 for hydrostatic testing. No leakage will be allowed at, and screwed joints. Do not backfill utility trench or begin testing on any section of a pipeline where concrete thrust blocks have been provided until at least 7 days after placing of the concrete.

3.3.1.2 Leakage Test

For leakage test, use a hydrostatic pressure not less than the maximum working pressure of the system. Leakage test may be performed at the same time and at the same test pressure as the pressure test.

3.3.1.3 Bacteriological Testing

Perform bacteriological tests in accordance with AWWA C651 Option A. Analyze samples by a certified laboratory, and submit the results of the bacteriological samples.

3.3.1.4 Special Testing Requirements for Fire Service

Test water mains and water service lines providing fire service or water and fire service in accordance with NFPA 24. The additional water added to the system must not exceed the limits given in NFPA 24

3.3.1.5 Tracer Wire Continuity Test

Test tracer wire for continuity after service connections have been completed and prior to final pavement or restoration. Verify that tracer wire is locatable with electronic utility locating equipment. Repair breaks or separations and re-test for continuity.

3.4 SYSTEM STARTUP

Water mains and appurtenances must be completely installed, disinfected, flushed, and satisfactory bacteriological sample results received prior to permanent connections being made to the active distribution system. Obtain approval by the Contracting Officer prior to the new water piping being placed into service.

3.5 CLEANUP

Upon completion of the installation of water lines and appurtenances, remove all debris and surplus materials resulting from the work.

-- End of Section --

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US Army Corps of Engineers ®

New York District