PROJECT SPECIFICATIONS

CONSTRUCTION DOCUMENTS 100% SUBMITTAL

PROJECT NAME: IMPROVE WATER SYSTEM TO REDUCE RISK OF LEGIONELLA CONTAMINATION AND PATIENT INJURY

PROJECT NUMBER: 538-18-101

DEPARTMENT OF VETERAN AFFAIRS (VA)

VETERANS HEALTH ADMINISTRATION (VHA)

VETERANS INTEGRATED SERVICE NETWORK (VISN) 10

CHILLICOTHE VA MEDICAL CENTER (VAMC)

17273 STATE ROUTE 104

CHILLICOTHE, OHIO 45601

DOCUMENT DATE: 10/11/2019

***CHILLICOTHE VAMC MISSION**: OUR MISSION IS TO HONOR OUR VETERANS' SERVICE AND SACRIFICES BY PROVIDING EXCEPTIONAL CARE*

***CHILLICOTHE VAMC VISION**: OUR VISION IS TO BE A HEALTHCARE PROVIDER OF CHOICE FOR VETERANS; IMPROVE VETERAN'S QUALITY OF LIFE BY ENHANCING SERVICES, ACCESS AND SAFETY; AND TO BE THE WORKPLACE OF CHOICE.*

DEPARTMENT OF VETERANS AFFAIRS
VHA MASTER SPECIFICATIONS

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GENERAL REQUIREMENTS

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SECTION 01 00 00
GENERAL REQUIREMENTS

1.1 SAFETY REQUIREMENTS

Refer to section 01 35 26, SAFETY REQUIREMENTS for safety and infection control requirements.

1.2 GENERAL INTENTION

A. Contractor shall completely prepare site for building operations, including demolition and removal of existing structures, and furnish labor and materials and perform work for 538-18-101, IMPROVE WATER SYSTEM TO REDUCE RISK OF LEGIONELLA CONTAMINATION AND PATIENT INJURY at VAMC Chillicothe, Ohio as required by drawings and specifications.

B. Visits to the site by Bidders will be as outlined in the solicitation.

C. Offices of FFE, Inc, Cincinnati, OH, as Architect-Engineers, will render certain technical services during construction. Such services shall be considered as advisory to the Government and shall not be construed as expressing or implying a contractual act of the Government without affirmations by Contracting Officer or his duly authorized representative.

D. All employees of the general contractor and subcontractors shall adhere to the Chillicothe VAMC contractor identification process and obtain VA issued badges. All employees of general contractor and subcontractors shall comply with VA security management program, be identified by project and employer, and restricted from unauthorized access.

E. REQUEST FOR INFORMATION

In the event an explanation or interpretation of the drawings or specifications is necessary, submit the request using RFI (Request for Information) Form included in the EXHIBITS SECTION of these specifications. Such requests shall be submitted to the Contracting Officer soon enough to allow a reply so as to affect the project as little as possible.

1.3 STATEMENT OF BID ITEM(S)

A. ITEM I, Perform all demolition and construction to provide domestic water system improvements, in accordance with project design documents. The improvements include dead-leg and unused fixture removal; installation of thermostatic mixing valves at point-of-use for scald protection; re-balancing of existing hot water recirculation loops and addition of new recirculation loops; installation of ultraviolet treatment equipment; installation of water monitoring equipment; connection and integration of water monitoring equipment and other water quality related instrumentation to the BAS; installation of a fiber optic backbone for the Building Automation System (BAS); demolition of abandoned equipment in Bldg 256; relocation of the site domestic water storage tank valving and upgrade to tank instrumentation; and installation of new site water delivery equipment between municipality water meter through Bldg 256 pump room.

B. BID OPTION NO.1: Provide all work in Item I except fiber loop work noted as "removed from scope under Bid Option #1" on sheet E04, Loop 1 – Fiber Cabling Diagram.

1.4 SPECIFICATIONS AND DRAWINGS FOR CONTRACTOR

A. Drawings and contract documents may be obtained from the website where the solicitation is posted. Additional copies will be at Contractor's expense.

1.5 CONSTRUCTION SECURITY REQUIREMENTS

A. Security Plan:

1. The security plan defines both physical and administrative security procedures that will remain effective for the entire duration of the project.

2. The General Contractor is responsible for assuring that all sub-contractors working on the project and their employees also comply with these regulations.

B. Security Procedures:

1. General Contractor's employees (including subcontractors) shall not enter the project site without appropriate badge. Any contractor

that will be working on the site must fill out a Contract Security Services Request Form in its entirety. They may also be subject to inspection of their personal effects when entering or leaving the project site.

2. Before starting work the General Contractor shall give one week's notice to the Contracting Officer so that security arrangements can be provided for the employees. This notice is separate from any notices required for utility shutdown described later in this section.

3. No photography of VA premises is allowed without written permission of the Contracting Officer.

4. VA reserves the right to close down or shut down the project site and order General Contractor's employees off the premises in the event of a national emergency. The General Contractor may return to the site only with the written approval of the Contracting Officer.

C. Key Control:

1. Keys necessary to access work areas will be issued following Standard Operating Procedure (SOP) 41 Contractor Key Control .

2. The General Contractor shall provide duplicate keys and lock combinations to the Contracting officers representative (COR) for the purpose of security inspections of every area of project including tool boxes and parked machines and take any emergency action.

3. The General Contractor shall turn over all permanent lock cylinders to the VA locksmith for permanent installation. See Section 08 71 00, DOOR HARDWARE and coordinate.

D. Document Control:

1. Before starting any work, the General Contractor/Sub Contractors shall submit an electronic security memorandum describing the approach to following goals and maintaining confidentiality of "sensitive information".

2. The General Contractor is responsible for safekeeping of all drawings, project manual and other project information. This information shall be shared only with those with a specific need to accomplish the project.

3. Certain documents, sketches, videos or photographs and drawings may be marked “Law Enforcement Sensitive” or “Sensitive Unclassified”. Secure such information in separate containers and limit the access to only those who will need it for the project. Return the information to the Contracting Officer upon request.

4. These security documents shall not be removed or transmitted from the project site without the written approval of Contracting Officer.

5. All paper waste or electronic media such as CD’s and diskettes shall be shredded and destroyed in a manner acceptable to the VA.

6. Notify Contracting Officer and Site Security Officer immediately when there is a loss or compromise of “sensitive information”.

7. All electronic information shall be stored in specified location following VA standards and procedures using an Engineering Document Management Software (EDMS).

   a. Security, access and maintenance of all project drawings, both scanned and electronic shall be performed and tracked through the EDMS system.

   b. “Sensitive information” including drawings and other documents may be attached to e-mail provided all VA encryption procedures are followed.

E. Motor Vehicle Restrictions

1. Reference Chillicothe VAMC Policy Memorandum No. 07-29, Parking and Motor Vehicle Operations, and Designated Parking for Contractors and Contractor Employees exhibits.

2. Vehicle authorization request shall be required for any vehicle entering the site and such request shall be submitted 24 hours

before the date and time of access. Access shall be restricted to picking up and dropping off materials and supplies.

3. A limited number of (2 to 5) permits shall be issued for General Contractor and its employees for parking in designated areas only.

1.6 OPERATIONS AND STORAGE AREAS

The following paragraphs are in addition to (FAR 52.236-10)

A. The Contractor shall confine all operations (including storage of materials) on Government premises to areas authorized or approved by the Contracting Officer. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance.

B. Temporary buildings (e.g., storage sheds, shops, offices) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the Government. No fuel storage tanks are acceptable for contractor staging areas. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.

C. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any Federal, State, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, roads, or lawn areas.

(FAR 52.236-10)

D. Working space and space available for storing materials shall be as shown on the drawings, and as determined by the COR.

E. Workers are subject to rules of Medical Center applicable to their conduct.

F. Execute work in such a manner as to interfere as little as possible with work being done by others. Keep roads clear of construction materials, debris, standing construction equipment and vehicles at all times.

G. Execute work so as to interfere as little as possible with normal functioning of Medical Center as a whole, including operations of utility services, fire protection systems and any existing equipment, and with work being done by others. Use of equipment and tools that transmit vibrations and noises through the building structure, are not permitted in buildings that are occupied, during construction, jointly by patients or medical personnel, and Contractor's personnel, except as permitted by COR.

1. Do not store materials and equipment in other than assigned areas.

2. Schedule delivery of materials and equipment to immediate construction working areas within buildings in use by Department of Veterans Affairs in quantities sufficient for not more than two work days. Provide unobstructed access to Medical Center required to remain in operation.

3. Where access by Medical Center personnel to vacated portions of buildings is not required, storage of Contractor's materials and equipment will be permitted subject to fire and safety requirements, and approval of the COR.

H. Utilities Services: Where necessary to cut existing pipes, electrical wires, conduits, cables, etc., of utility services, or of fire protection systems or communications systems (except telephone), they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by COR. All such actions shall be coordinated with the COR or Utility Company involved:

1. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.

I. Phasing:

The Medical Center must maintain its operation 24 hours a day 7 days a week. Therefore, any interruption in service must be scheduled and coordinated with the COR to ensure that no lapses in operation occur. It is the CONTRACTOR'S responsibility to develop a work plan and schedule detailing, at a minimum, the procedures to be employed, the equipment and materials to be used, the interim life safety measure to be used during the work, and a schedule defining the duration of the work with milestone subtasks. The work to be outlined shall include, but not be limited to:

To ensure such executions, Contractor shall furnish the COR with a schedule of approximate phasing dates on which the Contractor intends to accomplish work in each specific area of site, building or portion thereof. In addition, Contractor shall notify the COR two weeks in advance of the proposed date of starting work in each specific area of site, building or portion thereof. Arrange such phasing dates to ensure accomplishment of this work in successive phases mutually agreeable to COR and Contractor.

Contractor shall reference design drawings for phasing requirements specific to the various scopes of work.

J. All patient care buildings included in and adjacent to this project will be occupied during performance of work. Project work in non-patient care areas shall remain active during construction with exception of outages coordinated with the COR.

Contractor shall take all measures and provide all material necessary for protecting existing equipment and property in affected areas of construction against dust and debris, so that equipment and affected areas to be used in the Medical Centers operations will not be hindered. Contractor shall permit access to Department of Veterans Affairs personnel and patients through other construction

areas which serve as routes of access to such affected areas and equipment. These routes whether access or egress shall be isolated from the construction area by temporary partitions and have walking surfaces, lighting etc to facilitate patient and staff access. Coordinate alteration work in areas occupied by Department of Veterans Affairs so that Medical Center operations will continue during the construction period. This may include evening or weekend work.

K. Construction Fence: Before construction operations begin, Contractor shall provide a chain link construction fence, 2.1m (seven feet) minimum height, around the construction area indicated on the drawings. Provide gates as required for access with necessary hardware, including hasps and padlocks. Fasten fence fabric to terminal posts with tension bands and to line posts and top and bottom rails with tie wires spaced at maximum 375mm (15 inches). Bottom of fences shall extend to 25mm (one inch) above grade. Details of fence construction and finish thereof shall be submitted to COR for approval. Remove the fence when directed by Resident Engineer COR.

L. When a building and/or construction site is turned over to Contractor, Contractor shall accept entire responsibility including upkeep and maintenance therefore:

1. Contractor shall maintain a minimum temperature of 4 degrees C (40 degrees F) at all times, except as otherwise specified.

2. Contractor shall maintain in operating condition existing fire protection and alarm equipment. In connection with fire alarm equipment, Contractor shall make arrangements for pre-inspection of site with Chillicothe VAMC Fire Department required to respond to an alarm from Contractor's employee or watchman.

M. Utilities Services: Maintain existing utility services for Medical Center at all times. Provide temporary facilities, labor, materials, equipment, connections, and utilities to assure uninterrupted services. Where necessary to cut existing water, steam, gases, sewer or air pipes, or conduits, wires, cables, etc. of utility services or of fire protection systems and communications systems (including telephone),

they shall be cut and capped at suitable places where shown; or, in absence of such indication, where directed by Resident Engineer COR.

1. No utility service such as water, gas, steam, sewers or electricity, or fire protection systems and communications systems may be interrupted without prior approval of COR. Electrical work shall be accomplished with all affected circuits or equipment de-energized. When an electrical outage cannot be accomplished, work on any energized circuits or equipment shall not commence without a detailed work plan, the Medical Center Director’s prior knowledge and written approval. Refer to specification Sections 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, 27 05 11 REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and 28 05 00, COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY for additional requirements.

2. Contractor shall submit a request to interrupt any such services to COR, in writing, 7 days in advance of proposed interruption. Request shall state reason, date, exact time of, and approximate duration of such interruption.

3. Contractor will be advised (in writing) of approval of request, or of which other date and/or time such interruption will cause least inconvenience to operations of Medical Center. Interruption time approved by Medical Center may occur at other than Contractor's normal working hours.

4. Major interruptions of any system must be requested, in writing, at least 15 calendar days prior to the desired time and shall be performed as directed by the COR.

5. In case of a contract construction emergency, service will be interrupted on approval of COR. Such approval will be confirmed in writing as soon as practical.

6. Access to Data Rooms requires escorts at all times. Access requests must be requested in writing a minimum of 7 days in advance of the proposed dates of work. Requests shall state reason, date, exact time of, and approximate duration of such work activity.

7. Whenever it is required that a connection fee be paid to a public utility provider for new permanent service to the construction project, for such items as water, sewer, electricity, gas or steam, payment of such fee shall be the responsibility of the Government and not the Contractor.

N. Abandoned Lines: All service lines such as wires, cables, conduits, ducts, pipes and the like, and their hangers or supports, which are to be abandoned but are not required to be entirely removed, shall be sealed, capped or plugged at the main, branch or panel they originate from. The lines shall not be capped in finished areas, but shall be removed and sealed, capped or plugged in ceilings, within furred spaces, in unfinished areas, or within walls or partitions; so that they are completely behind the finished surfaces.

O. To minimize interference of construction activities with flow of Medical Center traffic, comply with the following:

1. Keep roads, walks and entrances to grounds, to parking and to occupied areas of buildings clear of construction materials, debris and standing construction equipment and vehicles. Wherever excavation for new utility lines cross existing roads, at least one lane must be open to traffic at all times with approval.

2. Method and scheduling of required cutting, altering and removal of existing roads, walks and entrances must be approved by the COR.

P. Coordinate the work for this contract with other construction operations as directed by COR. This includes the scheduling of traffic and the use of roadways, as specified in Article, USE OF ROADWAYS.

Q. Hours of Work:

1. The work of this contract is to be executed between 7:30 a.m. and 4:00 p.m., Monday through Friday, except as required by the specifications and/or otherwise authorized by the COR. Submit in writing to the COR requests for proposed hours of work changes. Work hours shall be between 1800 and 0500 during certain phases including (but not limited to):

a. Installation of interior hot water and compressed air lines.

b. Sensitive utility outages including domestic water shut down.

2. Hours of work may vary depending on the area of work being performed. Work in occupied spaces shall be scheduled at times convenient to the occupant and the Medical Center. Areas adjacent to the work area include urgent care which is open 24 hours, 7 days a week. No work will be performed on Government recognized holidays, except as required by the specifications and/or otherwise authorized by the COR.
3. Hot work shall stop prior to the specified end of work day at a minimum equal to the time required for final inspection.

See appendix for hours for each facility.

1.7 ALTERATIONS

A. Survey: Before any work is started, the Contractor shall make a thorough survey with the COR and a representative of VA Supply Service, of areas of buildings in which alterations occur and areas which are anticipated routes of access, and furnish a report, signed by all three, to the Contracting Officer. This report shall list by rooms and spaces:

1. Existing condition and types of resilient flooring, doors, windows, walls and other surfaces not required to be altered throughout affected areas of buildings.
2. Existence and conditions of items such as plumbing fixtures and accessories, electrical fixtures, equipment, venetian blinds, shades, etc., required by drawings to be either reused or relocated, or both.
3. Shall note any discrepancies between drawings and existing conditions at site.
4. Shall designate areas for working space, materials storage and routes of access to areas within buildings where alterations occur and which have been agreed upon by Contractor and COR.

B. Any items required by drawings to be either reused or relocated or both, found during this survey to be nonexistent, or in opinion of COR and/or Supply Representative, to be in such condition that their use is impossible or impractical, shall be furnished and/or replaced by Contractor with new items in accordance with specifications which will be furnished by Government. Provided the contract work is changed by

reason of this subparagraph B, the contract will be modified accordingly, under provisions of clause entitled "DIFFERING SITE CONDITIONS" (FAR 52.236-2) and "CHANGES" (FAR 52.243-4 and VAAR 852.236-88).

C. Re-Survey: Thirty days before expected partial or final inspection date, the Contractor and COR together shall make a thorough re-survey of the areas of buildings involved. They shall furnish a report on conditions then existing, of resilient flooring, doors, windows, walls and other surfaces as compared with conditions of same as noted in first condition survey report:

1. Re-survey report shall also list any damage caused by Contractor to such flooring and other surfaces, despite protection measures; and, will form basis for determining extent of repair work required of Contractor to restore damage caused by Contractor's workers in executing work of this contract.

D. Protection: Provide the following protective measures:

1. Wherever existing roof surfaces are disturbed they shall be protected against water infiltration. In case of leaks, they shall be repaired immediately upon discovery.

2. Temporary protection against damage for portions of existing structures and grounds where work is to be done, materials handled and equipment moved and/or relocated.

3. Protection of interior of existing structures at all times, from damage, dust and weather inclemency. Wherever work is performed, floor surfaces that are to remain in place shall be adequately protected prior to starting work, and this protection shall be maintained intact until all work in the area is completed.

4. Dampen debris to keep down dust.

5. Provide temporary construction partitions as described in Specification Section 01 35 26 paragraph Temporary Construction Partitions.

6. Block off ducts and diffusers to prevent circulation of dust into occupied areas during construction. Coordinate with COR.

7. See Specification Section 01 35 26 paragraph Infection Control for additional required measures.

1.8 DISPOSAL AND RETENTION

A. Materials and equipment accruing from work removed and from demolition of buildings or structures, or parts thereof, shall be disposed of as follows:

1. Reserved items which are to remain property of the Government are noted on drawings or in specifications as items to be stored. Items that remain property of the Government shall be removed or dislodged from present locations in such a manner as to prevent damage which would be detrimental to re-installation and reuse. The contractor shall secure and store the items until reinstallation. Store such items where directed by Resident COR.

2. Items not reserved shall become property of the Contractor and be removed by Contractor from Medical Center.

3. Items of portable equipment and furnishings located in rooms and spaces in which work is to be done under this contract shall remain the property of the Government. When rooms and spaces are vacated by the Department of Veterans Affairs during the alteration period, such items which are NOT required by drawings and specifications to be either relocated or reused will be removed by the Government in advance of work to avoid interfering with Contractor's operation.

1.9 PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS

The following paragraph is in addition to FAR 52.236-9 Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS

A. The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed and which do not unreasonably interfere with the work required under this contract. The Contractor

shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during contract performance, or by the careless operation of equipment, or by workers, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.

B. The Contractor shall protect from damage all existing improvements and utilities at or near the work site and on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. The Contractor shall repair any damage to those facilities, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

(FAR 52.236-9)

C. Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS, for additional requirements on protecting vegetation, soils and the environment. Refer to Articles, "Alterations", "Restoration", and "Operations and Storage Areas" for additional instructions concerning repair of damage to structures and site improvements.

D. Refer to FAR clause 52.236-7, "Permits and Responsibilities," which is included in General Conditions. A National Pollutant Discharge Elimination System (NPDES) permit is required for this project. The Contractor is considered an "operator" under the permit and has extensive responsibility for compliance with permit requirements. VA will make the permit application available at the (appropriate medical center) office. The apparent low bidder, contractor and affected subcontractors shall furnish all information and certifications that are required to comply with the permit process and permit requirements. Many of the permit requirements will be satisfied by completing construction as shown and specified. Some requirements involve the

Contractor's method of operations and operations planning and the Contractor is responsible for employing best management practices. The affected activities often include, but are not limited to the following:

- Designating areas for equipment maintenance and repair;
- Providing waste receptacles at convenient locations and provide regular collection of wastes;
- Locating equipment wash down areas on site, and provide appropriate control of wash-waters;
- Providing protected storage areas for chemicals, paints, solvents, fertilizers, and other potentially toxic materials; and
- Providing adequately maintained sanitary facilities.

1.10 RESTORATION

A. Remove, cut, alter, replace, patch and repair existing work as necessary to install new work. Except as otherwise shown or specified, do not cut, alter or remove any structural work, and do not disturb any ducts, plumbing, steam, gas, or electric work without approval of the COR. Existing work to be altered or extended and that is found to be defective in any way, shall be reported to the COR before it is disturbed. Materials and workmanship used in restoring work, shall conform in type and quality to that of original existing construction, except as otherwise shown or specified.

B. Upon completion of contract, deliver work complete and undamaged. Existing work (walls, ceilings, partitions, floors, mechanical and electrical work, lawns, paving, roads, walks, etc.) disturbed or removed as a result of performing required new work, shall be patched, repaired, reinstalled, or replaced with new work, and refinished and left in as good condition as existed before commencing work.

C. At Contractor's own expense, Contractor shall immediately restore to service and repair any damage caused by Contractor's workers to existing piping and conduits, wires, cables, etc., of utility services

or of fire protection systems and communications systems (including telephone) which are not scheduled for discontinuance or abandonment.

D. Expense of repairs to such utilities and systems not shown on drawings or locations of which are unknown will be covered by adjustment to contract time and price in accordance with clause entitled "CHANGES" (FAR 52.243-4 and VAAR 852.236-88) and "DIFFERING SITE CONDITIONS" (FAR 52.236-2).

1.11 PHYSICAL DATA

A. Data and information furnished or referred to below is for the Contractor's information. The Government shall not be responsible for any interpretation of or conclusion drawn from the data or information by the Contractor.

1. The indications of physical conditions on the drawings and in the specifications are the result of review of existing drawings and site investigations by the A/E and subcontractors. Conditions regarding hazardous materials are provided by TTL Associates Inc. and Terracon Consultants Inc. (attached).

(FAR 52.236-4)

B. Government does not guarantee that other materials will not be encountered nor that proportions, conditions or character of several materials will not vary from those indicated by explorations. Bidders are expected to examine site of work and logs of borings; and, after investigation, decide for themselves character of materials and make their bids accordingly. Upon proper application to Department of Veterans Affairs, bidders will be permitted to make subsurface explorations of their own at site.

1.12 PROFESSIONAL SURVEYING SERVICES

A registered professional land surveyor or registered civil engineer whose services are retained and paid for by the Contractor shall perform services specified herein and in other specification sections. The Contractor shall certify that the land surveyor or civil engineer is not one who is a regular employee of the Contractor, and that the

land surveyor or civil engineer has no financial interest in this contract.

1.13 LAYOUT OF WORK

A. The Contractor shall lay out the work from Government established base lines and bench marks, indicated on the drawings, and shall be responsible for all measurements in connection with the layout. The Contractor shall furnish, at Contractor's own expense, all stakes, templates, platforms, equipment, tools, materials, and labor required to lay out any part of the work. The Contractor shall be responsible for executing the work to the lines and grades that may be established or indicated by the Contracting Officer. The Contractor shall also be responsible for maintaining and preserving all stakes and other marks established by the Contracting Officer until authorized to remove them. If such marks are destroyed by the Contractor or through Contractor's negligence before their removal is authorized, the Contracting Officer may replace them and deduct the expense of the replacement from any amounts due or to become due to the Contractor.

(FAR 52.236-17)

B. Establish and plainly mark center lines for each building and corner of column lines and/or addition to each existing building, and such other lines and grades that are reasonably necessary to properly assure that location, orientation, and elevations established for each such structure and/or addition are in accordance with lines and elevations shown on contract drawings.

C. Following completion of general mass excavation and before any other permanent work is performed, establish and plainly mark (through use of appropriate batter boards or other means) sufficient additional survey control points or system of points as may be necessary to assure proper alignment, orientation, and grade of all major features of work. Survey shall include, but not be limited to, location of lines and grades of footings, exterior walls, center lines of columns in both directions, major utilities and elevations of floor slabs:

1. Such additional survey control points or system of points thus established shall be checked and certified by a registered land

surveyor or registered civil engineer. Furnish such certification to the COR before any work (such as footings, floor slabs, columns, walls, utilities and other major controlling features) is placed.

D. During progress of work, and particularly as work progresses from floor to floor, Contractor shall have line grades and plumbness of all major form work checked and certified by a registered land surveyor or registered civil engineer as meeting requirements of contract drawings. Furnish such certification to the Resident COR before any major items of concrete work are placed. In addition, Contractor shall also furnish to the COR certificates from a registered land surveyor or registered civil engineer that the following work is complete in every respect as required by contract drawings.

1. Lines of each building and/or addition.

2. Elevations of bottoms of footings and tops of floors of each building and/or addition.

3. Lines and elevations of sewers and of all outside distribution systems.

E. Whenever changes from contract drawings are made in line or grading requiring certificates, record such changes on a reproducible drawing bearing the registered land surveyor or registered civil engineer seal, and forward these drawings upon completion of work to COR.

F. The Contractor shall perform the surveying and layout work of this and other articles and specifications in accordance with the provisions of Article "Professional Surveying Services".

1.14 AS-BUILT DRAWINGS

A. The contractor shall maintain two full size sets of as-built drawings which will be kept current during construction of the project, to include all contract changes, modifications and clarifications.

B. All variations shall be shown in the same general detail as used in the contract drawings. To ensure compliance, as-built drawings shall be made available for the COR review, as often as requested.

C. Contractor shall deliver two approved completed sets of as-built drawings in the electronic version (scanned PDF) to the COR within 15 calendar days after each completed phase and after the acceptance of the project by the COR.

D. Paragraphs A, B, & C shall also apply to all shop drawings.

1.15 USE OF ROADWAYS

A. For hauling, use only established public roads and roads on Medical Center property and, when authorized by the COR, such temporary roads which are necessary in the performance of contract work. Temporary roads shall be constructed and restoration performed by the Contractor at Contractor's expense. When necessary to cross curbing, sidewalks, or similar construction, they must be protected by well-constructed bridges.

The plan must be in narrative form and contain sufficient detail to render it suitable for use by future maintenance and repair personnel, whether tradesman, or of engineering background, not necessarily familiar with this contract.

1.16 TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT

A. Use of new installed mechanical and electrical equipment to provide heat, ventilation, plumbing, light and power will be permitted subject to written approval and compliance with the following provisions:

1. Permission to use each unit or system must be given by COR in writing. If the equipment is not installed and maintained in accordance with the written agreement and following provisions, the COR will withdraw permission for use of the equipment.

2. Electrical installations used by the equipment shall be completed in accordance with the drawings and specifications to prevent damage to the equipment and the electrical systems, i.e. transformers, relays, circuit breakers, fuses, conductors, motor controllers and their overload elements shall be properly sized, coordinated and adjusted. Installation of temporary electrical equipment or devices shall be in accordance with NFPA 70, National Electrical Code, (2014 Edition), Article 590, *Temporary Installations.* Voltage supplied to

each item of equipment shall be verified to be correct and it shall be determined that motors are not overloaded. The electrical equipment shall be thoroughly cleaned before using it and again immediately before final inspection including vacuum cleaning and wiping clean interior and exterior surfaces.

3. Units shall be properly lubricated, balanced, and aligned. Vibrations must be eliminated.

4. Automatic temperature control systems for preheat coils shall function properly and all safety controls shall function to prevent coil freeze-up damage.

5. The air filtering system utilized shall be that which is designed for the system when complete, and all filter elements shall be replaced at completion of construction and prior to testing and balancing of system.

6. All components of heat production and distribution system, metering equipment, condensate returns, and other auxiliary facilities used in temporary service shall be cleaned prior to use; maintained to prevent corrosion internally and externally during use; and cleaned, maintained and inspected prior to acceptance by the Government.

B. Prior to final inspection, the equipment or parts used which show wear and tear beyond normal, shall be replaced with identical replacements, at no additional cost to the Government.

C. This paragraph shall not reduce the requirements of the mechanical and electrical specifications sections.

D. Any damage to the equipment or excessive wear due to prolonged use will be repaired replaced by the contractor at the contractor’s expense.

1.17 TEMPORARY USE OF EXISTING ELEVATORS

A. Use of existing elevators for handling building materials and Contractor's personnel will be permitted subject to following provisions:

1. Contractor makes all arrangements with the COR for use of elevators. The COR will ascertain that elevators are in proper condition.

Contractor may use elevators and for special nonrecurring time intervals when permission is granted. Personnel for operating elevators will not be provided by the Department of Veterans Affairs.

2. Contractor covers and provides maximum protection of following elevator components:

   a. Entrance jambs, heads soffits and threshold plates.

   b. Entrance columns, canopy, return panels and inside surfaces of car enclosure walls.

   c. Finish flooring.

3. Government will accept hoisting ropes of elevator and rope of each speed governor if they are worn under normal operation. However, if these ropes are damaged by action of foreign matter such as sand, lime, grit, stones, etc., during temporary use, they shall be removed and replaced by new hoisting ropes at the contractors expense.

4. If brake lining of elevators are excessively worn or damaged during temporary use, they shall be removed and replaced by new brake lining at the contractors expense.

5. All parts of main controller, starter, relay panel, selector, etc., worn or damaged during temporary use shall be removed and replaced with new parts at the contractors expense, if recommended by elevator inspector after elevator is released by Contractor.

6. Place elevator in condition equal, less normal wear, to that existing at time it was placed in service of Contractor as approved by Contracting Officer.

1.18 TEMPORARY TOILETS

A. Provide where directed, (for use of all Contractor's workers) ample temporary sanitary toilet accommodations with suitable sewer and water connections; or, when approved by COR, provide suitable dry closets where directed. Keep such places clean and free from flies, and all

connections and appliances connected therewith are to be removed prior to completion of contract, and premises left perfectly clean.

B. Contractor may have for use of Contractor's workers, such toilet accommodations as may be assigned to Contractor by Medical Center. Contractor shall keep such places clean and be responsible for any damage done thereto by Contractor's workers. Failure to maintain satisfactory condition in toilets will deprive Contractor of the privilege to use such toilets.

1.19 AVAILABILITY AND USE OF UTILITY SERVICES

A. The Government shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. The amount to be paid by the Contractor for chargeable electrical services shall be the prevailing rates charged to the Government. The Contractor shall carefully conserve any utilities furnished without charge. Failure to stop leakage or other waste will be cause for revocation (at COR's discretion).

B. The Contractor, at Contractor's expense and in a workmanlike manner, in compliance with code and as satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of electricity used for the purpose of determining charges. Before final acceptance of the work by the Government, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia and repair restore the infrastructure as required.

C. Contractor shall install meters at Contractor's expense and furnish the Medical Center a monthly record of the Contractor's usage of electricity as hereinafter specified.

D. Heat: Furnish temporary heat necessary to prevent injury to work and materials through dampness and cold. Temporary heating plans must be approved by the Chillicothe VAMC Fire Department; refer to Specification Section 01 35 26 Safety Requirements. Use of open salamanders or any temporary heating devices which may be fire hazards

or may smoke and damage finished work, will not be permitted. Maintain minimum temperatures as specified for various materials:

1. Obtain heat by connecting to Medical Center heating distribution system.

   a. Steam is available at no cost to Contractor. Maintain connections, pipe, fittings and fixtures and conserve steam-use so none is wasted. Failure to stop leakage or other waste will be cause for revocation (at COR's discretion), of use of steam from the Medical Center's system.

E. Electricity (for Construction and Testing): Furnish all temporary electric services.

1. Obtain electricity by connecting to the Medical Center electrical distribution system. The Contractor shall meter and pay for electricity required for electric cranes and hoisting devices, electrical welding devices and any electrical heating devices providing temporary heat. Electricity for all other uses is available at no cost to the Contractor.

F. Water (for Construction and Testing): Furnish temporary water service.

1. Obtain water by connecting to the Medical Center water distribution system. Provide reduced pressure backflow preventer at each connection as per code. For connection to hose bibs a vacuum breaker shall be used. In freezing conditions when the water source is not in use the vacuum breaker shall be removed. Water is available at no cost to the Contractor.

2. Maintain connections, pipe, fittings and fixtures and conserve water-use so none is wasted. Failure to stop leakage or other wastes will be cause for revocation (at COR discretion) of use of water from Medical Center's system.

G. Fuel: Natural and LP gas and burner fuel oil required for boiler cleaning, normal initial boiler-burner setup and adjusting, and for performing the specified boiler tests will be furnished by the Government. Fuel required for prolonged boiler-burner setup,

adjustments, or modifications due to improper design or operation of boiler, burner, or control devices shall be furnished and paid by the Contractor at Contractor's expense.

1.20 NEW TELEPHONE EQUIPMENT

The contractor shall coordinate with the work of installation of telephone equipment by others. This work shall be completed before the building is turned over to VA.

1.21 TESTS

A. Pre-test mechanical and electrical equipment and systems and make corrections required for proper operation of such systems before requesting final tests. Final test will not be conducted unless pre-tested.

B. Conduct final tests required in various sections of specifications in presence of an authorized representative of the Contracting Officer. Contractor shall furnish all labor, materials, equipment, instruments, and forms, to conduct and record such tests.

C. Mechanical and electrical systems shall be balanced, controlled and coordinated. A system is defined as the entire system which must be coordinated to work together during normal operation to produce results for which the system is designed. For example, air conditioning supply air is only one part of entire system which provides comfort conditions for a building. Other related components are return air, exhaust air, steam, chilled water, refrigerant, hot water, controls and electricity, etc. Another example of a system which involves several components of different disciplines is a boiler installation. Efficient and acceptable boiler operation depends upon the coordination and proper operation of fuel, combustion air, controls, steam, feedwater, condensate and other related components.

D. All related components as defined above shall be functioning when any system component is tested. Tests shall be completed within a reasonably period of time during which operating and environmental conditions remain reasonably constant and are typical of the design conditions.

E. Individual test result of any component, where required, will only be accepted when submitted with the test results of related components and of the entire system.

1.22 INSTRUCTIONS

A. Contractor shall furnish Maintenance and Operating manuals (hard copies and electronic) and verbal instructions when required by the various sections of the specifications and as hereinafter specified.

B. Manuals: Maintenance and operating manuals and one compact disc (four hard copies and one electronic copy each) for each separate piece of equipment shall be delivered to the COR coincidental with the delivery of the equipment to the job site. Manuals shall be complete, detailed guides for the maintenance and operation of equipment. They shall include complete information necessary for starting, adjusting, maintaining in continuous operation for long periods of time and dismantling and reassembling of the complete units and sub-assembly components. Manuals shall include an index covering all component parts clearly cross-referenced to diagrams and illustrations. Illustrations shall include "exploded" views showing and identifying each separate item. Emphasis shall be placed on the use of special tools and instruments. The function of each piece of equipment, component, accessory and control shall be clearly and thoroughly explained. All necessary precautions for the operation of the equipment and the reason for each precaution shall be clearly set forth. Manuals must reference the exact model, style and size of the piece of equipment and system being furnished. Manuals referencing equipment similar to but of a different model, style, and size than that furnished will not be accepted.

C. Instructions: Contractor shall provide qualified, factory-trained manufacturers' representatives to give detailed training to assigned Department of Veterans Affairs personnel in the operation and complete maintenance for each piece of equipment. All such training will be at the job site. These requirements are more specifically detailed in the various technical sections. Instructions for different items of equipment that are component parts of a complete system, shall be given in an integrated, progressive manner. All instructors for every piece

of component equipment in a system shall be available until instructions for all items included in the system have been completed. This is to assure proper instruction in the operation of inter-related systems. All instruction periods shall be at such times as scheduled by the COR and shall be considered concluded only when the COR is satisfied in regard to complete and thorough coverage. The contractor shall submit a course outline with associated material to the COR for review and approval prior to scheduling training to ensure the subject matter covers the expectations of the VA and the contractual requirements. The Department of Veterans Affairs reserves the right to request the removal of, and substitution for, any instructor who, in the opinion of the COR, does not demonstrate sufficient qualifications in accordance with requirements for instructors above.

1.23 HISTORIC PRESERVATION

A. Where the Contractor or any of the Contractor's employees, prior to, or during the construction work, are advised of or discover any possible archeological, historical and/or cultural resources, the Contractor shall immediately notify the COR verbally, and then with a written follow up.

B. If in the course of any earth disturbing activities human remains are discovered, or anything is discovered that could be reasonably suspected to be human remains, the Contractor shall immediately stop all work within 100 feet of the discovery and notify the COR. C. Prior to participating in construction or ground disturbance all contractor personnel involved in the construction or ground disturbance activity shall complete historic preservation training established by the medical center. All contractor personnel will be required to sign acknowledging receipt of the training. Training for this activity shall be approximately 30 minutes in length and be given at the medical center.

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SECTION 01 32 16.15
PROJECT SCHEDULES
(SMALL PROJECTS – DESIGN/BID/BUILD)

PART 1- GENERAL

1.1 DESCRIPTION:

A. The Contractor shall develop a Critical Path Method (CPM) plan and schedule demonstrating fulfillment of the contract requirements (Project Schedule), and shall keep the Project Schedule up-to-date in accordance with the requirements of this section and shall utilize the plan for scheduling, coordinating and monitoring work under this contract (including all activities of subcontractors, equipment vendors and suppliers). Conventional Critical Path Method (CPM) technique shall be utilized to satisfy both time and cost applications.

1.2 CONTRACTOR'S REPRESENTATIVE:

A. The Contractor shall designate an authorized representative responsible for the Project Schedule including preparation, review and progress reporting with and to the Contracting Officer's Representative (COR).

B. The Contractor's representative shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the requirements of this specification section.

C. The Contractor’s representative shall have the option of developing the project schedule within their organization or to engage the services of an outside consultant. If an outside scheduling consultant is utilized, Section 1.3 of this specification will apply.

1.3 CONTRACTOR'S CONSULTANT:

A. The Contractor shall submit a qualification proposal to the COR, within 10 days of bid acceptance. The qualification proposal shall include:

1. The name and address of the proposed consultant.
2. Information to show that the proposed consultant has the qualifications to meet the requirements specified in the preceding paragraph.
3. A representative sample of prior construction projects, which the proposed consultant has performed complete project scheduling services. These representative samples shall be of similar size and scope.

B. The Contracting Officer has the right to approve or disapprove the proposed consultant, and will notify the Contractor of the VA decision

within seven calendar days from receipt of the qualification proposal. In case of disapproval, the Contractor shall resubmit another consultant within 10 calendar days for renewed consideration. The Contractor shall have their scheduling consultant approved prior to submitting any schedule for approval.

1.4 COMPUTER PRODUCED SCHEDULES

A. The contractor shall provide monthly, to the Department of Veterans Affairs (VA), all computer-produced time/cost schedules and reports generated from monthly project updates. This monthly computer service will include: three copies of up to five different reports (inclusive of all pages) available within the user defined reports of the scheduling software approved by the Contracting Officer; a hard copy listing of all project schedule changes, and associated data, made at the update and an electronic file of this data; and the resulting monthly updated schedule in PDM format. These must be submitted with and substantively support the contractor’s monthly payment request and the signed look ahead report. The COR shall identify the five different report formats that the contractor shall provide.

B. The contractor shall be responsible for the correctness and timeliness of the computer-produced reports. The Contractor shall also responsible for the accurate and timely submittal of the updated project schedule and all CPM data necessary to produce the computer reports and payment request that is specified.

C. The VA will report errors in computer-produced reports to the Contractor’s representative within ten calendar days from receipt of reports. The Contractor shall reprocess the computer-produced reports and associated diskette(s), when requested by the Contracting Officer’s representative, to correct errors which affect the payment and schedule for the project.

1.5 THE COMPLETE PROJECT SCHEDULE SUBMITTAL

A. Within 45 calendar days after receipt of Notice to Proceed, the Contractor shall submit for the Contracting Officer's review; three blue line copies of the interim schedule on sheets of paper 765 x 1070 mm (30 x 42 inches) and an electronic file in the previously approved CPM schedule program. The submittal shall also include three copies of a computer-produced activity/event ID schedule showing project duration; phase completion dates; and other data, including event cost.

Each activity/event on the computer-produced schedule shall contain as a minimum, but not limited to, activity/event ID, activity/event description, duration, budget amount, early start date, early finish date, late start date, late finish date and total float. Work activity/event relationships shall be restricted to finish-to-start or start-to-start without lead or lag constraints. Activity/event date constraints, not required by the contract, will not be accepted unless submitted to and approved by the Contracting Officer. The contractor shall make a separate written detailed request to the Contracting Officer identifying these date constraints and secure the Contracting Officer's written approval before incorporating them into the network diagram. The Contracting Officer's separate approval of the Project Schedule shall not excuse the contractor of this requirement. Logic events (non-work) will be permitted where necessary to reflect proper logic among work events, but must have zero duration. The complete working schedule shall reflect the Contractor's approach to scheduling the complete project. **The final Project Schedule in its original form shall contain no contract changes or delays which may have been incurred during the final network diagram development period and shall reflect the entire contract duration as defined in the bid documents.** These changes/delays shall be entered at the first update after the final Project Schedule has been approved. The Contractor should provide their requests for time and supporting time extension analysis for contract time as a result of contract changes/delays, after this update, and in accordance with Article, ADJUSTMENT OF CONTRACT COMPLETION.

B. Within 30 calendar days after receipt of the complete project interim Project Schedule and the complete final Project Schedule, the Contracting Officer or his representative, will do one or both of the following:

1. Notify the Contractor concerning his actions, opinions, and objections.
2. A meeting with the Contractor at or near the job site for joint review, correction or adjustment of the proposed plan will be scheduled if required. Within 14 calendar days after the joint review, the Contractor shall revise and shall submit three blue line copies of the revised Project Schedule, three copies of the revised

computer-produced activity/event ID schedule and a revised electronic file as specified by the Contracting Officer. The revised submission will be reviewed by the Contracting Officer and, if found to be as previously agreed upon, will be approved.

C. The approved baseline schedule and the computer-produced schedule(s) generated there from shall constitute the approved baseline schedule until subsequently revised in accordance with the requirements of this section.

D. The Complete Project Schedule shall contain approximately 250 work activities/events.

1.6 WORK ACTIVITY/EVENT COST DATA

A. The Contractor shall cost load all work activities/events except procurement activities. The cumulative amount of all cost loaded work activities/events (including alternates) shall equal the total contract price. Prorate overhead, profit and general conditions on all work activities/events for the entire project length. The contractor shall generate from this information cash flow curves indicating graphically the total percentage of work activity/event dollar value scheduled to be in place on early finish, late finish. These cash flow curves will be used by the Contracting Officer to assist him in determining approval or disapproval of the cost loading. Negative work activity/event cost data will not be acceptable, except on VA issued contract changes.

B. The Contractor shall cost load work activities/events for guarantee period services, test, balance and adjust various systems in accordance with the provisions in Article, FAR 52.232 – 5 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS) and VAAR 852.232 –for (PAYMENTS UNDER FIXED PRICE CONSTRUCTION).

C. In accordance with FAR 52.236 – 1 (PERFORMANCE OF WORK BY THE CONTRACTOR) and VAAR 852.236 – 72 (PERFORMANCE OF WORK BY THE CONTRACTOR), the Contractor shall submit, simultaneously with the cost per work activity/event of the construction schedule required by this Section, a responsibility code for all activities/events of the project for which the Contractor's forces will perform the work.

D. The Contractor shall cost load work activities/events for all BID ITEMS including ASBESTOS ABATEMENT. The sum of each BID ITEM work shall equal the value of the bid item in the Contractors' bid.

1.7 PROJECT SCHEDULE REQUIREMENTS

A. Show on the project schedule the sequence of work activities/events required for complete performance of all items of work. The Contractor Shall:

1. Show activities/events as:
   a. Contractor's time required for submittal of shop drawings, templates, fabrication, delivery and similar pre-construction work.
   b. Contracting Officer's and Architect-Engineer's review and approval of shop drawings, equipment schedules, samples, template, or similar items.
   c. Interruption of VA Facilities utilities, delivery of Government furnished equipment, and rough-in drawings, project phasing and any other specification requirements.
   d. Test, balance and adjust various systems and pieces of equipment, maintenance and operation manuals, instructions and preventive maintenance tasks.
   e. VA inspection and acceptance activity/event with a minimum duration of five work days at the end of each phase and immediately preceding any VA move activity/event required by the contract phasing for that phase.
2. Show not only the activities/events for actual construction work for each trade category of the project, but also trade relationships to indicate the movement of trades from one area, floor, or building, to another area, floor, or building, for at least five trades who are performing major work under this contract.
3. Break up the work into activities/events of a duration no longer than 20 work days each or one reporting period, except as to non-construction activities/events (i.e., procurement of materials, delivery of equipment, concrete and asphalt curing) and any other activities/events for which the COR may approve the showing of a longer duration. The duration for VA approval of any required submittal, shop drawing, or other submittals will not be less than 20 work days.
4. Describe work activities/events clearly, so the work is readily identifiable for assessment of completion. Activities/events labeled

"start," "continue," or "completion," are not specific and will not be allowed. Lead and lag time activities will not be acceptable.

5. The schedule shall be generally numbered in such a way to reflect either discipline, phase or location of the work.

B. The Contractor shall submit the following supporting data in addition to the project schedule:

1. The appropriate project calendar including working days and holidays.
2. The planned number of shifts per day.
3. The number of hours per shift.

Failure of the Contractor to include this data shall delay the review of the submittal until the Contracting Officer is in receipt of the missing data.

C. To the extent that the Project Schedule or any revised Project Schedule shows anything not jointly agreed upon, it shall not be deemed to have been approved by the COR. Failure to include any element of work required for the performance of this contract shall not excuse the Contractor from completing all work required within any applicable completion date of each phase regardless of the COR's approval of the Project Schedule.

D. Compact Disk Requirements and CPM Activity/Event Record Specifications: Submit to the VA an electronic file(s) containing one file of the data required to produce a schedule, reflecting all the activities/events of the complete project schedule being submitted.

1.8 PAYMENT TO THE CONTRACTOR:

A. Monthly, the contractor shall submit an application and certificate for payment using VA Form 10-6001a or the AIA application and certificate for payment documents G702 & G703 reflecting updated schedule activities and cost data in accordance with the provisions of the following Article, PAYMENT AND PROGRESS REPORTING, as the basis upon which progress payments will be made pursuant to Article, FAR 52.232 – 5 (PAYMENT UNDER FIXED-PRICE CONSTRUCTION CONTRACTS) and VAAR 852.232 – for (PAYMENTS UNDER FIXED PRICE CONSTRUCTION). The Contractor shall be entitled to a monthly progress payment upon approval of estimates as determined from the currently approved updated project schedule. Monthly payment requests shall include: a listing of all agreed upon

project schedule changes and associated data; and an electronic file (s) of the resulting monthly updated schedule.

B. Approval of the Contractor's monthly Application for Payment shall be contingent, among other factors, on the submittal of a satisfactory monthly update of the project schedule.

1.9 PAYMENT AND PROGRESS REPORTING

A. Monthly schedule update meetings will be held on dates mutually agreed to by the COR and the Contractor. Contractor and their CPM consultant (if applicable) shall attend all monthly schedule update meetings. The Contractor shall accurately update the Project Schedule and all other data required and provide this information to the COR three work days in advance of the schedule update meeting. Job progress will be reviewed to verify:

1. Actual start and/or finish dates for updated/completed activities/events.
2. Remaining duration for each activity/event started, or scheduled to start, but not completed.
3. Logic, time and cost data for change orders, and supplemental agreements that are to be incorporated into the Project Schedule.
4. Changes in activity/event sequence and/or duration which have been made, pursuant to the provisions of following Article, ADJUSTMENT OF CONTRACT COMPLETION.
5. Completion percentage for all completed and partially completed activities/events.
6. Logic and duration revisions required by this section of the specifications.
7. Activity/event duration and percent complete shall be updated independently.

B. After completion of the joint review, the contractor shall generate an updated computer-produced calendar-dated schedule and supply the Contracting Officer's representative with reports in accordance with the Article, COMPUTER PRODUCED SCHEDULES, specified.

C. After completing the monthly schedule update, the contractor's representative or scheduling consultant shall rerun all current period contract change(s) against the prior approved monthly project schedule. The analysis shall only include original workday durations and schedule logic agreed upon by the contractor and COR for the contract change(s).

When there is a disagreement on logic and/or durations, the Contractor shall use the schedule logic and/or durations provided and approved by the COR. After each rerun update, the resulting electronic project schedule data file shall be appropriately identified and submitted to the VA in accordance to the requirements listed in articles 1.4 and 1.7. This electronic submission is separate from the regular monthly project schedule update requirements and shall be submitted to the COR within fourteen (14) calendar days of completing the regular schedule update. **Before inserting the contract changes durations, care must be taken to ensure that only the original durations will be used for the analysis, not the reported durations after progress. In addition, once the final network diagram is approved, the contractor must recreate all manual progress payment updates on this approved network diagram and associated reruns for contract changes in each of these update periods as outlined above for regular update periods. This will require detailed record keeping for each of the manual progress payment updates.**

D. Following approval of the CPM schedule, the VA, the General Contractor, its approved CPM Consultant, RE office representatives, and all subcontractors needed, as determined by the SRE, shall meet to discuss the monthly updated schedule. The main emphasis shall be to address work activities to avoid slippage of project schedule and to identify any necessary actions required to maintain project schedule during the reporting period. The Government representatives and the Contractor should conclude the meeting with a clear understanding of those work and administrative actions necessary to maintain project schedule status during the reporting period. This schedule coordination meeting will occur after each monthly project schedule update meeting utilizing the resulting schedule reports from that schedule update. If the project is behind schedule, discussions should include ways to prevent further slippage as well as ways to improve the project schedule status, when appropriate.

1.10 RESPONSIBILITY FOR COMPLETION

A. If it becomes apparent from the current revised monthly progress schedule that phasing or contract completion dates will not be met, the Contractor shall execute some or all of the following remedial actions:

1. Increase construction manpower in such quantities and crafts as necessary to eliminate the backlog of work.
2. Increase the number of working hours per shift, shifts per working day, working days per week, the amount of construction equipment, or any combination of the foregoing to eliminate the backlog of work.
3. Reschedule the work in conformance with the specification requirements.

B. Prior to proceeding with any of the above actions, the Contractor shall notify and obtain approval from the COR for the proposed schedule changes. If such actions are approved, the representative schedule revisions shall be incorporated by the Contractor into the Project Schedule before the next update, at no additional cost to the Government.

1.11 CHANGES TO THE SCHEDULE

A. Within 30 calendar days after VA acceptance and approval of any updated project schedule, the Contractor shall submit a revised electronic file (s) and a list of any activity/event changes including predecessors and successors for any of the following reasons:
1. Delay in completion of any activity/event or group of activities/events, which may be involved with contract changes, strikes, unusual weather, and other delays will not relieve the Contractor from the requirements specified unless the conditions are shown on the CPM as the direct cause for delaying the project beyond the acceptable limits.
2. Delays in submittals, or deliveries, or work stoppage are encountered which make rescheduling of the work necessary.
3. The schedule does not represent the actual prosecution and progress of the project.
4. When there is, or has been, a substantial revision to the activity/event costs regardless of the cause for these revisions.

B. CPM revisions made under this paragraph which affect the previously approved computer-produced schedules for Government furnished equipment, vacating of areas by the VA Facility, contract phase(s) and sub phase(s), utilities furnished by the Government to the Contractor, or any other previously contracted item, shall be furnished in writing to the Contracting Officer for approval.

C. Contracting Officer's approval for the revised project schedule and all relevant data is contingent upon compliance with all other paragraphs of this section and any other previous agreements by the Contracting Officer or the VA representative.

D. The cost of revisions to the project schedule resulting from contract changes will be included in the proposal for changes in work as specified in FAR 52.243 – 4 (Changes, and will be based on the complexity of the revision or contract change, man hours expended in analyzing the change, and the total cost of the change.

E. The cost of revisions to the Project Schedule not resulting from contract changes is the responsibility of the Contractor.

1.12 ADJUSTMENT OF CONTRACT COMPLETION

A. The contract completion time will be adjusted only for causes specified in this contract. Request for an extension of the contract completion date by the Contractor shall be supported with a justification, CPM data and supporting evidence as the COR may deem necessary for determination as to whether or not the Contractor is entitled to an extension of time under the provisions of the contract. Submission of proof based on revised activity/event logic, durations (in work days) and costs is obligatory to any approvals. The schedule must clearly display that the Contractor has used, in full, all the float time available for the work involved in this request. The Contracting Officer's determination as to the total number of days of contract extension will be based upon the current computer-produced calendar-dated schedule for the time period in question and all other relevant information.

B. Actual delays in activities/events which, according to the computer- produced calendar-dated schedule, do not affect the extended and predicted contract completion dates shown by the critical path in the network, will not be the basis for a change to the contract completion date. The Contracting Officer will within a reasonable time after receipt of such justification and supporting evidence, review the facts and advise the Contractor in writing of the Contracting Officer's decision.

C. The Contractor shall submit each request for a change in the contract completion date to the Contracting Officer in accordance with the provisions specified under FAR 52.243 – 4 (Changes). The Contractor

shall include, as a part of each change order proposal, a sketch showing all CPM logic revisions, duration (in work days) changes, and cost changes, for work in question and its relationship to other activities on the approved network diagram.

D. All delays due to non-work activities/events such as RFI's, WEATHER, STRIKES, and similar non-work activities/events shall be analyzed on a month by month basis.

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SECTION 01 33 23

SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES

PART 1 – GENERAL

1.1 DESCRIPTION

A. This specification defines the general requirements and procedures for submittals. A submittal is information submitted for VA review to establish compliance with the contract documents.

B. Detailed submittal requirements are found in the technical sections of the contract specifications. The Contracting Officer may request submittals in addition to those specified when deemed necessary to adequately describe the work covered in the respective technical specifications at no additional cost to the government.

C. VA approval of a submittal does not relieve the Contractor of the responsibility for any error which may exist. The Contractor is responsible for fully complying with all contract requirements and the satisfactory construction of all work, including the need to check, confirm, and coordinate the work of all subcontractors for the project. Non-compliant material incorporated in the work will be removed and replaced at the Contractor's expense.

1.2 DEFINITIONS

A. Preconstruction Submittals: Submittals which are required prior to issuing contract notice to proceed or starting construction. For example, Certificates of insurance; Surety bonds; Site-specific safety plan; Construction progress schedule; Schedule of values; Submittal register; List of proposed subcontractors.

B. Shop Drawings: Drawings, diagrams, and schedules specifically prepared to illustrate some portion of the work. Drawings prepared by or for the Contractor to show how multiple systems and interdisciplinary work will be integrated and coordinated.

C. Product Data: Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions, and brochures, which describe and illustrate 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.

D. Samples: 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 to establish standards by which the ensuing work can be judged.

E. Design Data: Calculations, mix designs, analyses, or other data pertaining to a part of work.

F. Test Reports: Report which includes findings of a test required to be performed by the Contractor on an actual portion of the work. Report which 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.

G. Certificates: Document required of Contractor, or of a manufacturer, supplier, installer, or subcontractor through Contractor. The purpose is to document procedures, acceptability of methods, or personnel qualifications for a portion of the work.

H. Manufacturer's Instructions: Pre-printed material describing installation of a product, system, or material, including special notices and MSDS concerning impedances, hazards, and safety precautions.

I. Manufacturer's Field Reports: Documentation of the testing and verification actions taken by manufacturer's representative at the job site on a portion of the work, during or after installation, to confirm compliance with manufacturer's standards or instructions. The documentation shall indicate whether the material, product, or system has passed or failed the test.

J. Operation and Maintenance Data: Manufacturer data that is required to operate, maintain, troubleshoot, and repair equipment, including manufacturer's help, parts list, and product line documentation. This data shall be incorporated in an operations and maintenance manual.

K. Closeout Submittals: Documentation 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 phase of construction on a multi-phase contract.

1.3 SUBMITTAL REGISTER

A. The submittal register will list 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 by the specifications. The Contractor is not relieved from supplying submittals required by the contract documents but which have been omitted from the submittal register.

B. The submittal register will serve as a scheduling document for submittals and will be used to control submittal actions throughout the contract period.

C. The VA will provide the initial submittal register in electronic format. Thereafter, the Contractor shall track all submittals by maintaining a complete list, including completion of all data columns, including dates on which submittals are received and returned by the VA.

D. The Contractor shall update the submittal register as submittal actions occur and maintain the submittal register at the project site until final acceptance of all work by Contracting Officer.

E. The Contractor shall submit formal monthly updates to the submittal register in electronic format. Each monthly update shall document actual submission and approval dates for each submittal.

1.4 SUBMITTAL SCHEDULING

A. Submittals shall be scheduled, submitted, reviewed, and approved prior to the acquisition of the material or equipment.

B. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of work so that work will not be delayed by submittal processing. Allow time for potential resubmittal.

C. No delay costs or time extensions will be allowed for time lost in late submittals or resubmittals.

D. All submittals are required to be approved prior to the start of the specified work activity.

1.5 SUBMITTAL PREPARATION

A. Each submittal shall be complete and in sufficient detail to allow ready determination of compliance with contract requirements.

B. Collect required data for each specific material, product, unit of work, or system into a single submittal. Prominently mark choices, options, and portions applicable to the submittal. Partial submittals will not be accepted for expedition of construction effort. Submittal will be returned without review if incomplete.

C. If available product data is incomplete, provide Contractor-prepared documentation to supplement product data and satisfy submittal requirements.

D. All irrelevant or unnecessary data shall be removed from the submittal to facilitate accuracy and timely processing. Submittals that contain the excessive amount of irrelevant or unnecessary data will be returned with review.

E. Provide a transmittal form for each submittal with the following information:

1. Project title, location and number.
2. Construction contract number.
3. Date of the drawings and revisions.
4. Name, address, and telephone number of subcontractor, supplier, manufacturer, and any other subcontractor associated with the submittal.
5. List paragraph number of the specification section and sheet number of the contract drawings by which the submittal is required.
6. When a resubmission, add alphabetic suffix on submittal description. For example, submittal 18 would become 18A, to indicate resubmission.
7. Product identification and location in project.

F. The Contractor is responsible for reviewing and certifying that all submittals are in compliance with contract requirements before submitting for VA review. Proposed deviations from the contract requirements shall be clearly identified. All deviations submitted shall include a side by side comparison of item being proposed against item specified. Failure to point out deviations will result in the VA requiring removal and replacement of such work at the Contractor's expense.

G. Stamp, sign, and date each submittal transmittal form indicating action taken.

H. Stamp used by the Contractor on the submittal transmittal form to certify that the submittal meets contract requirements shall be similar to the following:

CONTRACTOR
(Firm Name)
_____Approved
_____Approved with corrections as noted on submittal data and/or attached sheets(s)
SIGNATURE: _____
TITLE: _____
DATE: _____

1.6 SUBMITTAL FORMAT AND TRANSMISSION

A. Provide submittals in electronic format, with the exception of material samples. Use PDF as the electronic format, unless otherwise specified or directed by the Contracting Officer.

B. Compile the electronic submittal file as a single, complete document. Name the electronic submittal file specifically according to its contents.

C. Electronic files shall be of sufficient quality that all information is legible. Generate PDF files from original documents so that the text included in the PDF file is both searchable and can be copied. If documents are scanned, Optical Character Resolution (OCR) routines are required.

D. E-mail electronic submittal documents smaller than 5MB in size to e-mail addresses as directed by the Contracting Officer.
E. Provide electronic documents over 5MB through an electronic FTP file sharing system. Confirm that the electronic FTP file sharing system can be accessed from the VA computer network. The Contractor is responsible for setting up, providing, and maintaining the electronic FTP file sharing system for the construction contract period of performance.
F. Provide hard copies of submittals when requested by the Contracting Officer. Up to 3 additional hard copies of any submittal may be requested at the discretion of the Contracting Officer, at no additional cost to the VA.

1.7 SAMPLES

A. Submit two sets of physical samples showing range of variation, for each required item.
B. 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.
C. When color, texture, or pattern is specified by naming a particular manufacturer and style, include one sample of that manufacturer and style, for comparison.
D. Before submitting samples, the Contractor shall ensure 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.
E. The VA reserves the right to disapprove any material or equipment which previously has proven unsatisfactory in service.
F. Physical samples supplied may be requested back for use in the project after reviewed and approved.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit data specified for a given item within 30 calendar days after the item is delivered to the contract site.
B. In the event the Contractor fails to deliver O&M Data within the time limits specified, the Contracting Officer may withhold from progress

payments 50 percent of the price of the item with which such O&M Data are applicable.

1.9 TEST REPORTS

Contracting Officer's Representative may require specific test after work has been installed or completed which could require contractor to repair test area at no additional cost to contract.

1.10 VA REVIEW OF SUBMITTALS AND RFIS

A. The VA will review all submittals for compliance with the technical requirements of the contract documents. The Architect-Engineer for this project will assist the VA in reviewing all submittals and determining contractual compliance. Review will be only for conformance with the applicable codes, standards and contract requirements.

B. Period of review for submittals begins when the VA COR receives submittal from the Contractor.

C. Period of review for each resubmittal is the same as for initial submittal.

D. VA review period is 15 working days for submittals.

E. VA review period is 10 working days for RFIs.

F. The VA will return submittals to the Contractor with the following notations:

1. "Approved": authorizes the Contractor to proceed with the work covered.
2. "Approved as noted": authorizes the Contractor to proceed with the work covered provided the Contractor incorporates the noted comments and makes the noted corrections.
3. "Disapproved, revise and resubmit": indicates noncompliance with the contract requirements or that submittal is incomplete. Resubmit with appropriate changes and corrections. No work shall proceed for this item until resubmittal is approved.
4. "Not reviewed": indicates submittal 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 after taking appropriate action.

1.11 APPROVED SUBMITTALS

A. The VA approval of submittals shall not be construed as a complete check, and indicates only that the general method of construction, materials, detailing, and other information are satisfactory.

B. VA approval of a submittal does not relieve the Contractor of the responsibility for any error which may exist. The Contractor is responsible for fully complying with all contract requirements and the satisfactory construction of all work, including the need to check, confirm, and coordinate the work of all subcontractors for the project. Non-compliant material incorporated in the work will be removed and replaced at the Contractor's expense.

C. After submittals have been approved, no resubmittal for the purpose of substituting materials or equipment will be considered unless accompanied by an explanation of why a substitution is necessary.

D. Retain a copy of all approved submittals at project site, including approved samples.

1.12 WITHHOLDING OF PAYMENT

Payment for materials incorporated in the work will not be made if required approvals have not been obtained.

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SECTION 01 35 26 SAFETY REQUIREMENTS

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PART 1 - GENERAL

1.01 APPLICABLE PUBLICATIONS:

Latest publications listed below form part of this Article to extent referenced. Publications are referenced in text by basic designations only.

A. American Society of Safety Engineers (ASSE):

1. A10.1-2011 Pre-Project & Pre-Task Safety and Health Planning
2. A10.34-2012 Protection of the Public on or Adjacent to Construction Sites
3. A10.38-2013 Basic Elements of an Employer's Program to Provide a Safe and Healthful Work Environment American National Standard Construction and Demolition Operations

B. American Society for Testing and Materials (ASTM):

E84-2013 Surface Burning Characteristics of Building Materials

C. The Facilities Guidelines Institute (FGI):

FGI Guidelines- 2014 FGI Guidelines for Design and Construction of Hospitals and Outpatient Facilities

D. National Fire Protection Association (NFPA):

1. 10-2018 Standard for Portable Fire Extinguishers
2. 30-2018 Flammable and Combustible Liquids Code
3. 51B-2014 Standard for Fire Prevention During Welding, Cutting and Other Hot Work
4. 70-2017 National Electrical Code
5. 70B-2016 Recommended Practice for Electrical Equipment Maintenance
6. 70E-2018 Standard for Electrical Safety in the Workplace
7. 99-2018 Health Care Facilities Code
8. 241-2013 Standard for Safeguarding Construction, Alteration, and Demolition Operations

E. The Joint Commission (TJC)

TJC Manual Comprehensive Accreditation and Certification Manual

F. U.S. Nuclear Regulatory Commission

10 CFR 20 Standards for Protection Against Radiation

G. U.S. Occupational Safety and Health Administration (OSHA):

1. 29 CFR 1904 Reporting and Recording Injuries & Illnesses
2. 29 CFR 1910 Safety and Health Regulations for General Industry
3. 29 CFR 1926 Safety and Health Regulations for Construction Industry
4. CPL 2-0.124 Multi-Employer Citation Policy

H. Chillicothe VAMC Standard Operating Procedures (SOP) and Policies

1. Engineering SOP #11 Fall Protection
2. Engineering SOP #12 Construction Project Inspections
3. Engineering SOP #13 Construction Risk Assessment and Infection Control Plan
4. Engineering SOP #20 Confined Space Entry
5. Engineering SOP #30 Control of Hazardous Energy – Lockout Tagout
6. Engineering SOP #31 Hot Work Operations
7. Engineering SOP #44 Ladder Safety Practices
8. Engineering SOP #45 Excavation and Trenching
9. Engineering SOP #57 Coordinating Utility Outages
10. Policy Memorandum No. 138-10 Fire/Smoke Barrier Permits
11. Policy Memorandum No. 138-15 Electrical Safety
12. Chillicothe VAMC Safety and Infection Control Handbook for Contractors
13. Standard Operating Procedure (SOP) 41 Contractor Key Control
14. Standard Operating Procedure (SOP) 30 Control of Hazardous Energy(Lockout/Tagout) Appendix A Hazardous Energy Inventory
15. VHA Directive 1085 SMOKE-FREE POLICY FOR PATIENTS, VISITORS, CONTRACTORS, VOLUNTEERS, AND VENDORS AT VA HEALTH CARE FACILITIES
16. Policy Memorandum (PM) No. 07-29 Parking and Motor Vehicle Operation
17. Policy Memorandum (PM) No. 116-25 Management of Violence in the Workplace
18. Policy Memorandum (PM) No. 00-07 Prevention of Sexual Harassment
19. Standard Operating Procedure (SOP) 32 Dig Permits

1.02 DEFINITIONS:

A. OSHA “Competent Person” (CP). One who is capable of identifying existing and predictable hazards in the surroundings and working conditions which are unsanitary, hazardous or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them (see 29 CFR 1926.32(f)).

B. "Qualified Person" means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.

C. High Visibility Accident. Any mishap which may generate publicity or high visibility.

D. Medical Treatment. Treatment administered by a physician or by registered professional personnel under the standing orders of a

physician. Medical treatment does not include first aid treatment even through provided by a physician or registered personnel.

E. Recordable Injuries or Illnesses. Any work-related injury or illness that results in:

1. Death, regardless of the time between the injury and death, or the length of the illness;
2. Days away from work (any time lost after day of injury/illness onset);
3. Restricted work;
4. Transfer to another job;
5. Medical treatment beyond first aid;
6. Loss of consciousness; or
7. A significant injury or illness diagnosed by a physician or other licensed health care professional, even if it did not result in (1) through (6) above.

1.03 REGULATORY REQUIREMENTS:

In addition to the detailed requirements included in the provisions of this contract, comply with 29 CFR 1926, comply with 29 CFR 1910 as incorporated by reference within 29 CFR 1926, comply with ASSE A10.34, and all applicable federal, state, and local laws, ordinances, criteria, rules and regulations. Submit matters of interpretation of standards 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 except with specific approval and acceptance by the Contracting Officer Representative.

1.04 ACCIDENT PREVENTION PLAN (APP):

A. The APP (aka Construction Safety & Health Plan) shall interface with the Contractor's overall safety and health program. Include any portions of the Contractor's overall safety and health program referenced in the APP in the applicable APP element and ensure it is site-specific. The Government considers the Prime Contractor to be the "controlling authority" for all worksite safety and health of each subcontractor(s). 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.

B. The APP shall be prepared as follows:

1. Written in English by a qualified person who is employed by the Prime Contractor articulating the specific work and hazards pertaining to the contract (model language can be found in ASSE A10.33). Specifically articulating the safety requirements found within these VA contract safety specifications.

2. Address both the Prime Contractors and the subcontractors work operations.

3. State measures to be taken to control hazards associated with materials, services, or equipment provided by suppliers.

4. Address all the elements/sub-elements and in order as follows:

   a. SIGNATURE SHEET. Title, signature, and phone number of the following:

      i. Plan preparer (Qualified Person such as corporate safety staff person or contracted Certified Safety Professional with construction safety experience);

      ii. Plan approver (company/corporate officers authorized to obligate the company);

      iii. Plan concurrence (e.g., Chief of Operations, Corporate Chief of Safety, Corporate Industrial Hygienist, project manager or superintendent, project safety professional). Provide concurrence of other applicable corporate and project personnel (Contractor).

   b. BACKGROUND INFORMATION. List the following:

      i. Contractor;

      ii. Contract number;

      iii. Project name;

      iv. Brief project description, description of work to be performed, and location; phases of work anticipated (these will require an AHA).

   c. STATEMENT OF SAFETY AND HEALTH POLICY. Provide a copy of current corporate/company Safety and Health Policy Statement, detailing commitment to providing a safe and healthful workplace for all employees. The Contractor’s written safety program goals, objectives, and accident experience goals for this contract shall be provided.

   d. RESPONSIBILITIES AND LINES OF AUTHORITIES. Provide the following:

      i. A statement of the employer’s ultimate responsibility for the implementation of his Safety and Occupational Health program;

      ii. Identification and accountability of personnel responsible for safety at both corporate and project level. Contracts specifically requiring safety or industrial hygiene personnel shall include a copy of their resumes.

      iii. The names of Competent and/or Qualified Person(s) and proof of competency/qualification to meet specific OSHA Competent/Qualified Person(s) requirements shall be attached;

      iv. Requirements that no work shall be performed unless a designated competent person is present on the job site;

      v. Requirements for pre-task Activity Hazard Analysis (AHAs);

vi. Lines of authority;

vii. Policies and procedures regarding noncompliance with safety requirements (to include disciplinary actions for violation of safety requirements) shall be identified;

e. SUBCONTRACTORS AND SUPPLIERS. If applicable, provide procedures for coordinating Safety and Occupational Health activities with other employers on the job site:

i. Identification of subcontractors and suppliers (if known);

ii. Safety responsibilities of subcontractors and suppliers.

f. TRAINING.

i. Site-specific Safety and Occupational Health orientation training at the time of initial hire or assignment to the project for every employee before working on the project site is required.

ii. Mandatory training and certifications that are applicable to this project (e.g., explosive actuated tools, crane operator, rigger, crane signal person, fall protection, electrical lockout/NFPA 70E, machine/equipment lockout, confined space, etc…) and any requirements for periodic retraining/recertification are required.

iii. Procedures for ongoing safety and health training for supervisors and employees shall be established to address changes in site hazards/conditions.

iv. OSHA 10-hour training is required for all workers on site and the OSHA 30-hour training is required for Trade Competent Persons (CPs)

g. SAFETY AND HEALTH INSPECTIONS.

i. Specific assignment of responsibilities for a minimum daily job site safety and health inspection during periods of work activity: Who will conduct (e.g., "Site Safety and Health CP"), proof of inspector's training/qualifications, when inspections will be conducted, procedures for documentation, deficiency tracking system, and follow-up procedures.

ii. Any external inspections/certifications that may be required (e.g., contracted CSP or CSHT)

h. ACCIDENT INVESTIGATION & REPORTING. The Contractor shall conduct mishap investigations of all OSHA Recordable Incidents. The APP shall include accident/incident investigation procedure & identify person(s) responsible to provide the following to the Contracting Officer Representative :

i. Exposure data (man-hours worked);

ii. Accident investigations, reports, and logs.

i. PLANS (PROGRAMS, PROCEDURES) REQUIRED. Based on a risk assessment of contracted activities and on mandatory OSHA compliance programs, the Contractor shall address all

applicable occupational risks in site-specific compliance and accident prevention plans. These Plans shall include but are not limited to procedures for addressing the risks associated with the following:

i. Emergency response ;

ii. Contingency for severe weather;

iii. Fire Prevention ;

iv. Medical Support;

v. Posting of emergency telephone numbers;

vi. Prevention of alcohol and drug abuse;

vii. Site sanitation (housekeeping, drinking water, toilets);

viii. Night operations and lighting ;

ix. Hazard communication program;

x. Welding/Cutting "Hot" work ;

xi. Electrical Safe Work Practices (Electrical LOTO/NFPA 70E);

xii. General Electrical Safety

xiii. Hazardous energy control (Machine LOTO);

xiv. Site-Specific Fall Protection & Prevention;

xv. Excavation/trenching;

xvi. Asbestos abatement;

xvii. Lead abatement;

xviii. Crane Critical lift;

xix. Respiratory protection;

xx. Health hazard control program;

xxi. Radiation Safety Program;

xxii. Abrasive blasting;

xxiii. Heat/Cold Stress Monitoring;

xxiv. Crystalline Silica Monitoring (Assessment);

xxv. Demolition plan (to include engineering survey);

xxvi. Formwork and shoring erection and removal;

xxvii. PreCast Concrete.

C. Submit the APP to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the start of construction for acceptance. Work cannot proceed without an accepted APP.

D. Once accepted by the Contracting Officer Representative , the APP and attachments will be enforced as part of the contract. Disregarding the

provisions of this contract or the accepted APP will be cause for stopping of work, at the discretion of the Contracting Officer, until the matter has been rectified.

E. Once work begins, changes to the accepted APP shall be made with the knowledge and concurrence of the Contracting Officer Representative. 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/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 ASSE/SAFE A10.34) and the environment.

1.05 ACTIVITY HAZARD ANALYSES (AHAS):

A. AHAs are also known as Job Hazard Analyses, Job Safety Analyses, and Activity Safety Analyses. Before beginning each work activity involving a type of work presenting hazards not experienced in previous project operations or where a new work crew or sub-contractor is to perform the work, the Contractor(s) performing that work activity shall prepare an AHA (Example electronic AHA forms can be found on the US Army Corps of Engineers web site)

B. AHAs shall define the activities being performed and identify the work sequences, the specific anticipated hazards, site conditions, equipment, materials, and the control measures to be implemented to eliminate or reduce each hazard to an acceptable level of risk.

C. Work shall not begin until the AHA for the work activity has been accepted by the Contracting Officer Representative and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.

1. The names of the Competent/Qualified Person(s) required for a particular activity (for example, excavations, scaffolding, fall protection, other activities as specified by OSHA and/or other State and Local agencies) shall be identified and included in the AHA. Certification of their competency/qualification shall be submitted to the Government Designated Authority (GDA) for acceptance prior to the start of that work activity.

2. The AHA shall be reviewed and modified as necessary to address changing site conditions, operations, or change of competent/qualified person(s).

   a. If more than one Competent/Qualified Person is used on the AHA activity, a list of names shall be submitted as an attachment to the AHA. Those listed shall be Competent/Qualified for the type of work involved in the AHA and familiar with current site safety issues.

   b. If a new Competent/Qualified Person (not on the original list) is added, the list shall be updated (an administrative action not requiring an updated AHA). The new person shall acknowledge

in writing that he or she has reviewed the AHA and is familiar with current site safety issues.

3. Submit AHAs to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES for review at least 15 calendar days prior to the start of each phase. Subsequent AHAs as shall be formatted as amendments to the APP. The analysis shall be used during daily inspections to ensure the implementation and effectiveness of the activity's safety and health controls.

4. The AHA list will be reviewed periodically (at least monthly) at the Contractor supervisory safety meeting and updated as necessary when procedures, scheduling, or hazards change.

5. Develop the activity hazard analyses using the project schedule as the basis for the activities performed. All activities listed on the project schedule will require an AHA. The AHAs shall be developed by the contractor, supplier, or subcontractor and provided to the prime contractor for review and approval and then submitted to the Contracting Officer Representative.

1.06 PRECONSTRUCTION CONFERENCE:

A. Contractor representatives who have a responsibility or significant role in implementation of the accident prevention program, as required by 29 CFR 1926.20(b)(1), on the project shall attend the preconstruction conference to gain a mutual understanding of its implementation. This includes the project superintendent, subcontractor superintendents, and any other assigned safety and health professionals.

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 at the conference and an agreement will be reached between the Contractor and the Contracting Officer's representative as to which phases will require an analysis. In addition, establish a schedule for the preparation, submittal, review, and acceptance of AHAs to preclude project delays.

C. Deficiencies in the submitted APP will be brought to the attention of the Contractor within 14 days of submittal, and the Contractor shall revise the plan to correct deficiencies and re-submit it for acceptance. Do not begin work until there is an accepted APP.

1.07 "SITE SAFETY AND HEALTH OFFICER" (SSHO) AND "COMPETENT PERSON" (CP):

A. The Prime Contractor shall designate a minimum of one SSHO at each project site that will be identified as the SSHO to administer the Contractor's safety program and government-accepted Accident Prevention Plan. The SSHO may be the Contractor's Superintendent. Each subcontractor shall designate a minimum of one CP in compliance with 29 CFR 1926.20 (b)(2) that will be identified as a CP to administer their individual safety programs.

B. Further, all specialized Competent Persons for the work crews will be supplied by the respective contractor as required by 29 CFR 1926 (i.e.

Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).

C. These Competent Persons can have collateral duties as the subcontractor's superintendent and/or work crew lead persons as well as fill more than one specialized CP role (i.e. Asbestos, Electrical, Cranes, & Derricks, Demolition, Fall Protection, Fire Safety/Life Safety, Ladder, Rigging, Scaffolds, and Trenches/Excavations).

D. The SSHO or an equally-qualified Designated Representative/alternate will maintain a presence on the site during construction operations in accordance with FAR Clause 52.236-6: Superintendence by the Contractor. CPs will maintain presence during their construction activities in accordance with above mentioned clause. A listing of the designated SSHO and all known CPs shall be submitted prior to the start of work as part of the APP with the training documentation and/or AHA as listed in Section 1.08 below.

E. The repeated presence of uncontrolled hazards during a contractor's work operations will result in the designated CP as being deemed incompetent and result in the required removal of the employee in accordance with FAR Clause 52.236-5: Material and Workmanship, Paragraph (c).

1.08 TRAINING:

A. The designated Prime Contractor SSHO shall meet the requirements of all applicable OSHA standards and be capable (through training, experience, and qualifications) of ensuring that the requirements of 29 CFR 1926.16 and other appropriate Federal, State and local requirements are met for the project. As a minimum the SSHO must have completed the OSHA 30-hour Construction Safety class and have five (5) years of construction industry safety experience or three (3) years if he/she possesses a Certified Safety Professional (CSP) or certified Construction Safety and Health Technician (CSHT) certification or have a safety and health degree from an accredited university or college.

B. All designated CPs shall have completed the OSHA 30-hour Construction Safety course within the past 5 years.

C. In addition to the OSHA 30 Hour Construction Safety Course, all CPs with high hazard work operations such as operations involving asbestos, electrical, cranes, demolition, work at heights/fall protection, fire safety/life safety, ladder, rigging, scaffolds, and trenches/excavations shall have a specialized formal course in the hazard recognition & control associated with those high hazard work operations. Documented "repeat" deficiencies in the execution of safety requirements will require retaking the requisite formal course.

D. All other construction workers shall have the OSHA 10-hour Construction Safety Outreach course and any necessary safety training to be able to identify hazards within their work environment.

E. Submit training records associated with the above training requirements to the Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33

23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES 15 calendar days prior to the date of the start of construction for acceptance.

F. Prior to any worker for the contractor or subcontractors beginning work, they shall undergo a safety briefing provided by the SSHO or his/her designated representative. As a minimum, this briefing shall include information on the site-specific hazards, construction limits, VAMC safety guidelines, means of egress, break areas, work hours, locations of restrooms, use of VAMC equipment, emergency procedures, accident reporting etc... Documentation shall be provided to the Contracting Officer Representative that individuals have undergone contractor's safety briefing.

G. Ongoing safety training shall be accomplished in the form of weekly documented safety meeting.

1.09 INSPECTIONS:

A. The SSHO shall conduct frequent and regular safety inspections (daily) of the site and each of the subcontractors CPs shall conduct frequent and regular safety inspections (daily) of their work operations as required by 29 CFR 1926.20(b)(2). Each week, the SSHO shall conduct a formal documented inspection of the entire construction areas with the subcontractors' "Trade Safety and Health CPs" present in their work areas. Coordinate with, and report findings and corrective actions weekly to Contracting Officer Representative .

B. A Certified Safety Professional (CSP) with specialized knowledge in construction safety or a certified Construction Safety and Health Technician (CSHT) shall randomly conduct a monthly site safety inspection. The CSP or CSHT can be a corporate safety professional or independently contracted. The CSP or CSHT will provide their certificate number on the required report for verification as necessary.

1. Results of the inspection will be documented with tracking of the identified hazards to abatement.
2. The Contracting Officer Representative will be notified immediately prior to start of the inspection and invited to accompany the inspection.
3. Identified hazard and controls will be discussed to come to a mutual understanding to ensure abatement and prevent future reoccurrence.
4. A report of the inspection findings with status of abatement will be provided to the Contracting Officer Representative within one week of the onsite inspection.

1.10 ACCIDENTS, OSHA 300 LOGS, AND MAN-HOURS:

A. Notify the Contracting Officer Representative as soon as practical, but no more than four hours after any accident meeting the definition of OSHA Recordable Injuries or Illnesses or High Visibility Accidents, property damage equal to or greater than $5,000, or any weight handling equipment accident. 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 (to include type of construction equipment used, PPE used, etc.). Preserve the conditions and evidence on the accident site until the Contracting Officer Representative determine whether a government investigation will be conducted.

B. Conduct an accident investigation for recordable injuries and illnesses, for Medical Treatment defined in paragraph DEFINITIONS, and property damage accidents resulting in at least $20,000 in damages, to establish the root cause(s) of the accident. Complete the VA Form 2162, and provide the report to the Contracting Officer Representative within 5 calendar days of the accident. The Contracting Officer Representative will provide copies of any required or special forms.

C. A summation of all man-hours worked by the contractor and associated sub-contractors for each month will be reported to the Contracting Officer Representative monthly.

D. A summation of all OSHA recordable accidents experienced on site by the contractor and associated sub-contractors for each month will be provided to the Contracting Officer Representative monthly. The contractor and associated sub-contractors' OSHA 300 logs will be made available to the Contracting Officer Representative as requested.

1.11 PERSONAL PROTECTIVE EQUIPMENT (PPE):

A. PPE is governed in all areas by the nature of the work the employee is performing. For example, specific PPE required for performing work on electrical equipment is identified in NFPA 70E, Standard for Electrical Safety in the Workplace.

B. Mandatory PPE includes:

1. Hard Hats – unless written authorization is given by the Contracting Officer Representative in circumstances of work operations that have limited potential for falling object hazards such as during finishing work or minor remodeling. With authorization to relax the requirement of hard hats, if a worker becomes exposed to an overhead falling object hazard, then hard hats would be required in accordance with the OSHA regulations.

2. Safety glasses - unless written authorization is given by the Contracting Officer Representative appropriate safety glasses meeting the ANSI Z.87.1 standard shall be worn by each person on site.

3. Appropriate Safety Shoes – based on the hazards present, safety shoes meeting the requirements of ASTM F2413-11 shall be worn by each person on site unless written authorization is given by the Contracting Officer Representative .

4. Hearing protection - Use personal hearing protection at all times in designated noise hazardous areas or when performing noise hazardous tasks.

1.12 INFECTION CONTROL

A. Infection Control is critical in all medical center facilities. Interior construction activities causing disturbance of existing dust, or creating new dust, shall be conducted within ventilation-controlled areas that minimize the flow of airborne particles into patient areas. Exterior construction activities causing disturbance of soil or creates dust in some other manner shall be controlled.

B. An AHA associated with infection control will be performed by VA personnel in accordance with FGI Guidelines (i.e. Infection Control Risk Assessment (ICRA)). The ICRA procedure found on the American Society for Healthcare Engineering (ASHE) website will be utilized. Risk classifications of Class II or lower will require approval by the Contracting Officer Representative before beginning any construction work. Risk classifications of Class III or higher will require a permit before beginning any construction work. Infection Control permits will be issued by the Contracting Officer Representative. The Infection Control Permits will be posted outside the appropriate construction area. More than one permit may be issued for a construction project if the work is located in separate areas requiring separate classes. The primary project scope area for this project is: as shown on the approved Infection Control Safety Construction Permit(s) (ICRA), however, work outside the primary project scope area may vary. The required infection control precautions with each class are as follows:

1. Class I requirements:

    a. During Construction Work:

        i. Notify the Contracting Officer Representative

        ii. Execute work by methods to minimize raising dust from construction operations.

        iii. Ceiling tiles: Immediately replace a ceiling tiles displaced for visual inspection.

    b. Upon Completion:

        i. Clean work area upon completion of task

        ii. Notify the Contracting Officer Representative

2. Class II requirements:

    a. During Construction Work:

        i. Notify the Contracting Officer Representative

        ii. Provide active means to prevent airborne dust from dispersing into atmosphere such as wet methods or tool mounted dust collectors where possible.

        iii. Water mist work surfaces to control dust while cutting.

        iv. Seal unused doors with duct tape.

        v. Block off and seal air vents.

vi. Remove or isolate HVAC system in areas where work is being performed.

b. Upon Completion:

i. Wipe work surfaces with cleaner/disinfectant.

ii. Contain construction waste before transport in tightly covered containers.

iii. Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area.

iv. Upon completion, restore HVAC system where work was performed

v. Notify the Contracting Officer Representative

3. Class III requirements:

a. During Construction Work:

i. Obtain permit from the Contracting Officer Representative

ii. Remove or Isolate HVAC system in area where work is being done to prevent contamination of duct system.

iii. Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Install construction barriers and ceiling protection carefully, outside of normal work hours.

iv. Maintain negative air pressure, 0.01 inches of water gauge, within work site utilizing HEPA equipped air filtration units and continuously monitored with a digital display, recording and alarm instrument, which shall be calibrated on installation, maintained with periodic calibration and monitored by the contractor.

v. Contain construction waste before transport in tightly covered containers.

vi. Cover transport receptacles or carts. Tape covering unless solid lid.

b. Upon Completion:

i. Do not remove barriers from work area until completed project is inspected by the Contracting Officer Representative and thoroughly cleaned by the VA Environmental Services Department.

ii. Remove construction barriers and ceiling protection carefully to minimize spreading of dirt and debris associated with construction, outside of normal work hours.

iii. Vacuum work area with HEPA filtered vacuums.

iv. Wet mop area with cleaner/disinfectant.

v. Upon completion, restore HVAC system where work was performed.

vi. Return permit to the Contracting Officer Representative

4. Class IV requirements:

a. During Construction Work:

i. Obtain permit from the Contracting Officer Representative

ii. Isolate HVAC system in area where work is being done to prevent contamination of duct system.

iii. Complete all critical barriers i.e. sheetrock, plywood, plastic, to seal area from non work area or implement control cube method (cart with plastic covering and sealed connection to work site with HEPA vacuum for vacuuming prior to exit) before construction begins. Install construction barriers and ceiling protection carefully, outside of normal work hours.

iv. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units.

v. Seal holes, pipes, conduits, and punctures.

vi. Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave work site.

vii. All personnel entering work site are required to wear shoe covers. Shoe covers shall be changed each time the worker exits the work area.

b. Upon Completion:

i. Do not remove barriers from work area until completed project is inspected by the Contracting Officer Representative with thorough cleaning by the VA Environmental Services Dept.

ii. Remove construction barriers and ceiling protection carefully to minimize spreading of dirt and debris associated with construction, outside of normal work hours.

iii. Contain construction waste before transport in tightly covered containers.

iv. Cover transport receptacles or carts. Tape covering unless solid lid.

v. Vacuum work area with HEPA filtered vacuums.

vi. Wet mop area with cleaner/disinfectant.

vii. Upon completion, restore HVAC system where work was performed.

viii. Return permit to the Contracting Officer Representative

C. Barriers shall be erected as required based upon classification (Class III & IV requires barriers) and shall be constructed as follows:

1. Class III and IV - closed door with masking tape applied over the frame and door is acceptable for projects that can be contained in a single room.

2. Construction, demolition or reconstruction not capable of containment within a single room shall have the following barriers erected and made presentable on hospital occupied side:

   a. Class III & IV (where dust control is the only hazard, and an agreement is reached with the COR and Medical Center) - Airtight fire retardant sheet plastic barrier that extends from the floor to ceiling. Seams shall be sealed with duct tape to prevent dust and debris from escaping

   b. Class III & IV - Drywall barrier erected with joints covered or sealed to prevent dust and debris from escaping.

   c. Class III & IV - Seal all penetrations in existing barrier airtight

   d. Class III & IV - Barriers at penetration of ceiling envelopes, chases and ceiling spaces to stop movement air and debris

   e. Class IV only - Anteroom or double entrance openings that allow workers to remove protective clothing or vacuum off existing clothing

   f. Class III & IV - At elevators shafts or stairways within the field of construction, overlapping flap minimum of two feet wide of fire retardant sheet plastic enclosures for personnel access.

D. Products and Materials:

1. Sheet Plastic: Fire retardant polystyrene, 6-mil thickness or greater meeting local fire codes, may be used where dust control is the only hazard, and an agreement is reached with the COR

2. Barrier Doors: Self Closing Two-hour fire-rated solid core wood in steel frame, painted

3. Dust proof two-hour fire-rated drywall

4. High Efficiency Particulate Air-Equipped filtration machine rated at 95% capture of 0.3 microns including pollen, mold spores and dust particles. HEPA filters shall have ASHRAE 85 or other prefilter to extend the useful life of the HEPA. Provide both primary and secondary filtrations units. Maintenance of equipment and replacement of the HEPA filters and other filters will be in accordance with manufacturer’s instructions.

5. Exhaust Hoses: Heavy duty, flexible steel reinforced; Ventilation Blower Hose

6. Adhesive Walk-off Mats: Provide minimum size mats of 24 inches x 36 inches

7. Disinfectant: Hospital-approved disinfectant or equivalent product

8. Portable Ceiling Access Module

E. Before any construction on site begins, all contractor personnel involved in the construction or renovation activity shall be educated and trained in infection prevention measures established by the medical center.

F. A dust control program shall be established and maintained as part of the contractor's infection preventive measures in accordance with the FGI Guidelines for Design and Construction of Healthcare Facilities. Prior to start of work, prepare a plan detailing project-specific dust protection measures with associated product data, including periodic status reports, and submit to Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

G. Medical center Infection Control personnel shall at their discretion have access to the site to monitor for airborne disease (e.g. aspergillosis) during construction. A baseline of conditions may be established by the medical center prior to the start of work and periodically during the construction stage to determine impact of construction activities on indoor air quality with safe thresholds established.

H. In general, the following preventive measures shall be adopted during construction to keep down dust and prevent mold.

1. Contractor shall verify that construction exhaust to exterior is not reintroduced to the medical center through intake vents, or building openings. HEPA filtration is required where the exhaust dust may reenter the medical center.

2. Exhaust hoses shall be exhausted so that dust is not reintroduced to the medical center.

3. Adhesive Walk-off/Carpet Walk-off Mats shall be used at all interior transitions from the construction area to occupied medical center area. These mats shall be changed as often as required to maintain clean work areas directly outside construction area at all times.

4. Vacuum and wet mop all transition areas from construction to the occupied medical center at the end of each workday. Vacuum shall utilize HEPA filtration. Maintain surrounding area frequently. Remove debris as it is created. Transport these outside the construction area in containers with tightly fitting lids.

5. The contractor shall not haul debris through patient-care areas without prior approval of the Contracting Officer Representative and the Medical Center. When approved, debris shall be hauled in enclosed dust proof containers or wrapped in plastic and sealed with duct tape. No sharp objects shall be allowed to cut through the plastic. Wipe down the exterior of the containers with a damp rag to remove dust. All equipment, tools, material, etc. transported through occupied areas shall be made free from dust and moisture by vacuuming and wipe down.

6. There shall be no standing water during construction. This includes water in equipment drip pans and open containers within the construction areas. All accidental spills shall be cleaned up and dried within 12 hours. Remove and dispose of porous materials that remain damp for more than 72 hours.

7. At completion, remove construction barriers and ceiling protection carefully, outside of normal work hours. Vacuum and clean all surfaces free of dust after the removal.

I. Final Cleanup:

1. Upon completion of project, or as work progresses, remove all construction debris from above ceiling, vertical shafts and utility chases that have been part of the construction.

2. Perform HEPA vacuum cleaning of all surfaces in the construction area. This includes walls, ceilings, cabinets, furniture (built-in or free standing), partitions, flooring, etc.

3. All new air ducts shall be cleaned prior to final inspection.

J. Exterior Construction

1. Contractor shall verify that dust will not be introduced into the medical center through intake vents, or building openings. HEPA filtration on intake vents is required where dust may be introduced.

2. Dust created from disturbance of soil such as from vehicle movement will be wetted with use of a water truck as necessary

3. All cutting, drilling, grinding, sanding, or disturbance of materials shall be accomplished with tools equipped with either local exhaust ventilation (i.e. vacuum systems) or wet suppression controls.

1.13 NOT APPLICABLE

1.14 FIRE SAFETY

A. Fire Safety Plan: Establish and maintain a site-specific fire protection program in accordance with 29 CFR 1926. Prior to start of work, prepare a plan detailing project-specific fire safety measures, including periodic status reports, and submit to Contracting Officer Representative for review for compliance with contract requirements in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. This plan may be an element of the Accident Prevention Plan.

B. Site and Building Access: Maintain free and unobstructed access to facility emergency services and for fire, police and other emergency response forces in accordance with NFPA 241.

C. Separate temporary facilities, such as trailers, storage sheds, and dumpsters, from existing buildings and new construction by distances in accordance with NFPA 241. For small facilities with less than 6 m (20 feet) exposing overall length, separate by 3m (10 feet).

D. Temporary Construction Partitions:

1. Install and maintain temporary construction partitions to provide smoke-tight separations between construction areas, the areas that are described in phasing requirements, and adjoining areas. Construct partitions of gypsum board or treated plywood (flame spread rating of 25 or less in accordance with ASTM E84) on both sides of fire retardant treated wood or metal steel studs. Extend the partitions through suspended ceilings to floor slab deck or

roof. Seal joints and penetrations. At door openings, install Class C, ¾ hour fire/smoke rated doors with self-closing devices.

2. Install two-hour fire-rated temporary construction partitions as shown on drawings to maintain integrity of existing exit stair enclosures, exit passageways, fire-rated enclosures of hazardous areas, horizontal exits, smoke barriers, vertical shafts and openings enclosures.

3. Close openings in smoke barriers and fire-rated construction to maintain fire ratings. Seal penetrations with listed through-penetration firestop materials in accordance with Section 07 84 00, FIRESTOPPING.

E. Temporary Heating and Electrical: Install, use and maintain installations in accordance with 29 CFR 1926, NFPA 241 and NFPA 70. Use of Temporary Heating requires approval in writing by the Chillicothe VAMC Fire Department. Submit temporary heating plan for approval. Coordinate with the Contracting Officer Representative.

F. Means of Egress: Do not block exiting for occupied buildings, including paths from exits to roads. Minimize disruptions and coordinate with Contracting Officer Representative.

G. Egress Routes for Construction Workers: Maintain free and unobstructed egress. Inspect daily. Report findings and corrective actions weekly to Contracting Officer Representative .

H. Fire Extinguishers: Provide and maintain extinguishers in construction areas and temporary storage areas in accordance with 29 CFR 1926, NFPA 241 and NFPA 10.

I. Flammable and Combustible Liquids: Store, dispense and use liquids in accordance with 29 CFR 1926, NFPA 241 and NFPA 30.

J. Standpipes: Install and extend standpipes up with each floor in accordance with 29 CFR 1926 and NFPA 241. Do not charge wet standpipes subject to freezing until weather protected.

K. Sprinklers: Install, test and activate new automatic sprinklers prior to removing existing sprinklers.

L. Existing Fire Protection: Do not impair automatic sprinklers, smoke and heat detection, and fire alarm systems, except for portions immediately under construction, and temporarily for connections. Provide fire watch for impairments more than 4 hours in a 24-hour period. Request interruptions in accordance with Article, OPERATIONS AND STORAGE AREAS, and coordinate with Contracting Officer Representative. All existing or temporary fire protection systems (fire alarms, sprinklers) located in construction areas shall be tested as coordinated with the medical center. Parameters for the testing and results of any tests performed shall be recorded by the medical center and copies provided to the Contracting Officer Representative .

M. Smoke Detectors: Prevent accidental operation. Remove temporary covers at end of work operations each day. Coordinate with Contracting Officer Representative .

N. Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B, and the Chillicothe VAMC Station Standard Operating Procedure on Hot Work. Coordinate with Contracting Officer Representative. Obtain permits per the Chillicothe VAMC Station Standard Operating Procedure on Hot Work before performing any hot work.

O. Fire Hazard Prevention and Safety Inspections: Inspect entire construction areas weekly. Coordinate with, and report findings and corrective actions weekly to Contracting Officer Representative.

P. Smoking: Smoking is prohibited in and adjacent to construction areas inside existing buildings and additions under construction. In separate and detached buildings under construction, smoking is prohibited except in designated smoking rest areas.

Q. Dispose of waste and debris in accordance with NFPA 241. Remove from buildings daily.

R. If required, submit documentation to the Contracting Officer Representative that personnel have been trained in the fire safety aspects of working in areas with impaired structural or compartmentalization features.

1.15 ELECTRICAL

A. All electrical work shall comply with NFPA 70 (NEC), NFPA 70B, NFPA 70E, 29 CFR Part 1910 Subpart J – General Environmental Controls, 29 CFR Part 1910 Subpart S – Electrical, and 29 CFR 1926 Subpart K in addition to other references required by contract.

B. All qualified persons performing electrical work under this contract shall be licensed journeyman or master electricians. All apprentice electricians performing under this contract shall be deemed unqualified persons unless they are working under the immediate supervision of a licensed electrician or master electrician.

C. All electrical work shall be accomplished de-energized and in the Electrically Safe Work Condition (refer to NFPA 70E for Work Involving Electrical Hazards, including Exemptions to Work Permit). Any Contractor, subcontractor or temporary worker who fails to fully comply with this requirement is subject to immediate termination in accordance with FAR clause 52.236-5(c). Only in rare circumstance where achieving an electrically safe work condition prior to beginning work would increase or cause additional hazards, or is infeasible due to equipment design or operational limitations is energized work permitted. The Contracting Officer Representative with approval of the Medical Center Director will make the determination if the circumstances would meet the exception outlined above. An AHA specific to energized work activities will be developed, reviewed, and accepted prior to the start of that work.

1. Development of a Hazardous Electrical Energy Control Procedure is required prior to de-energization. A single Simple Lockout/Tagout Procedure for multiple work operations can only be used for work involving qualified person(s) de-energizing one set of conductors or

circuit part source. Task specific Complex Lockout/Tagout Procedures are required at all other times.

2. Verification of the absence of voltage after de-energization and lockout/tagout is considered "energized electrical work" (live work) under NFPA 70E, and shall only be performed by qualified persons wearing appropriate shock protective (voltage rated) gloves and arc rate personal protective clothing and equipment, using Underwriters Laboratories (UL) tested and appropriately rated contact electrical testing instruments or equipment appropriate for the environment in which they will be used.

3. Personal Protective Equipment (PPE) and electrical testing instruments will be readily available for inspection by the Contracting Officer Representative.

D. Before beginning any electrical work, an Activity Hazard Analysis (AHA) will be conducted to include Shock Hazard and Arc Flash Hazard analyses (NFPA Tables can be used only as a last alterative and it is strongly suggested a full Arc Flash Hazard Analyses be conducted). Work shall not begin until the AHA for the work activity has been accepted by the Contracting Officer Representative and discussed with all engaged in the activity, including the Contractor, subcontractor(s), and Government on-site representatives at preparatory and initial control phase meetings.

E. Ground-fault circuit interrupters. All 120-volt, single-phase 15- and 20-ampere receptacle outlets on construction sites shall have approved ground-fault circuit interrupters for personnel protection. "Assured Equipment Grounding Conductor Program" only is not allowed.

1.16 FALL PROTECTION

The fall protection (FP) threshold height requirement is 6 ft (1.8 m) for ALL WORK, unless specified differently or the OSHA 29 CFR 1926 requirements are more stringent, to include steel erection activities, systems-engineered activities (prefabricated) metal buildings, residential (wood) construction and scaffolding work.

A. The use of a Safety Monitoring System (SMS) as a fall protection method is prohibited.

B. The use of Controlled Access Zone (CAZ) as a fall protection method is prohibited.

C. A Warning Line System (WLS) shall ONLY be used on floors or flat or low-sloped roofs (between 0 - 18.4 degrees or 4:12 slope) and shall be erected around all sides of the work area (See 29 CFR 1926.502(f) for construction of WLS requirements). Working within the WLS does not require FP. No worker shall be allowed in the area between the roof or floor edge and the WLS without FP. FP is required when working outside the WLS.

D. Fall protection while using a ladder will be governed by the OSHA requirements.

1.17 SCAFFOLDS AND OTHER WORK PLATFORMS

A. All scaffolds and other work platforms construction activities shall comply with 29 CFR 1926 Subpart L.

B. The fall protection (FP) threshold height requirement is 6 ft (1.8 m) as stated in Section 1.16.

C. The following hierarchy and prohibitions shall be followed in selecting appropriate work platforms.

1. Scaffolds, platforms, or temporary floors shall be provided for all work except that can be performed safely from the ground or similar footing.

2. Ladders less than 20 feet may be used as work platforms only when use of small hand tools or handling of light material is involved.

3. Ladder jacks, lean-to, and prop-scaffolds are prohibited.

4. Emergency descent devices shall not be used as working platforms.

D. Contractors shall use a scaffold tagging system in which all scaffolds are tagged by the Competent Person. Tags shall be color-coded: green indicates the scaffold has been inspected and is safe to use; red indicates the scaffold is unsafe to use. Tags shall be readily visible, made of materials that will withstand the environment in which they are used, be legible and shall include:

1. The Competent Person’s name and signature;

2. Dates of initial and last inspections.

E. Mast Climbing work platforms: When access ladders, including masts designed as ladders, exceed 20 ft (6 m) in height, positive fall protection shall be used.

1.18 EXCAVATION AND TRENCHES

A. All excavation and trenching work shall comply with 29 CFR 1926 Subpart P , and the Chillicothe VAMC Standard Operating Procedure on Excavation and Trenching .

B. All excavations and trenches 5 feet in depth or greater shall require a written trenching and excavation permit (NOTE – some States and other local jurisdictions require separate state/jurisdiction-issued excavation permits). The permit shall be completed and provided to the Contracting Officer Representative prior to commencing work. The permit shall be maintained onsite and include the following:

1. Determination of soil classification

2. Indication that utilities have been located and identified. If utilities could not be located after all reasonable attempt, then excavating operations will proceed cautiously.

3. Indication of selected excavation protective system.

4. Indication that the spoil pile will be stored at least 2 feet from the edge of the excavation and safe access provided within 25 feet of the workers.

5. Indication of assessment for a potential toxic, explosive, or oxygen deficient atmosphere.

6. Map, Drawing, or Sketch showing a minimum 10’ beyond the extents of the excavation, spatially recognizable by building or road features.

If the above location or conditions change to a more hazardous condition than described on the original permit, particularly when additional precautions would be required, the approved permit shall become invalid, and a new permit shall be submitted. There is not a standardized Chillicothe VAMC Excavation Permit, and thus the excavation permit shall be submitted as a letter from the Contractor on their Company Letterhead for acceptance by the Government.

C. If not using an engineered protective system such as a trench box, shielding, shoring, or other Professional Engineer designed system and using a sloping or benching system, soil classification cannot be Solid Rock or Type A. All soil will be classified as Type C and sloped in accordance with Appendix B of 29 CFR 1926; any exceptions are certified in writing by a registered professional engineer (PE).

1.19 CRANES

A. All crane work shall comply with 29 CFR 1926 Subpart CC.

B. Prior to operating a crane, the operator shall be licensed, qualified or certified to operate the crane. Thus, all the provisions contained with Subpart CC are effective and there is no “Phase In” date of November 10, 2014.

C. A detailed lift permit shall be submitted to the Contracting Officer Representative 14 days prior to the scheduled lift complete with route for truck carrying load, crane load analysis, siting of crane and path of swing. The lift will not be allowed without approval of this document.

D. Crane operators shall not carry loads

1. over the general public or VAMC personnel

2. over any occupied building unless

a. the top two floors are vacated

b. or overhead protection with a design live load of 300 psf is provided

1.20 CONTROL OF HAZARDOUS ENERGY (LOCKOUT/TAGOUT)

A. All installation, maintenance, and servicing of equipment or machinery shall comply with 29 CFR 1910.147 except for specifically referenced operations in 29 CFR 1926 such as concrete & masonry equipment [1926.702(j)], heavy machinery & equipment [1926.600(a)(3)(i)], and process safety management of highly hazardous chemicals (1926.64). Control of hazardous electrical energy during the installation, maintenance, or servicing of electrical equipment shall comply with Section 1.15 to include NFPA 70E and other VA specific requirements discussed in the section.

B. Contractor shall submit their LOCKOUT/TAGOUT written procedures to the Chillicothe VAMC. These procedures are shared with the Construction Safety Working Group and Engineering Employees to ensure they know the Contractor's LOCKOUT/TAGOUT procedures.

1.21 CONFINED SPACE ENTRY

A. All confined space entry shall comply with 29 CFR 1910.146 except for specifically referenced operations in 29 CFR 1926 such as excavations/trenches [1926.651(g)]In addition, the Chillicothe VAMC station Standard Operating Procedure on Confined Space Entry, or the Contractor's Confined Space Entry Procedure shall be followed.

B. A site-specific Confined Space Entry Plan (including permitting process) shall be developed and submitted to the Contracting Officer Representative.

1.22 WELDING AND CUTTING

As specified in section FIRE SAFETY, Hot Work: Perform and safeguard hot work operations in accordance with NFPA 241 and NFPA 51B , and the Chillicothe VAMC Station Standard Operating Procedure on Hot Work . Coordinate with Contracting Officer Representative . Obtain permits per the Chillicothe VAMC Station Standard Operating Procedure on Hot Work before performing any hot work .

1.23 LADDERS

A. All Ladder use shall comply with 29 CFR 1926 Subpart X.

B. All portable ladders shall be of sufficient length and shall be placed so that workers will not stretch or assume a hazardous position.

C. Manufacturer safety labels shall be in place on ladders

D. Step Ladders shall not be used in the closed position

E. Top steps or cap of step ladders shall not be used as a step

F. Portable ladders, used as temporary access, shall extend at least 3 ft (0.9 m) above the upper landing surface.

1. When a 3 ft (0.9-m) extension is not possible, a grasping device (such as a grab rail) shall be provided to assist workers in mounting and dismounting the ladder.

2. In no case shall the length of the ladder be such that ladder deflection under a load would, by itself, cause the ladder to slip from its support.

G. Ladders shall be inspected for visible defects on a daily basis and after any occurrence that could affect their safe use. Broken or damaged ladders shall be immediately tagged "DO NOT USE," or with similar wording, and withdrawn from service until restored to a condition meeting their original design.

1.24 FLOOR & WALL OPENINGS

A. All floor and wall openings shall comply with 29 CFR 1926 Subpart M.

B. Floor and roof holes/openings are any that measure over 2 in (51 mm) in any direction of a walking/working surface which persons may trip or

fall into or where objects may fall to the level below. See 21.F for covering and labeling requirements. Skylights located in floors or roofs are considered floor or roof hole/openings.

C. All floor, roof openings or hole into which a person can accidentally walk or fall through shall be guarded either by a railing system with toeboards along all exposed sides or a load-bearing cover. When the cover is not in place, the opening or hole shall be protected by a removable guardrail system or shall be attended when the guarding system has been removed, or other fall protection system.

1. Covers shall be capable of supporting, without failure, at least twice the weight of the worker, equipment and material combined.
2. Covers shall be secured when installed, clearly marked with the word "HOLE", "COVER" or "Danger, Roof Opening-Do Not Remove" or color-coded or equivalent methods (e.g., red or orange "X"). Workers shall be made aware of the meaning for color coding and equivalent methods.
3. Roofing material, such as roofing membrane, insulation or felts, covering or partly covering openings or holes, shall be immediately cut out. No hole or opening shall be left unattended unless covered.
4. Non-load-bearing skylights shall be guarded by a load-bearing skylight screen, cover, or railing system along all exposed sides.
5. Workers are prohibited from standing/walking on skylights.

1.25 ASBESTOS AWARENESS

A. The Chillicothe VA Medical Center maintains a database of known locations of Asbestos Containing Materials (ACMs). This information is available to the contractor upon request to the Contracting Officer Representative. In addition the contractor is advised that, at the time most of the buildings at this facility were constructed, ACMs were widely used in the construction industry for a broad range of applications. Through numerous abatement projects much of the ACM has been removed, but not yet all.

B. Efforts have been made by the VA to identify the presence of any remaining ACMs in the construction work area. However, the contractor shall remain alert to the possibility that there could be ACMs present in locations not readily accessible prior to the start of construction. If during the course of his work the contractor identifies a building product or other substance which he has reason to believe could be an ACM, he shall immediately stop any and all work as necessary to avoid disturbing said material and contact the Contracting Officer Representative for a determination.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

Appendix:

	ICRA
BLDG 35	Class TBD
BLDG 210	Class TBD
BLDG 211	Class TBD
Fiber Loop	Class TBD
BLDG 256 - WTP	Class TBD
BLDG 24	Class TBD
Storage Tanks	Class TBD
BLDG 27	Class TBD
BLDG 30	Class TBD
BLDG 31	Class TBD

--- END OF SECTION – SAFETY REQUIREMENTS ---

SECTION 01 42 19
REFERENCE STANDARDS

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies the availability and source of references and standards specified in the project manual under paragraphs APPLICABLE PUBLICATIONS and/or shown on the drawings.

1.2 AVAILABILITY OF SPECIFICATIONS LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS FPMR PART 101-29 (FAR 52.211-1) (AUG 1998)

A. The GSA Index of Federal Specifications, Standards and Commercial Item Descriptions, FPMR Part 101-29 and copies of specifications, standards, and commercial item descriptions cited in the solicitation may be obtained for a fee by submitting a request to – GSA Federal Supply Service, Specifications Section, Suite 8100, 470 East L'Enfant Plaza, SW, Washington, DC 20407, Telephone (202) 619-8925, Facsimile (202) 619-8978.

B. If the General Services Administration, Department of Agriculture, or Department of Veterans Affairs issued this solicitation, a single copy of specifications, standards, and commercial item descriptions cited in this solicitation may be obtained free of charge by submitting a request to the addressee in paragraph (a) of this provision. Additional copies will be issued for a fee.

1.3 AVAILABILITY FOR EXAMINATION OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-4) (JUN 1988)

The specifications and standards cited in this solicitation can be examined at the following location:

DEPARMENT OF VETERANS AFFAIRS
Office of Construction & Facilities Management
Facilities Quality Service (00CFM1A)
425 Eye Street N.W, (sixth floor)
Washington, DC 20001
Telephone Numbers: (202) 632-5249 or (202) 632-5178
Between 9:00 AM - 3:00 PM

1.4 AVAILABILITY OF SPECIFICATIONS NOT LISTED IN THE GSA INDEX OF FEDERAL SPECIFICATIONS, STANDARDS AND COMMERCIAL ITEM DESCRIPTIONS (FAR 52.211-3) (JUN 1988)

The specifications cited in this solicitation may be obtained from the associations or organizations listed below.

AA Aluminum Association Inc.
http://www.aluminum.org

AABC Associated Air Balance Council
http://www.aabchq.com

AAMA American Architectural Manufacturer's Association
http://www.aamanet.org

AAN American Nursery and Landscape Association
http://www.anla.org

AASHTO American Association of State Highway and Transportation Officials
http://www.aashto.org

AATCC American Association of Textile Chemists and Colorists
http://www.aatcc.org

ACGIH American Conference of Governmental Industrial Hygienists
http://www.acgih.org

ACI American Concrete Institute
http://www.aci-int.net

ACPA American Concrete Pipe Association
http://www.concrete-pipe.org

ACPPA American Concrete Pressure Pipe Association
http://www.acppa.org

ADC Air Diffusion Council
http://flexibleduct.org

AGA American Gas Association
http://www.aga.org

AGC Associated General Contractors of America
http://www.agc.org

AGMA American Gear Manufacturers Association, Inc.
http://www.agma.org

AHAM Association of Home Appliance Manufacturers
http://www.aham.org

AIA American Institute of Architects

http://www.aia.org

AISC American Institute of Steel Construction
http://www.aisc.org

AISI American Iron and Steel Institute
http://www.steel.org

AITC American Institute of Timber Construction
http://www.aitc-glulam.org

AMCA Air Movement and Control Association, Inc.
http://www.amca.org

ANLA American Nursery & Landscape Association
http://www.anla.org

ANSI American National Standards Institute, Inc.
http://www.ansi.org

APA The Engineered Wood Association
http://www.apawood.org

ARI Air-Conditioning and Refrigeration Institute
http://www.ari.org

ASAE American Society of Agricultural Engineers
http://www.asae.org

ASCE American Society of Civil Engineers
http://www.asce.org

ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers http://www.ashrae.org
ASME	American Society of Mechanical Engineers http://www.asme.org
ASSE	American Society of Sanitary Engineering http://www.asse-plumbing.org
ASTM	American Society for Testing and Materials http://www.astm.org
AWI	Architectural Woodwork Institute http://www.awinet.org
AWS	American Welding Society http://www.aws.org
AWWA	American Water Works Association http://www.awwa.org
BHMA	Builders Hardware Manufacturers Association http://www.buildershardware.com
BIA	Brick Institute of America http://www.bia.org
CAGI	Compressed Air and Gas Institute http://www.cagi.org
CGA	Compressed Gas Association, Inc. http://www.cganet.com
CI	The Chlorine Institute, Inc. http://www.chlorineinstitute.org
CISCA	Ceilings and Interior Systems Construction Association http://www.cisca.org
CISPI	Cast Iron Soil Pipe Institute http://www.cispi.org

CLFMI Chain Link Fence Manufacturers Institute
http://www.chainlinkinfo.org

CPMB Concrete Plant Manufacturers Bureau
http://www.cpmb.org

CRA California Redwood Association
http://www.calredwood.org

CRSI Concrete Reinforcing Steel Institute
http://www.crsi.org

CTI Cooling Technology Institute
http://www.cti.org

DHI Door and Hardware Institute
http://www.dhi.org

EGSA Electrical Generating Systems Association
http://www.egsa.org

EEI Edison Electric Institute
http://www.eei.org

EPA Environmental Protection Agency
http://www.epa.gov

ETL ETL Testing Laboratories, Inc.
http://www.etl.com

FAA Federal Aviation Administration
http://www.faa.gov

FCC Federal Communications Commission
http://www.fcc.gov

FPS The Forest Products Society
http://www.forestprod.org

GANA Glass Association of North America
http://www.cssinfo.com/info/gana.html/

FM Factory Mutual Insurance
http://www.fmglobal.com

GA Gypsum Association
http://www.gypsum.org

GSA General Services Administration
http://www.gsa.gov

HI Hydraulic Institute
http://www.pumps.org

HPVA Hardwood Plywood & Veneer Association
http://www.hpva.org

ICBO International Conference of Building Officials
http://www.icbo.org

ICEA Insulated Cable Engineers Association Inc.
http://www.icea.net

\ICAC Institute of Clean Air Companies
http://www.icac.com

IEEE Institute of Electrical and Electronics Engineers
http://www.ieee.org\

IMSA International Municipal Signal Association
http://www.imsasafety.org

IPCEA Insulated Power Cable Engineers Association

NBMA Metal Buildings Manufacturers Association
http://www.mbma.com

MSS Manufacturers Standardization Society of the Valve and Fittings Industry Inc.
http://www.mss-hq.com

NAAMM National Association of Architectural Metal Manufacturers
http://www.naamm.org

NAPHCC Plumbing-Heating-Cooling Contractors Association
http://www.phccweb.org.org

NBS National Bureau of Standards
See - NIST

NBBPVI National Board of Boiler and Pressure Vessel Inspectors
http://www.nationboard.org

NEC National Electric Code
See - NFPA National Fire Protection Association

NEMA National Electrical Manufacturers Association
http://www.nema.org

NFPA National Fire Protection Association
http://www.nfpa.org

NHLA National Hardwood Lumber Association
http://www.natlhardwood.org

NIH National Institute of Health
http://www.nih.gov

NIST National Institute of Standards and Technology
http://www.nist.gov

NLMA Northeastern Lumber Manufacturers Association, Inc.
http://www.nelma.org

NPA National Particleboard Association
18928 Premiere Court
Gaithersburg, MD 20879
(301) 670-0604

NSF National Sanitation Foundation
http://www.nsf.org

NWWDA Window and Door Manufacturers Association
http://www.nwwda.org

OSHA Occupational Safety and Health Administration
Department of Labor
http://www.osha.gov

PCA Portland Cement Association
http://www.portcement.org

PCI Precast Prestressed Concrete Institute
http://www.pci.org

PPI The Plastic Pipe Institute
http://www.plasticpipe.org

PEI Porcelain Enamel Institute, Inc.
http://www.porcelainenamel.com

PTI Post-Tensioning Institute
http://www.post-tensioning.org

RFCI The Resilient Floor Covering Institute
http://www.rfci.com

RIS Redwood Inspection Service
See - CRA

RMA Rubber Manufacturers Association, Inc.
http://www.rma.org

SCMA Southern Cypress Manufacturers Association
http://www.cypressinfo.org

SDI Steel Door Institute
http://www.steeldoor.org

SOI Secretary of the Interior

http://www.cr.nps.gov/local-law/arch_stnds_8_2.htm

IGMA Insulating Glass Manufacturers Alliance
http://www.igmaonline.org

SJI Steel Joist Institute
http://www.steeljoist.org

SMACNA Sheet Metal and Air-Conditioning Contractors National Association, Inc.
http://www.smacna.org

SSPC The Society for Protective Coatings
http://www.sspc.org

STI	Steel Tank Institute http://www.steeltank.com
SWI	Steel Window Institute http://www.steelwindows.com
TCA	Tile Council of America, Inc. http://www.tileusa.com
TEMA	Tubular Exchange Manufacturers Association http://www.tema.org
TPI	Truss Plate Institute, Inc. 583 D'Onofrio Drive; Suite 200 Madison, WI 53719 (608) 833-5900
UBC	The Uniform Building Code See ICBO
UL	Underwriters' Laboratories Incorporated http://www.ul.com
ULC	Underwriters' Laboratories of Canada http://www.ulc.ca
WCLIB	West Coast Lumber Inspection Bureau 6980 SW Varns Road, P.O. Box 23145 Portland, OR 97223 (503) 639-0651
WRCLA	Western Red Cedar Lumber Association P.O. Box 120786 New Brighton, MN 55112 (612) 633-4334
WWPA	Western Wood Products Association http://www.wwpa.org

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SECTION 01 45 00
QUALITY CONTROL

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies requirements for Contractor Quality Control (CQC) for Design-Bid-Build (DBB) construction projects.

1.2 APPLICABLE PUBLICATIONS

A. The publication 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.

B. ASTM International (ASTM)

1. D3740 - (2012a) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
2. E329 - (2014a) Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction

1.3 SUBMITTALS

Government approval is required for all submittals. CQC inspection reports shall be submitted under this Specification section and follow the [Applicable CQC Control Phase (Preparatory, Initial, or Follow-Up)]: [Applicable Specification section] naming convention.

1. Preconstruction Submittals
   a. CQC Plan
2. Test Reports
   a. Verification Statement

PART 2 PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

Establish and maintain an effective quality control (QC) system. that complies with the FAR Clause 52.246.12 titled "Inspection of Construction". QC consists of plans, procedures, and organization necessary to produce an end product which complies with the Contract requirements. The QC system covers all construction operations, both onsite and offsite, and be keyed to the proposed construction sequence.

The project superintendent will be held responsible for the quality of work and is subject to removal by the Contracting Office or Authorized designee for non-compliance with the quality requirements specified in the Contract. In this context the highest level manager responsible for the overall construction activities at the site, including quality and production is the project superintendent. The project superintendent maintains a physical presence at the site at all times and is responsible for all construction and related activities at the site, except as otherwise acceptable to the Contracting Officer.

3.2 CQC PLAN:

A. Submit the CQC Plan no later than 30 days after receipt of Notice to Proceed (NTP) proposed to implement the requirements of the FAR Clause 52.246.12 titled "Inspection of Construction". Construction will be permitted to begin only after acceptance of the CQC Plan applicable to the particular feature of work to be started.

B. Content of the CQC Plan: Include, as a minimum, the following to cover all construction operations, both onsite and offsite, including work by subcontractors, , fabricators, suppliers, and purchasing agents:

1. A description of the QC organization, including a chart showing lines of authority and acknowledgement that the CQC staff will implement the three phase control system for all aspects of the work specified. Include a CQC System Manager that reports to the project superintendent.
2. The name, qualifications (in resume format) duties, responsibilities, and authorities of each person assigned a CQC function.
3. A copy of the letter to the CQC System Manager signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop work which is not in compliance with the Contract. Letters of direction to all other various quality control representatives outlining duties, authorities, and responsibilities will be issued by the CQC System Manager. Furnish copies of these letters to the Contracting Officer or Authorized designee.
4. Procedures for scheduling, reviewing, certifying, and managing submittals including those of subcontractors, designers of record,

consultants, A/E's offsite fabricators, suppliers and purchasing agents. These procedures must be in accordance with Section 01 33 23 Shop Drawings, Product Data, and Samples.

5. Control, verification, and acceptance of testing procedures for each specific test to include the test name, specification paragraph requiring test, feature of work to be tested, test frequency, and person responsible for each test. (Laboratory facilities approved by the Contracting Officer or Authorized designee are required to be used)
6. Procedures for tracking Preparatory, Initial, and Follow-Up control phases and control, verification, and acceptance tests including documentation.
7. Procedures for tracking construction deficiencies from identification through acceptable corrective action. Establish verification procedures that identified deficiencies have been corrected.
8. Reporting procedures, including proposed reporting formats.
9. A list of the definable features of work. A definable feature of work is a task which is separate and distinct from other tasks has separate control requirements, and is identified by different trades or disciplines, or it is work by the same trade in a different environment. Although each section of specifications can generally be considered as a definable feature of work, there are frequently more than one definable feature under a particular section. This list will be agreed upon during the Coordination meeting.
10. Coordinate schedule work with Special Inspections required by Section 01 45 35 Special Inspections, the Statement of Special Inspections and Schedule of Special Inspections. Where the applicable Code issue by the International Code Council (ICC) calls for inspections by the Building Official, the Contractor must include the inspections in the CQC Plan and must perform the inspections required by the applicable ICC. The Contractor must perform these inspections using independent qualified inspectors. Include the Special Inspection Plan requirements in the CQC Plan.

C. Acceptance of Plan: Acceptance of the Contractor's plan is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. The

Government reserves the right to require the Contractor to make changes in the CQC Plan and operations including removal of personnel as necessary, to obtain the quality specified.

D. Notification of Changes: After acceptance of the CQC Plan, notify the Contracting Officer or Authorized designee in writing of any proposed change. Proposed changes are subject to acceptance by the Government prior to implementation by the Contractor.

1.3 COORDINATION MEETING:

After the Preconstruction Conference Post-award Conference before start of construction, and prior to acceptance by the Government of the CQC Plan, meet with the Contracting Officer or Authorized designee to discuss the Contractor's quality control system. Submit the CQC Plan a minimum of 2 business days prior to the Coordination Meeting. During the meeting, a mutual understanding of the system details must be developed, including the forms for recording the CC 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 Government, signed by both the Contractor and Contracting Officer or Authorized designee and will become a part of the contract file. There can be 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.

1.4 QUALITY CONTROL ORGANIZATION:

A. Personnel Requirements: The requirements for the CQC organization are a Safety and Health Manager, CQC System Manager, and sufficient number of additional qualified personnel to ensure safety and Contract compliance. The Safety and Health Manager shall satisfy the requirements of Specification 01 35 26 Safety Requirements and reports directly to a senior project (or corporate) official independent from the CQC System Manager. The Safety and Health Manager 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 will also be included as part of the CQC organization. The Contractor's CQC staff maintains a presence at the site at all times 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 or Authorized designee. 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 drawings submittals, schedules and all other project documentation to the CQC organization. The CQC organization is responsible to maintain these documents and records at the site at all times, except as otherwise acceptable to the Government.

B. CQC System Manager: Identify as CQC System Manager an individual within the onsite work organization that is responsible for overall management of CQC and has the authority to act in all CQC matters for the Contractor. The CQC system Manager is required to be a construction person with a minimum of 10 years in related work. This CQC System manager is on the site at all times during construction and is employed by the General Contractor. The CQC System Manger is assigned as CQC System Manager but can have duties as project superintendent in addition to quality control. Identify in the plan an alternate to serve in the event of the CQC System Manager’s absence. The requirements for the alternate are the same as the CQC System Manager.

C. CQC Personnel: In addition to CQC personnel specified elsewhere in the contract, provide as part of the CQC organization specialized personnel to assist in the CQC System Manager for the following areas, as applicable: electrical, mechanical, civil, structural, environmental, materials technician submittals clerk, Commissioning Agent, and low voltage systems. These individuals or specified technical companies are employees of the prime or subcontractor; be responsible to the CQC System Manager; be physically present at the construction site during work on the specialized personnel’s areas of responsibility; have the necessary education or experience in accordance with the Experience Matrix listed herein. These individuals can perform other duties but need to be allowed sufficient time to perform the specialized personnel’s assigned quality controls duties as described in the CQC Plan. A single person can cover more than one area provided that the single person is qualified to perform QC activities in each designated and that workload allows.

EXPERIENCE MATRIX

Area	Qualifications
Civil	Graduate Civil Engineer or Construction Manager with 2 years experience in the type of work being performed on this project or technician with 5 years related experience.
Mechanical	Graduate Mechanical Engineer with 2 years experience or construction professional with 5 years of experience supervising mechanical features of work in the field with a construction company.
Electrical	Graduate Electrical Engineer with 2 years related experience or construction professional with 5 years of experience supervising electrical features of work in the field with a construction company.
Structural	Graduate Civil Engineer (with Structural Track or Focus), Structural Engineer, or Construction Manager with 2 years experience or construction professional with 5 years experience supervising structural features of work in the field with a construction company.
Environmental	Graduate Environmental Engineer with 3 years experience.
Submittals	Submittal Clerk with 1 year experience.
Concrete, Pavement, and Soils	Materials Technician with 2 years experience for the appropriate area.
Testing, Adjusting, and Balancing (TAB)	Specialist must be a member of AABC or an experienced technicaion of the firm certified by the NEBB.

D. Additional Requirements: In addition to the above experience and education requirements, the CQC System Manager and Alternate CQC System Manager are required to have completed the Construction Quality Management (CQM) for Construction course. If the CQC System Manager does not have a current specification, obtain the CQM for Contractors course identification within 90 days of award. This course is periodically offered by the Naval Facilities Engineering Command and the Army Corps of Engineers. Contact the Contracting Officer or Authorized designee for information on the next scheduled class.

E. Organizational Changes: Maintain the CQC staff at full strength at all times. When it is necessary to make changes to the CQC staff, revise the CQC Plan to reflect the changes and submit the changes to the Contracting Officer or Authorized designee for acceptance.

1.5 **SUBMITTALS AND DELIVERABLES:** Submittals have to comply with the requirements in Section 01 33 23 Shop Drawings, Product Data, and Samples. The CQC organization is responsible for certifying that all submittals and deliverables are in compliance with the contract requirements. When Section 01 91 00 General Commissioning Requirements is included in the contract, the submittals required by the section have to be coordinated with the Section 01 33 23 Shop Drawings, Product Data, and Samples to ensure adequate time is allowed for each type of submittal required.

1.6 CONTROL:

A. CQC is the means by which the Contractor ensures that the construction, to include that of subcontractors and suppliers, complies with the requirements of the contract. At least three phases of control are required to be conducted by the CQC System Manager for each definable feature of the construction work as follows:

1. Preparatory Phase: 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. This phase includes:
   a. A review of each paragraph of applicable specifications, references codes, and standards. Make available during the preparatory 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 of the Contract drawings.
   c. Check to assure that all materials and equipment have been tested, submitted, and approved.
   d. Review of provisions that have been made to provide required control inspection and testing.

e. Review Special Inspections required by Section 01 45 35 Special Inspections, that Statement of Special Inspections and the Schedule of Specials Inspections.

f. Examination of the work area to assure that all required preliminary work has been completed and is in compliance with the Contract.

g. Examination of required materials, equipment, and sample work to assure that they are on hand conform to approved shop drawings or submitted data, and are properly stored.

h. Review of the appropriate Activity Hazard Analysis (AHA) to assure safety requirements are met.

i. Discussion of procedures for controlling quality of the work including repetitive deficiencies. Document construction tolerances and workmanship standards – contract defined or industry standard if not contract defined - for that feature of work.

j. Check to ensure that the portion of the plan for the work to be performed has been accepted by the Contracting Officer.

k. Discussion of the initial control phase.

l. The Government needs to be notified at least 48 hours or 2 business days in advance of beginning the Preparatory control phase. Include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. Document the results of the Preparatory phase actions by separate minutes prepared by the CQC System Manager and attach to the daily CQC report. Instruct applicable workers as to the acceptable level of workmanship required in order to meet contract specifications.

B. Initial Phase: This phase is accomplished at the beginning of a definable feature of work. Accomplish the following:

1. Check work to ensure that it is in full compliance with contract requirements. Review minutes of the Preparatory meeting.

2. Verify adequacy of controls to ensure full contract compliance. Verify the required control inspection and testing is in compliance with the contract.

3. Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Compare with required sample panels as appropriate.
4. Resolve all differences.
5. Check safety to include compliance with an upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
6. The Government needs to be notified at least 48 hours or 2 business days in advance of beginning the initial phase for definable features of work. Prepare separate minutes of this phase by the CQC System Manager and attach to the daily CQC report. Indicate the exact location of initial phase for definable feature of work for future reference and comparison with Follow-Up phases.
7. The initial phase for each definable feature of work is repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.
8. Coordinate scheduled work with Special Inspections required by Section 01 45 35 Special Inspections, the Statement of Special Inspections, and the Schedule of Special Inspections.

C. Follow-Up Phase: Perform daily checks to assure control activities, including control testing, are providing continued compliance with contract requirements until the completion of the particular feature of work. Record the checks in the CQC documentation. 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. Do not build upon nor conceal non-conforming work. Coordinate scheduled work with Special Inspections required by Section 01 45 35 Special Inspections, the Statement of Special Inspections, and the Schedule of Special Inspections

D. Additional Preparatory and Initial Phases on the same definable features of work if: the quality ongoing work is unacceptable; if there are changes in the applicable CQC staff, onsite production supervision or work crew; if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

1.7 TESTS

A. Testing Procedure: 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 test when specified. Procure the services of a Department of Veteran Affairs approved testing laboratory or establish an approved testing laboratory at the project site. Perform the following activities and record and provide the following data:

1. Verify that testing procedures comply with contract requirements.
2. Verify that facilities and testing equipment are available and comply with testing standards.
3. Check test instrument calibration data against certified standards.
4. Verify that recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
5. 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 unique sequential control number identifying the test. If approved by the Contracting Officer or Authorized designee, 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 or Authorized designee. Failure to submit timely test reports as stated results in nonpayment for related work performed and disapproval of the test facility for this Contract.

B. Testing Laboratories: All testing laboratories must be validated through the procedures contained in Specification section 01 45 29 Testing Laboratory Services.

1. Capability Check: The Government reserves the right to check laboratory equipment in the proposed laboratory for compliance with the standards set forth in the contract specifications and to check the laboratory technician’s testing procedures and techniques. Laboratories utilized for testing soils, concrete, asphalt and steel is required to meet criteria detailed in ASTM D3740 and ASTM E329.
2. Capability Recheck: If the selected laboratory fails the capability check, the Contractor will be assessed a charge equal to value 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.

C. 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.

1.8 COMPLETION INSPECTION

A. Punch-Out Inspection: Conduct an inspection of the work by the CQC system Manager near the end of the work, or any increment of the work established by the specifications. Prepare and include in the CQC documentation a punch list of items which do not conform to the approved drawings and specifications. Include within the list of deficiencies the estimated date by which the deficiencies will be corrected. Make a second inspection the CQC System Manager or staff to ascertain that all deficiencies have been corrected. Once this is accomplished, notify the Government that the facility is ready for the Government Pre-Final Inspection.

B. Pre-Final Inspection: The Government will perform the Pre-Final Inspection to verify that the facility is complete and ready to be occupied. A Government Pre-Final Punch List may be developed as a result of this inspection. Ensure that all items on this list have been corrected before notifying the Government, so that a Final Acceptance Inspection with the customer can be scheduled. Correct any items noted on the Pre-Final Inspection in a timely manner. These inspections and any deficiency corrections required by this paragraph need to be accomplished within the time slated for completion of the entire work or any particular increment of the work if the project is divided into increments by separate construction completion dates.

C. Final Acceptance Inspection: The Contractor's QC Inspection personnel, plus the superintendent or other primary management person, and the Contracting Officer's Authorized designee is required to be in attendance at the Final Acceptance Inspection. Additional Government personnel can also be in attendance. The Final Acceptance Inspection will be formally scheduled by the Contracting Officer's or Authorized designee based upon results of the Pre-Final Inspection. Notify the Contracting Officer through the COR's office at least 14 days prior to

the Final Acceptance Inspection and include the Contractor's assurance that all specific items previously identified to the Contractor as being unacceptable, along with all remaining work performed under the contract, will be complete and acceptable by the date schedule for the Final Acceptance Inspection. 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 FAR Clause 52.246-12 titled "Inspection of Construction".

1.9 DOCUMENTATION

A. Quality Control Activities: Maintain current records providing factual evidence that required QC 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:

1. The name and area of responsibility of the Contractor/Subcontractor
2. Operating plant/equipment with hours worked, idle, or down for repair.
3. Work performed each day, giving location, description, and by whom. When Network Analysis (NAS) is used, identify each phase of work performed each day by NAS activity number.
4. Test and control activities performed with results and references to specification/drawing requirements. Identify the Control Phase (Preparatory, Initial, and/or Follow-Up). List deficiencies noted, along with corrective action.
5. Quantity of materials received at the site with statement as to acceptability, storage, and reference to specification/drawing requirements.
6. Submittals and deliverables reviewed, with Contract reference, by whom, and action taken.
7. Offsite surveillance activities, including actions taken.
8. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
9. Instructions given/received and conflicts in plans and specifications.
10. Provide documentation of quality control activities. For independent reviews, provide, as a minimum, identification of the Independent

Technical Reviewer (ITR) team, the ITR review comments, responses, and the record of resolution of the comments.

B. 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 daily with 1 week after the date covered by the report, except that reports need not be submitted for days on which no work is performed. As a minimum, prepare and submit on 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 CQC System Manager. Include copies of test reports and copies of reports prepared by all subordinate QC personnel within the CQC System Manager Report.

1.10 SAMPLE FORMS

Templates of various quality control reports can be found on the Whole Building Design Guide website at https://www.wbdg.org/FFC/NAVGRAPH/01%2045%2000.00%2020_quality_control_reports.pdf

1.11 **NOTIFICATION OF NONCOMPLIANCE:** The Contracting Officer or Authorized designee will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor should take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor at the work site will be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Contracting Officer can 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 claim for extension of time or for excess costs or damages by the Contractor.

- - -- END - - -

SECTION 01 45 29
TESTING LABORATORY SERVICES

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies materials testing activities and inspection services required during project construction to be provided by a Testing Laboratory retained by the General Contractor.

1.2 APPLICABLE PUBLICATIONS:

A. 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.

B. American Association of State Highway and Transportation Officials (AASHTO):

T27-11.....Standard Method of Test for Sieve Analysis of Fine and Coarse Aggregates

T96-02 (R2006).....Standard Method of Test for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

T99-10.....Standard Method of Test for Moisture-Density Relations of Soils Using a 2.5 Kg (5.5 lb.) Rammer and a 305 mm (12 in.) Drop

T104-99 (R2007).....Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate

T180-10.....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

T191-02(R2006).....Standard Method of Test for Density of Soil In-Place by the Sand-Cone Method

T310-13.....Standard Method of Test for In-place Density and Moisture Content of Soil and Soil-aggregate by Nuclear Methods (Shallow Depth)

C. American Concrete Institute (ACI):

506.4R-94 (R2004).....Guide for the Evaluation of Shotcrete

D. American Society for Testing and Materials (ASTM):

A370-12.....Standard Test Methods and Definitions for Mechanical Testing of Steel Products

A416/A416M-10.....Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete

C31/C31M-10.....Standard Practice for Making and Curing Concrete Test Specimens in the Field

C33/C33M-11a.....Standard Specification for Concrete Aggregates

C39/C39M-12.....Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens

C109/C109M-11b.....Standard Test Method for Compressive Strength of Hydraulic Cement Mortars

C136-06.....Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates

C138/C138M-10b.....Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete

C140-12.....Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units

C143/C143M-10a.....Standard Test Method for Slump of Hydraulic Cement Concrete

C172/C172M-10.....Standard Practice for Sampling Freshly Mixed Concrete

C173/C173M-10b.....Standard Test Method for Air Content of freshly Mixed Concrete by the Volumetric Method

C330/C330M-09.....Standard Specification for Lightweight Aggregates for Structural Concrete

C567/C567M-11.....Standard Test Method for Density Structural Lightweight Concrete

C780-11.....Standard Test Method for Pre-construction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry

C1019-11.....Standard Test Method for Sampling and Testing Grout

C1064/C1064M-11.....Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete

C1077-11c.....Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation

C1314-11a.....Standard Test Method for Compressive Strength of Masonry Prisms

D422-63(2007).....Standard Test Method for Particle-Size Analysis of Soils

D698-07e1.....Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort

D1140-00(2006).....Standard Test Methods for Amount of Material in Soils Finer than No. 200 Sieve

D1143/D1143M-07e1.....Standard Test Methods for Deep Foundations Under Static Axial Compressive Load

D1188-07e1.....Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples

D1556-07.....Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

D1557-09.....Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000ft lbf/ft3 (2,700 KNm/m3))

D2166-06.....Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

D2167-08).....Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method

D2216-10.....Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

D2974-07a.....Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils

D3666-11.....Standard Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials

D3740-11.....Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection

of Soil and Rock as used in Engineering Design and Construction

D6938-10.....Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

E94-04(2010).....Standard Guide for Radiographic Examination

E164-08.....Standard Practice for Contact Ultrasonic Testing of Weldments

E329-11c.....Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection

E543-09.....Standard Specification for Agencies Performing Non-Destructive Testing

E605-93(R2011).....Standard Test Methods for Thickness and Density of Sprayed Fire Resistive Material (SFRM) Applied to Structural Members

E709-08.....Standard Guide for Magnetic Particle Examination

E1155-96(R2008).....Determining FF Floor Flatness and FL Floor Levelness Numbers

F3125/F3125M-15.....Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions

E. American Welding Society (AWS):

D1.D1.1M-10.....Structural Welding Code-Steel

1.3 REQUIREMENTS:

A. Accreditation Requirements: Construction materials testing laboratories must be accredited by a laboratory accreditation authority and will be required to submit a copy of the Certificate of Accreditation and Scope of Accreditation. The laboratory’s scope of accreditation must include the appropriate ASTM standards (i.e.; E329, C1077, D3666, D3740, A880, E543) listed in the technical sections of the specifications. Laboratories engaged in Hazardous Materials Testing shall meet the requirements of OSHA and EPA. The policy applies to the specific

laboratory performing the actual testing, not just the "Corporate Office."

B. Inspection and Testing: Testing laboratory shall inspect materials and workmanship and perform tests described herein and additional tests requested by COR. When it appears materials furnished, or work performed by Contractor fail to meet construction contract requirements, Testing Laboratory shall direct attention of COR to such failure.

C. Written Reports: Testing laboratory shall submit test reports to COR, Contractor, unless other arrangements are agreed to in writing by the COR. Submit reports of tests that fail to meet construction contract requirements on colored paper.

D. Verbal Reports: Give verbal notification to COR immediately of any irregularity.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EARTHWORK:

A. General: The Testing Laboratory shall provide qualified personnel, materials, equipment, and transportation as required to perform the services identified/required herein, within the agreed to schedule and/or time frame. The work to be performed shall be as identified herein and shall include but not be limited to the following:

1. Observe fill and subgrades during proof-rolling to evaluate suitability of surface material to receive fill or base course. Provide recommendations to the COR regarding suitability or unsuitability of areas where proof-rolling was observed. Where unsuitable results are observed, witness excavation of unsuitable material and recommend to COR extent of removal and replacement of unsuitable materials and observe proof-rolling of replaced areas until satisfactory results are obtained.
2. Provide part time observation of fill placement and compaction and field density testing in building areas and provide part time observation of fill placement and compaction and field density testing in pavement areas to verify that earthwork compaction obtained is in accordance with contract documents.
3. Provide supervised geotechnical technician to inspect excavation, subsurface preparation, and backfill for structural fill.

B. Testing Compaction:
   1. Determine maximum density and optimum moisture content for each type of fill, backfill and subgrade material used, in compliance with AASHTO T99/T180 Method A.
   2. Make field density tests in accordance with the primary testing method following AASHTO T310 wherever possible. Field density tests utilizing AASHTO T191, or ASTM D2167 shall be utilized on a case by case basis only if there are problems with the validity of the results from the primary method due to specific site field conditions. Should the testing laboratory propose these alternative methods, they should provide satisfactory explanation to the COR before the tests are conducted.
C. Testing for Footing Bearing Capacity: Evaluate if suitable bearing capacity material is encountered in footing subgrade.
D. Testing Materials: Test suitability of on-site and off-site borrow as directed by COR.

3.2 LANDSCAPING:

A. Test topsoil for organic materials, pH, phosphate, potash content, and gradation of particles.
   1. Test for organic material by using ASTM D2974.
   2. Determine percent of silt, sand, clay, and foreign materials such as rock, roots, and vegetation.
B. Submit laboratory test report of topsoil to COR.

3.3 SITE WORK CONCRETE:

Test site work concrete including materials for concrete as required in Article CONCRETE of this section.

3.4 CONCRETE:

A. Batch Plant Inspection and Materials Testing:
   1. Perform continuous batch plant inspection until concrete quality is established to satisfaction of COR with concurrence of Contracting Officer and perform periodic inspections thereafter as determined by COR.
   2. Periodically inspect and test batch proportioning equipment for accuracy and report deficiencies to COR.

3. Sample and test mix ingredients as necessary to ensure compliance with specifications.
4. Sample and test aggregates daily and as necessary for moisture content. Test the dry rodded weight of the coarse aggregate whenever a sieve analysis is made, and when it appears there has been a change in the aggregate.
5. Certify, in duplicate, ingredients and proportions and amounts of ingredients in concrete conform to approved trial mixes. When concrete is batched or mixed off immediate building site, certify (by signing, initialing or stamping thereon) on delivery slips (duplicate) that ingredients in truck-load mixes conform to proportions of aggregate weight, cement factor, and water-cement ratio of approved trial mixes.

B. Field Inspection and Materials Testing:
1. Provide a technician at site of placement at all times to perform concrete sampling and testing.
2. Review the delivery tickets of the ready-mix concrete trucks arriving on-site. Notify the Contractor if the concrete cannot be placed within the specified time limits or if the type of concrete delivered is incorrect. Reject any loads that do not comply with the Specification requirements. Rejected loads are to be removed from the site at the Contractor’s expense. Any rejected concrete that is placed will be subject to removal.
3. Take concrete samples at point of placement in accordance with ASTM C172. Mold and cure compression test cylinders in accordance with ASTM C31. Make at least three cylinders for each 40 m^3 (50 cubic yards) or less of each concrete type, and at least three cylinders for any one day's pour for each concrete type. Label each cylinder with an identification number. COR may require additional cylinders to be molded and cured under job conditions.
4. Perform slump tests in accordance with ASTM C143. Test the first truck each day, and every time test cylinders are made. Test pumped concrete at the hopper and at the discharge end of the hose at the beginning of each day’s pumping operations to determine change in slump.
5. Determine the air content of concrete per ASTM C173. For concrete required to be air-entrained, test the first truck and every 20 m^3

(25 cubic yards) thereafter each day. For concrete not required to be air-entrained, test every 80 m^3 (100 cubic yards) at random. For pumped concrete, initially test concrete at both the hopper and the discharge end of the hose to determine change in air content.

6. If slump or air content fall outside specified limits, make another test immediately from another portion of same batch.
7. Perform unit weight tests in compliance with ASTM C138 for normal weight concrete and ASTM C567 for lightweight concrete. Test the first truck and each time cylinders are made.
8. Notify laboratory technician at batch plant of mix irregularities and request materials and proportioning check.
9. Verify that specified mixing has been accomplished.
10. Environmental Conditions: Determine the temperature per ASTM C1064 for each truckload of concrete during hot weather and cold weather concreting operations:
    a. When ambient air temperature falls below 4.4 degrees C (40 degrees F), record maximum and minimum air temperatures in each 24 hour period; record air temperature inside protective enclosure; record minimum temperature of surface of hardened concrete.
    b. When ambient air temperature rises above 29.4 degrees C (85 degrees F), record maximum and minimum air temperature in each 24 hour period; record minimum relative humidity; record maximum wind velocity; record maximum temperature of surface of hardened concrete.
11. Inspect the reinforcing steel placement, including bar size, bar spacing, top and bottom concrete cover, proper tie into the chairs, and grade of steel prior to concrete placement. Submit detailed report of observations.
12. Observe conveying, placement, and consolidation of concrete for conformance to specifications.
13. Observe condition of formed surfaces upon removal of formwork prior to repair of surface defects and observe repair of surface defects.
14. Observe curing procedures for conformance with specifications, record dates of concrete placement, start of preliminary curing, start of final curing, end of curing period.
15. Observe preparations for placement of concrete:

a. Inspect handling, conveying, and placing equipment, inspect vibrating and compaction equipment.
b. Inspect preparation of construction, expansion, and isolation joints.

16. Observe preparations for protection from hot weather, cold weather, sun, and rain, and preparations for curing.
17. Observe concrete mixing:
    a. Monitor and record amount of water added at project site.
    b. Observe minimum and maximum mixing times.
18. Measure concrete flatwork for levelness and flatness as follows:
    a. Perform Floor Tolerance Measurements F_F and F_L in accordance with ASTM E1155. Calculate the actual overall F- numbers using the inferior/superior area method.
    b. Perform all floor tolerance measurements within 48 hours after slab installation and prior to removal of shoring and formwork.
    c. Provide the Contractor and the COR with the results of all profile tests, including a running tabulation of the overall F_F and F_L values for all slabs installed to date, within 72 hours after each slab installation.
19. Other inspections:
    a. Grouting under base plates.
    b. Grouting anchor bolts and reinforcing steel in hardened concrete.

C. Laboratory Tests of Field Samples:

1. Test compression test cylinders for strength in accordance with ASTM C39. For each test series, test one cylinder at 7 days and one cylinder at 28 days. Use remaining cylinder as a spare tested as directed by COR. Compile laboratory test reports as follows: Compressive strength test shall be result of one cylinder, except when one cylinder shows evidence of improper sampling, molding or testing, in which case it shall be discarded and strength of spare cylinder shall be used.
2. Make weight tests of hardened lightweight structural concrete in accordance with ASTM C567.
3. Furnish certified compression test reports (duplicate) to COR. In test report, indicate the following information:
    a. Cylinder identification number and date cast.
    b. Specific location at which test samples were taken.

c. Type of concrete, slump, and percent air.

d. Compressive strength of concrete in MPa (psi).

e. Weight of lightweight structural concrete in kg/m^3 (pounds per cubic feet).

f. Weather conditions during placing.

g. Temperature of concrete in each test cylinder when test cylinder was molded.

h. Maximum and minimum ambient temperature during placing.

i. Ambient temperature when concrete sample in test cylinder was taken.

j. Date delivered to laboratory and date tested.

3.5 REINFORCEMENT:

A. Review mill test reports furnished by Contractor.

B. Make one tensile and one bend test in accordance with ASTM A370 from each pair of samples obtained.

C. Written report shall include, in addition to test results, heat number, manufacturer, type and grade of steel, and bar size.

D. Perform tension tests of mechanical and welded splices in accordance with ASTM A370.

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SECTION 01 57 19
TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the control of environmental pollution and damage that the Contractor must consider for air, water, and land resources. It includes management of visual aesthetics, noise, solid waste, radiant energy, and radioactive materials, as well as other pollutants and resources encountered or generated by the Contractor. The Contractor is obligated to consider specified control measures with the costs included within the various contract items of work.

B. Environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents which:
   1. Adversely effect human health or welfare,
   2. Unfavorably alter ecological balances of importance to human life,
   3. Effect other species of importance to humankind, or;
   4. Degrade the utility of the environment for aesthetic, cultural, and historical purposes.

C. Definitions of Pollutants:
   1. Chemical Waste: Petroleum products, bituminous materials, salts, acids, alkalis, herbicides, pesticides, organic chemicals, and inorganic wastes.
   2. Debris: Combustible and noncombustible wastes, such as leaves, tree trimmings, ashes, and waste materials resulting from construction or maintenance and repair work.
   3. Sediment: Soil and other debris that has been eroded and transported by runoff water.
   4. Solid Waste: Rubbish, debris, garbage, and other discarded solid materials resulting from industrial, commercial, and agricultural operations and from community activities.
   5. Surface Discharge: The term "Surface Discharge" implies that the water is discharged with possible sheeting action and subsequent soil erosion may occur. Waters that are surface discharged may terminate in drainage ditches, storm sewers, creeks, and/or "water of the United States" and would require a permit to discharge water from the governing agency.

6. Rubbish: Combustible and noncombustible wastes such as paper, boxes, glass and crockery, metal and lumber scrap, tin cans, and bones.
7. Sanitary Wastes:
   a. Sewage: Domestic sanitary sewage and human and animal waste.
   b. Garbage: Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.2 QUALITY CONTROL

A. Establish and maintain quality control for the environmental protection of all items set forth herein.

B. Record on daily reports any problems in complying with laws, regulations, and ordinances. Note any corrective action taken.

1.3 REFERENCES

A. 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.

B. U.S. National Archives and Records Administration (NARA):
33 CFR 328.....Definitions

1.4 SUBMITTALS

A. In accordance with Section, 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:
   1. Environmental Protection Plan: After the contract is awarded and prior to the commencement of the work, the Contractor shall meet with the Contracting Officer’s Representative (COR) to discuss the proposed Environmental Protection Plan and to develop mutual understanding relative to details of environmental protection. Not more than 20 days after the meeting, the Contractor shall prepare and submit to the COR for approval, a written and/or graphic Environmental Protection Plan including, but not limited to, the following:
      a. Name(s) of person(s) within the Contractor's organization who is (are) responsible for ensuring adherence to the Environmental Protection Plan.
      b. Name(s) and qualifications of person(s) responsible for manifesting hazardous waste to be removed from the site.
      c. Name(s) and qualifications of person(s) responsible for training the Contractor's environmental protection personnel.

d. Description of the Contractor's environmental protection personnel training program.

e. A list of Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control, noise control and abatement that are applicable to the Contractor's proposed operations and the requirements imposed by those laws, regulations, and permits.

f. Methods for protection of features to be preserved within authorized work areas including trees, shrubs, vines, grasses, ground cover, landscape features, air and water quality, fish and wildlife, soil, historical, and archeological and cultural resources.

g. Procedures to provide the environmental protection that comply with the applicable laws and regulations. Describe the procedures to correct pollution of the environment due to accident, natural causes, or failure to follow the procedures as described in the Environmental Protection Plan.

h. Permits, licenses, and the location of the solid waste disposal area.

i. Drawings showing locations of any proposed temporary excavations or embankments for haul roads, stream crossings, material storage areas, structures, sanitary facilities, and stockpiles of excess or spoil materials. Include as part of an Erosion Control Plan approved by the District Office of the U.S. Soil Conservation Service and the Department of Veterans Affairs.

j. Environmental Monitoring Plans for the job site including land, water, air, and noise.

k. Work Area Plan showing the proposed activity in each portion of the area and identifying the areas of limited use or nonuse. Plan should include measures for marking the limits of use areas. This plan may be incorporated within the Erosion Control Plan.

l. Inclusion of “best management practices” and methodologies.

B. Approval of the Contractor's Environmental Protection Plan will not relieve the Contractor of responsibility for adequate and continued control of pollutants and other environmental protection measures.

1.5 PROTECTION OF ENVIRONMENTAL RESOURCES

A. Protect environmental resources within the project boundaries and those affected outside the limits of permanent work during the entire period of this contract. Confine activities to areas defined by the specifications and drawings.

B. Protection of Land Resources: Prior to construction, identify all land resources to be preserved within the work area. Do not remove, cut, deface, injure, or destroy land resources including trees, shrubs, vines, grasses, topsoil, and landforms without permission from the COR. Do not fasten or attach ropes, cables, or guys to trees for anchorage unless specifically authorized, or where special emergency use is permitted. Provide erosion control plans, in phases where required.

1. Work Area Limits: Prior to any construction, mark the areas that require work to be performed under this contract. Mark or fence isolated areas within the general work area that are to be saved and protected. Protect monuments, works of art, and markers before construction operations begin. Convey to all personnel the purpose of marking and protecting all necessary objects.
2. Protection of Landscape: Protect trees, shrubs, vines, grasses, land forms, and other landscape features shown on the drawings to be preserved by marking, fencing, or using any other approved techniques.
   a. Box and protect from damage existing trees and shrubs to remain on the construction site.
   b. Immediately repair all damage to existing trees and shrubs by trimming, cleaning, and painting with antiseptic tree paint.
   c. Do not store building materials or perform construction activities closer to existing trees or shrubs than the farthest extension of their limbs.
3. Reduction of Exposure of Unprotected Erodible Soils: Plan and conduct earthwork to minimize the duration of exposure of unprotected soils. Clear areas in reasonably sized increments only as needed to use. Form earthwork to final grade as shown. Immediately protect side slopes and back slopes upon completion of rough grading.
4. Temporary Protection of Disturbed Areas: Construct diversion ditches, benches, and berms to retard and divert runoff from the

construction site to protected drainage areas approved under paragraph 208 of the Clean Water Act.

a. Sediment Basins: Trap sediment from construction areas in temporary or permanent sediment basins that accommodate the runoff of a local 10-year storm. After each storm, pump the basins dry and remove the accumulated sediment. Control overflow/drainage with paved weirs or by vertical overflow pipes, draining from the surface.

b. Reuse or conserve the collected topsoil sediment as directed by the COR. Topsoil use and requirements are specified in Section 31 20 00, EARTH MOVING.

c. Institute effluent quality monitoring programs as required by Federal, State, and local environmental agencies.

5. Erosion and Sedimentation Control Devices: The erosion and sediment controls selected and maintained by the Contractor shall be such that water quality standards are not violated as a result of the Contractor's activities. Construct or install all temporary and permanent erosion and sedimentation control features. Maintain temporary erosion and sediment control measures such as berms, dikes, drains, sedimentation basins, grassing, and mulching, until permanent drainage and erosion control facilities are completed and operative.

6. Manage borrow areas on and off Government property to minimize erosion and to prevent sediment from entering nearby water courses or lakes.

7. Manage and control spoil areas on and off Government property to limit spoil and prevent erosion of soil or sediment from entering nearby water courses or lakes.

8. Protect adjacent areas from despoilment by temporary excavations and embankments.

9. Handle and dispose of solid wastes in such a manner that will prevent contamination of the environment. Place solid wastes (excluding clearing debris) in containers that are emptied on a regular schedule. Transport all solid waste off Government property and dispose of waste in compliance with Federal, State, and local requirements.

10. Store chemical waste away from the work areas in corrosion resistant containers and dispose of waste in accordance with Federal, State, and local regulations.
11. Handle discarded materials other than those included in the solid waste category as directed by the COR.

C. Protection of Water Resources: Keep construction activities under surveillance, management, and control to avoid pollution of surface and ground waters and sewer systems. Implement management techniques to control water pollution by the listed construction activities that are included in this contract.
   1. Washing and Curing Water: Do not allow wastewater directly derived from construction activities to enter water areas. Collect and place wastewater in retention ponds allowing the suspended material to settle, the pollutants to separate, or the water to evaporate.
   2. Control movement of materials and equipment at stream crossings during construction to prevent violation of water pollution control standards of the Federal, State, or local government.
   3. Monitor water areas affected by construction.

D. Protection of Fish and Wildlife Resources: Keep construction activities under surveillance, management, and control to minimize interference with, disturbance of, or damage to fish and wildlife. Prior to beginning construction operations, list species that require specific attention along with measures for their protection.

E. Protection of Air Resources: Keep construction activities under surveillance, management, and control to minimize pollution of air resources. Burning is not permitted on the job site. Keep activities, equipment, processes, and work operated or performed, in strict accordance with the State of Ohio regulations and Federal emission and performance laws and standards. Maintain ambient air quality standards set by the Environmental Protection Agency, for those construction operations and activities specified.
   1. Particulates: Control dust particles, aerosols, and gaseous by-products from all construction activities, processing, and preparation of materials (such as from asphaltic batch plants) at all times, including weekends, holidays, and hours when work is not in progress.

2. Particulates Control: Maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, spoil areas, borrow areas, and all other work areas within or outside the project boundaries free from particulates which would cause a hazard or a nuisance. Sprinklering, chemical treatment of an approved type, light bituminous treatment, baghouse, scrubbers, electrostatic precipitators, or other methods are permitted to control particulates in the work area.
3. Hydrocarbons and Carbon Monoxide: Control monoxide emissions from equipment to Federal and State allowable limits.
4. Odors: Control odors of construction activities and prevent obnoxious odors from occurring.

F. Reduction of Noise: Minimize noise using every action possible. Perform noise-producing work in less sensitive hours of the day or week as directed by the COR. Maintain noise-produced work at or below the decibel levels and within the time periods specified.

1. Perform construction activities involving repetitive, high-level impact noise only between 8:00 a.m. and 6:00 p.m unless otherwise permitted by local ordinance or the COR. Repetitive impact noise on the property shall not exceed the following dB limitations:

Time Duration of Impact Noise	Sound Level in dB
More than 12 minutes in any hour	70
Less than 30 seconds of any hour	85
Less than three minutes of any hour	80
Less than 12 minutes of any hour	75

2. Provide sound-deadening devices on equipment and take noise abatement measures that are necessary to comply with the requirements of this contract, consisting of, but not limited to, the following:
   a. Maintain maximum permissible construction equipment noise levels at 15 meter (50 feet) (dBA):

EARTHMOVING		MATERIALS HANDLING	
FRONT LOADERS	75	CONCRETE MIXERS	75
BACKHOES	75	CONCRETE PUMPS	75
DOZERS	75	CRANES	75
TRACTORS	75	DERRICKS IMPACT	75

SCAPERS	80	PILE DRIVERS	95
GRADERS	75	JACK HAMMERS	75
TRUCKS	75	ROCK DRILLS	80
PAVERS, STATIONARY	80	PNEUMATIC TOOLS	80
PUMPS	75		
GENERATORS	75	SAWS	75
COMPRESSORS	75	VIBRATORS	75

b. Use shields or other physical barriers to restrict noise transmission.
c. Provide soundproof housings or enclosures for noise-producing machinery.
d. Use efficient silencers on equipment air intakes.
e. Use efficient intake and exhaust mufflers on internal combustion engines that are maintained so equipment performs below noise levels specified.
f. Line hoppers and storage bins with sound deadening material.
g. Conduct truck loading, unloading, and hauling operations so that noise is kept to a minimum.

3. Measure sound level for noise exposure due to the construction at least once every five successive working days while work is being performed above 60dB(A) noise level. Measure noise exposure at the property line or 15 m (50 feet) from the noise source, whichever is greater. Measure the sound levels on the A weighing network of a General Purpose sound level meter at slow response. To minimize the effect of reflective sound waves at buildings, take measurements at 900 to 1800 mm (three to six feet) in front of any building face. Submit the recorded information to the COR noting any problems and the alternatives for mitigating actions.

G. Restoration of Damaged Property: If any direct or indirect damage is done to public or private property resulting from any act, omission, neglect, or misconduct, the Contractor shall restore the damaged property to a condition equal to that existing before the damage at no additional cost to the Government. Repair, rebuild, or restore property as directed or make good such damage in an acceptable manner.

H. Final Clean-up: On completion of project and after removal of all debris, rubbish, and temporary construction, Contractor shall leave the

construction area in a clean condition satisfactory to the COR. Cleaning shall include off the station disposal of all items and materials not required to be salvaged, as well as all debris and rubbish resulting from demolition and new work operations.

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SECTION 01 58 16
TEMPORARY INTERIOR SIGNAGE

PART 1 GENERAL

DESCRIPTION

This section specifies temporary interior signs.

PART 2 PRODUCTS

2.1 TEMPORARY SIGNS

A. Fabricate from 50 Kg (110 pound) mat finish white paper.

B. Cut to 100 mm (4-inch) wide by 300 mm (12 inch) long size tag.

C. Punch 3 mm (1/8-inch) diameter hole centered on 100 mm (4-inch) dimension of tag. Edge of Hole spaced approximately 13 mm (1/2-inch) from one end on tag.

D. Reinforce hole on both sides with gummed cloth washer or other suitable material capable of preventing tie pulling through paper edge.

E. Ties: Steel wire 0.3 mm (0.0120-inch) thick, attach to tag with twist tie, leaving 150 mm (6-inch) long free ends.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install temporary signs attached to room door frame or room door knob, lever, or pull for doors on corridor openings.

B. Mark on signs with felt tip marker having approximately 3 mm (1/8-inch) wide stroke for clearly legible numbers or letters.

C. Identify room with numbers as designated on floor plans.

3.2 LOCATION

A. Install on doors that have room, corridor, and space numbers shown.

B. Doors that do not require signs are as follows:

1. Corridor barrier doors (cross-corridor) in corridor with same number.
2. Folding doors or partitions.
3. Toilet or bathroom doors within and between rooms.
4. Communicating doors in partitions between rooms with corridor entrance doors.
5. Closet doors within rooms.

C. Replace missing, damaged, or illegible signs.

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SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT

PART 1 – GENERAL

1.1 DESCRIPTION

A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.

B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.

C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:

1. Waste Management Plan development and implementation.
2. Techniques to minimize waste generation.
3. Sorting and separating of waste materials.
4. Salvage of existing materials and items for reuse or resale.
5. Recycling of materials that cannot be reused or sold.

D. At a minimum the following waste categories shall be diverted from landfills:

1. Soil.
2. Inerts (eg, concrete, masonry and asphalt).
3. Clean dimensional wood and palette wood.
4. Green waste (biodegradable landscaping materials).
5. Engineered wood products (plywood, particle board and I-joists, etc).
6. Metal products (eg, steel, wire, beverage containers, copper, etc).
7. Cardboard, paper and packaging.
8. Bitumen roofing materials.
9. Plastics (eg, ABS, PVC).
10. Carpet and/or pad.
11. Gypsum board.
12. Insulation.
13. Paint.
14. Fluorescent lamps.

1.2 RELATED WORK

A. Section 02 41 00, DEMOLITION.

B. Section 01 00 00, GENERAL REQUIREMENTS.

1.3 QUALITY ASSURANCE

A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction /Demolition waste includes products of the following:
   1. Excess or unusable construction materials.
   2. Packaging used for construction products.
   3. Poor planning and/or layout.
   4. Construction error.
   5. Over ordering.
   6. Weather damage.
   7. Contamination.
   8. Mishandling.
   9. Breakage.

B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.

C. Contractor shall develop and implement procedures to recycle construction and demolition waste to a minimum of 50 percent.

D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.

E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website http://www.wbdg.org/tools/cwm.php provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.

F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas shall be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.

G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.

H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

1.4 TERMINOLOGY

A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.

B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.

C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.

D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.

E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).

F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.

G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.

H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.

I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.

J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.

K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.

L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.

1. On-site Recycling – Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.
2. Off-site Recycling – Materials hauled to a location and used in an altered form in the manufacture of new products.

M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.

N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.

O. Return: To give back reusable items or unused products to vendors for credit.

P. Salvage: To remove waste materials from the site for resale or re-use by a third party.

Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.

R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.

S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

1.5 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES, furnish the following:

B. Prepare and submit to the COR a written demolition debris management plan. The plan shall include, but not be limited to, the following information:
   1. Procedures to be used for debris management.
   2. Techniques to be used to minimize waste generation.
   3. Analysis of the estimated job site waste to be generated:
      a. List of each material and quantity to be salvaged, reused, recycled.
      b. List of each material and quantity proposed to be taken to a landfill.
   4. Detailed description of the Means/Methods to be used for material handling.
      a. On site: Material separation, storage, protection where applicable.
      b. Off site: Transportation means and destination. Include list of materials.
         1) Description of materials to be site-separated and self-hauled to designated facilities.
         2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
      c. The names and locations of mixed debris reuse and recycling facilities or sites.
      d. The names and locations of trash disposal landfill facilities or sites.
      e. Documentation that the facilities or sites are approved to receive the materials.

C. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.

D. Monthly summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.

1.6 APPLICABLE PUBLICATIONS

A Publications listed below form a part of this specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.

B. U.S. Green Building Council (USGBC):
LEED Green Building Rating System for New Construction

1.7 RECORDS

Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Records shall be kept in accordance with the LEED Reference Guide and LEED Template.

PART 2 - PRODUCTS

2.1 MATERIALS

A. List of each material and quantity to be salvaged, recycled, reused.
B. List of each material and quantity proposed to be taken to a landfill.
C. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs or savings.

PART 3 - EXECUTION

3.1 COLLECTION

A. Provide all necessary containers, bins and storage areas to facilitate effective waste management.
B. Clearly identify containers, bins and storage areas so that recyclable materials are separated from trash and can be transported to respective recycling facility for processing.
C. Hazardous wastes shall be separated, stored, disposed of according to local, state, federal regulations.

3.2 DISPOSAL

A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with state and federal regulations.
B. Construction or demolition materials with no practical reuse or that cannot be salvaged or recycled shall be disposed of at a landfill or incinerator.

3.3 REPORT

A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.

B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices. Include the net total costs or savings for each salvaged or recycled material.

C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices. Include the net total costs for each disposal.

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SECTION 01 81 13
SUSTAINABLE CONSTRUCTION REQUIREMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section describes general requirements and procedures to comply with federal mandates and U.S. Department of Veterans Affairs (VA) policies for sustainable construction.

B. The Design Professional has selected materials and utilized integrated design processes that achieve the Government's objectives. Contractor is responsible to maintain and support these objectives in developing means and methods for performing work and in proposing product substitutions or changes to specified processes. Obtain approval from Contracting Officer for all changes and substitutions to materials or processes. Proposed changes must meet, or exceed, materials or processes specified.

1.2 RELATED WORK

A. Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

B. Section 01 74 19 CONSTRUCTION WASTE MANANGEMENT.

1.3 DEFINITIONS

A. Recycled Content: Recycled content of materials is defined according to Federal Trade Commission Guides for the Use of Environmental Marketing Claims (16 CFR Part 260). Recycled content value of a material assembly is determined by weight. Recycled fraction of assembly is multiplied by cost of assembly to determine recycled content value.

1. "Post-Consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
2. "Pre-Consumer" material is defined as material diverted from waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind, or scrap generated in a process and capable of being reclaimed within the same process that generated it.

B. Biobased Products: Biobased products are derived from plants and other renewable agricultural, marine, and forestry materials and provide an alternative to conventional petroleum derived products. Biobased

products include diverse categories such as lubricants, cleaning products, inks, fertilizers, and bioplastics.

C. Low Pollutant-Emitting Materials: Materials and products which are minimally odorous, irritating, or harmful to comfort and well-being of installers and occupants.

D. Volatile Organic Compounds (VOC): Chemicals that are emitted as gases from certain solids or liquids. VOCs include a variety of chemicals, some of which may have short- and long-term adverse health effects.

1.4 REFERENCE STANDARDS

A. Carpet and Rug Institute Green Label Plus program.

B. U.S. Department of Agriculture BioPreferred program (USDA BioPreferred).

C. U.S. Environmental Protection Agency Comprehensive Procurement Guidelines (CPG).

D. U.S. Environmental Protection Agency WaterSense Program (WaterSense).

E. U.S. Environmental Protection Agency ENERGY STAR Program (ENERGY STAR).

F. U. S. Department of Energy Federal Energy Management Program (FEMP).

G. Green Electronic Council EPEAT Program (EPEAT).

1.5 SUBMITTALS

A. All submittals to be provided by contractor to COR.

B. Sustainability Action Plan:

1. Submit documentation as required by this section; provide additional copies of typical submittals required under technical sections when sustainable construction requires copies of record submittals.
2. Within 30 days after Preconstruction Meeting provide a narrative plan for complying with requirements stipulated within this section.
3. Sustainability Action Plan must:
   a. Make reference to sustainable construction submittals defined by this section.
   b. Address all items listed under PERFORMANCE CRITERIA.
   c. Indicate individual(s) responsible for implementing the plan.

C. Low Pollutant-Emitting Materials Tracking Spreadsheet: Within 30 days after Preconstruction Meeting provide a preliminary Low Pollutant-Emitting Materials Tracking Spreadsheet. The Low Pollutant-Emitting Materials Tracking Spreadsheet must be an electronic file and include all materials on Project in categories described under Low Pollutant-Emitting Materials in 01 81 13.

D. Construction Indoor Air Quality (IAQ) Management Plan:

1. Not more than 30 days after Preconstruction Meeting provide a Construction IAQ Management Plan as an electronic file including descriptions of the following:
   a. Instruction procedures for meeting or exceeding minimum requirements of ANSI/SMACNA 008-2008, Chapter 3, including procedures for HVAC Protection, Source Control, Pathway Interruption, Housekeeping, and Scheduling.
   b. Instruction procedures for protecting absorptive materials stored on-site or installed from moisture damage.
   c. Schedule of submission of photographs of on-site construction IAQ management measures such as protection of ducts and on-site stored oil installed absorptive materials.
   d. Instruction procedures if air handlers must be used during construction, including a description of filtration media to be used at each return air grille.
   e. Instruction procedure for replacing all air-filtration media immediately prior to occupancy after completion of construction, including a description of filtration media to be used at each air handling or air supply unit.
   f. Instruction procedures and schedule for implementing building flush-out.

E. Product Submittals:

1. Recycled Content: Submit product data from manufacturer indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content (excluding MEP systems equipment and components).
2. Biobased Content: Submit product data for products to be installed or used which are included in any of the USDA BioPreferred program's product categories. Data to include percentage of biobased content and source of biobased material.
3. Low Pollutant-Emitting Materials: Submit product data confirming compliance with relevant requirements for all materials on Project in categories described under Low Pollutant-Emitting Materials in 01 81 13.

4. For applicable products and equipment, submit product documentation confirming ENERGY STAR label, FEMP certification, WaterSense, and/or EPEAT certification.

F. Sustainable Construction Progress Reports: Concurrent with each Application for Payment, submit a Sustainable Construction Progress Report to confirm adherence with Sustainability Action Plan.

1. Include narratives of revised strategies for bringing work progress into compliance with plan and product submittal data.
2. Include updated and current Low Pollutant-Emitting Materials Tracking Spreadsheet.
3. Include construction waste tracking, in tons or cubic yards, including waste description, whether diverted or landfilled, hauler, and percent diverted for comingled quantities; and excluding land-clearing debris and soil. Provide haul receipts and documentation of diverted percentages for comingled wastes.

G. Closeout Submittals: Within 14 days after Substantial Completion provide the following:

1. Final version of Low Pollutant-Emitting Materials Tracking Spreadsheet.
2. Manufacturer’s cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for filtration media installed at return air grilles during construction if permanently installed air handling units are used during construction.
3. Manufacturer’s cut sheets and product data highlighting the Minimum Efficiency Reporting Value (MERV) for final filtration media in air handling units.
4. Minimum 18 construction photographs including six photographs taken on three different occasions during construction of ANSI/SMACNA 008-2008, Chapter 3 approaches employed, along with a brief description of each approach, documenting implementation of IAQ management measures, such as protection of ducts and on-site stored or installed absorptive materials.
5. Flush-out Documentation:
   a. Product data for filtration media used during flush-out.
   b. Product data for filtration media installed immediately prior to occupancy.

c. Signed statement describing building air flush-out procedures including dates when flush-out was begun and completed and statement that filtration media was replaced after flush-out.

1.6 QUALITY ASSURANCE

A. Preconstruction Meeting: After award of Contract and prior to commencement of Work, schedule and conduct meeting with COR and A/E to discuss the Project Sustainable Action Plan content as it applies to submittals, project delivery, required Construction Indoor Air Quality (IAQ) Management Plan, and other Sustainable Construction Requirements. The purpose of this meeting is to develop a mutual understanding of the Sustainable Construction Requirements and coordination of contractor's management of these requirements with the Contracting Officer and the Construction Quality Manager.

B. Construction Job Conferences: Status of compliance with Sustainable Construction Requirements of these specifications will be an agenda item at regular job meetings conducted during the course of work at the site.

1.7 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

B. Green Seal Standard GS-11, Paints, 1st Edition, May 20, 1993.

C. Green Seal Standard GC-03, Anti-Corrosive Paints, 2nd Edition, January 7, 1997.

D. Green Seal Standard GC-36, Commercial Adhesives, October 19, 2000.

E. South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings, rules in effect on January 1, 2004.

F. South Coast Air Quality Management District (SCAQMD) Rule 1168, July 1, 2005 and rule amendment date of January 7, 2005.

G. Sheet Metal and Air Conditioning National Contractors' Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 2nd Edition (ANSI/SMACNA 008-2008), Chapter 3.

H. California Department of Public Health Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.1, Emission Testing

method for California Specification 01350 (CDPH Standard Method V1.1-2010).

I. Federal Trade Commission Guides for the Use of Environmental Marketing Claims (16 CFR Part 260).

J. ASHRAE Standard 52.2-2007.

PART 2 – PRODUCTS

2.1 PERFORMANCE CRITERIA

A. Construction waste diversion from landfill disposal must comprise at least 50 percent of total construction waste, excluding land clearing debris and soil. Alternative daily cover (ADC) does not qualify as material diverted from disposal.

B. Low Pollutant-Emitting Materials:

1. Adhesives, sealants and sealant primers applied on site within the weatherproofing membrane must comply with VOC limits of SCAQMD Rule 1168:

a. Flooring Adhesives and Sealants:

1) Indoor carpet adhesives: 50 g/L.
2) Wood Flooring Adhesive: 100 g/L.
3) Rubber Floor Adhesives: 60 g/L.
4) Subfloor Adhesives: 50 g/L.
5) Ceramic Tile Adhesives and Grout: 65 g/L.
6) Cove Base Adhesives: 50 g/L.
7) Multipurpose Construction Adhesives: 70 g/L.
8) Porous Material (Except Wood) Substrate: 50 g/L.
9) Wood Substrate: 30 g/L.
10) Architectural Non-Porous Sealant Primer: 250 g/L.
11) Architectural Porous Sealant Primer: 775 g/L.
12) Other Sealant Primer: 750 g/L.
13) Structural Wood Member Adhesive: 140 g/L.
14) Sheet-Applied Rubber Lining Operations: 850 g/L.
15) Top and Trim Adhesive: 250 g/L.
16) Architectural Sealant: 250 g/L.
17) Other Sealant: 420 g/L.

b. Non-Flooring Adhesives and Sealants:

1) Drywall and Panel Adhesives: 50 g/L.
2) Multipurpose Construction Adhesives: 70 g/L.
3) Structural Glazing Adhesives: 100 g/L.

4) Metal-to-Metal Substrate Adhesives: 30 g/L.
5) Plastic Foam Substrate Adhesive: 50 g/L.
6) Porous Material (Except Wood) Substrate Adhesive: 50 g/L.
7) Wood Substrate Adhesive: 30 g/L.
8) Fiberglass Substrate Adhesive: 80 g/L.
9) Architectural Non-Porous Sealant Primer: 250 g/L.
10) Architectural Porous Sealant Primer: 775 g/L.
11) Other Sealant Primer: 750 g/L.
12) PVC Welding Adhesives: 510 g/L.
13) CPVC Welding Adhesives: 490 g/L.
14) ABS Welding Adhesives: 325 g/L.
15) Plastic Cement Welding Adhesives: 250 g/L.
16) Adhesive Primer for Plastic: 550 g/L.
17) Contact Adhesive: 80 g/L.
18) Special Purpose Contact Adhesive: 250 g/L.
19) Structural Wood Member Adhesive: 140 g/L.
20) Sheet Applied Rubber Lining Operations: 850 g/L.
21) Top and Trim Adhesive: 250 g/L.
22) Architectural Sealants: 250 g/L.
23) Other Sealants: 420 g/L.

2. Aerosol adhesives applied on site within the weatherproofing membrane must comply with the following Green Seal GS-36.
   a. Aerosol Adhesive, General-Purpose Mist Spray: 65 percent VOCs by weight.
   b. Aerosol Adhesive, General-Purpose Web Spray: 55 percent VOCs by weight.
   c. Special-Purpose Aerosol Adhesive (All Types): 70 percent VOCs by weight.
3. Paints and coatings applied on site within the weatherproofing membrane must comply with the following criteria:
   a. VOC content limits for paints and coatings established in Green Seal Standard GS-11.
   b. VOC content limit for anti-corrosive and anti-rust paints applied to interior ferrous metal substrates of 250 g/L established in Green Seal GC-03.

c. Clear wood finishes, floor coatings, stains, primers, sealers, and shellacs applied to interior elements must not exceed VOC content limits established in SCAQMD Rule 1113.

d. Comply with the following VOC content limits:

1) Anti-Corrosive/Antirust Paints: 250 g/L.
2) Clear Wood Finish, Lacquer: 550 g/L.
3) Clear Wood Finish, Sanding Sealer: 350 g/L.
4) Clear Wood Finish, Varnish: 350 g/L.
5) Floor Coating: 100 g/L.
6) Interior Flat Paint, Coating or Primer: 50 g/L.
7) Interior Non-Flat Paint, Coating or Primer: 150 g/L.
8) Sealers and Undercoaters: 200 g/L.
9) Shellac, Clear: 730 g/L.
10) Shellac, Pigmented: 550 g/L.
11) Stain: 250 g/L.
12) Clear Brushing Lacquer: 680 g/L.
13) Concrete Curing Compounds: 350 g/L.
14) Japans/Faux Finishing Coatings: 350 g/L.
15) Magnesite Cement Coatings: 450 g/L.
16) Pigmented Lacquer: 550 g/L.
17) Waterproofing Sealers: 250 g/L.
18) Wood Preservatives: 350 g/L.
19) Low-Solids Coatings: 120 g/L.

4. Carpet installed in building interior must comply with one of the following:

a. Meet testing and product requirements of the Carpet and Rug Institute Green Label Plus program.

b. Maximum VOC concentrations specified in CDPH Standard Method V1.1-2010, using office scenario at the 14 day time point.

5. Each non-carpet flooring element installed in building interior which is not inherently non-emitting (stone, ceramic, powder-coated metals, plated or anodized metal, glass, concrete, clay brick, and unfinished or untreated solid wood flooring) must comply with one of the following:

a. Meet requirements of the FloorScore standard as shown with testing by an independent third-party.

b. Maximum VOC concentrations specified in CDPH Standard Method V1.1-2010, using office scenario at 14 day time point.

6. Composite wood and agrifiber products used within the weatherproofing membrane must contain no added urea-formaldehyde resins.

7. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies must not contain added urea-formaldehyde.

C. Recycled Content:

1. Any products being installed or used that are listed on EPA Comprehensive Procurement Guidelines designated product list must meet or exceed the EPA's recycled content recommendations. The EPA Comprehensive Procurement Guidelines categories include:

a. Building insulation.

b. Cement and concrete.

c. Consolidated and reprocessed latex paint.

d. Floor tiles.

e. Flowable fill.

f. Laminated paperboard.

g. Modular threshold ramps.

h. Nonpressure pipe.

i. Patio blocks.

j. Railroad grade crossing surfaces.

k. Roofing materials.

l. Shower and restroom dividers/partitions.

m. Structural fiberboard.

n. Nylon carpet and nylon carpet backing.

o. Compost and fertilizer made from recovered organic materials.

p. Hydraulic mulch.

q. Lawn and garden edging.

r. Plastic lumber landscaping timbers and posts.

s. Park benches and picnic tables.

t. Plastic fencing.

u. Playground equipment.

v. Playground surfaces.

w. Bike racks.

D. Biobased Content:

1. Materials and equipment being installed or used that are listed on the USDA BioPreferred program product category list must meet or exceed USDA's minimum biobased content threshold. Refer to individual specification sections for detailed requirements applicable to that section.
   a. USDA BioPreferred program categories include:
      1) Adhesive and Mastic Removers.
      2) Carpets.
      3) Cleaners.
      4) Composite Panels.
      5) Corrosion Preventatives.
      6) Erosion Control Materials.
      7) Dust Suppressants.
      8) Fertilizers.
      9) Floor Cleaners and Protectors.
      10) Floor Coverings (Non-Carpet).
      11) Glass Cleaners.
      12) Hydraulic Fluids.
      13) Industrial Cleaners.
      14) Interior Paints and Coatings.
      15) Mulch and Compost Materials.
      16) Multipurpose Cleaners.
      17) Multipurpose Lubricants.
      18) Packaging Films.
      19) Paint Removers.
      20) Plastic Insulating Foam.
      21) Pneumatic Equipment Lubricants.
      22) Roof Coatings.
      23) Wastewater Systems Coatings.
      24) Water Tank Coatings.
      25) Wood and Concrete Sealers.
      26) Wood and Concrete Stains.

E. Materials, products, and equipment being installed which fall into a category covered by the WaterSense program must be WaterSense-labeled or meet or exceed WaterSense program performance requirements, unless disallowed for infection control reasons.
   1. WaterSense categories include:

a. Bathroom Faucets

b. Commercial Toilets

c. Irrigation Controllers

d. Pre-Rinse Spray Valves

e. Residential Toilets

f. Showerheads

g. Spray Sprinkler Bodies

h. Urinals

F. Materials, products, and equipment being installed which fall into any of the following product categories must be Energy Star-labeled.

1. Applicable Energy Star product categories as of 09/14/2017 include:

a. Appliances:

1) Air Purifiers and Cleaners.

2) Clothes Dryers (Residential).

3) Clothes Washers (Commercial & Residential).

4) Dehumidifiers.

5) Dishwashers (Residential).

6) Freezers (Residential).

7) Refrigerators (Residential).

b. Electronics and Information Technology:

1) Audio/Video Equipment.

2) Computers.

3) Data Center Storage.

4) Digital Media Player.

5) Enterprise Servers.

6) Imaging Equipment.

7) Monitors.

8) Professional Displays.

9) Set-Top and Cable Boxes.

10) Telephones.

11) Televisions.

12) Uninterruptible Power Supplies.

13) Voice over Internet Protocol (VoIP) Phones.

c. Food Service Equipment (Commercial):

1) Dishwashers.

2) Fryers.

3) Griddles.

4) Hot Food Holding Cabinets.
5) Ice Makers.
6) Ovens.
7) Refrigerators and Freezers.
8) Steam Cookers.
9) Vending Machines.

d. Heating and Cooling Equipment:
1) Air-Source Heat Pumps (Residential).
2) Boilers.
3) Ceiling Fans (Residential).
4) Central Air Conditioners (Residential).
5) Ductless Heating and Cooling (Residential).
6) Furnaces (Residential).
7) Water Heaters.
8) Geothermal Heat Pumps (Residential).
9) Light Commercial Heating and Cooling Equipment.
10) Room Air Conditioners (Residential).
11) Ventilation Fans (Residential).

e. Other:
1) Decorative Light Strings.
2) Electric Vehicle Supply Equipment.
3) Laboratory-Grade Refrigerators and Freezers.
4) Light Bulbs.
5) Light Fixtures.
6) Pool Pumps.
7) Roof Products.
8) Water Coolers.
9) Windows, Doors, and Skylights.

G. Materials, products, and equipment being installed which fall into any of the following categories must be FEMP-designated. FEMP-designated product categories as of 09/14/2017 include:
1. Boilers (Commercial).
2. Dishwashers (Commercial).
3. Electric Chillers, Air-Cooled (Commercial).
4. Electric Chillers, Water-Cooled (Commercial).
5. Exterior Lighting.
6. Fluorescent Ballasts.

7. Fluorescent Lamps, General Service.
8. Ice Machines, Water-Cooled.
9. Industrial Lighting (High/Low Bay).
10. Light Emitting Diode (LED) Luminaires.

H. Electronic products and equipment being installed which fall into any of the following categories shall be EPEAT registered. Electronic products and equipment covered by EPEAT program as of 09/14/2017 include:
1. Computers.
2. Displays.
3. Imaging Equipment.
4. Televisions.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

A. Construction Indoor Air Quality Management:
1. During construction, meet or exceed recommended control measures of ANSI/SMACNA 008-2008, Chapter 3.
2. Protect stored on-site and installed absorptive materials from moisture damage.
3. If permanently installed air handlers are used during construction, filtration media with a minimum efficiency reporting value (MERV) of 8 must be used at each return air grille, as determined by ASHRAE Standard 52.2-1999 (with errata but without addenda). Replace all filtration media immediately prior to occupancy.
4. Perform building flush-out as follows:
a. After construction ends, prior to occupancy and with interior finishes installed, perform a building flush-out by supplying a total volume of 14000 cu. ft. of outdoor air per sq. ft. of floor area while maintaining an internal temperature of at least 60 degrees Fahrenheit and a relative humidity no higher than 60 percent. OR
b. If occupancy is desired prior to flush-out completion, the space may be occupied following delivery of a minimum of 3500 cu. ft. of outdoor air per sq. ft. of floor area to the space. Once a space is occupied, it must be ventilated at a minimum rate of 0.30 cfm per sq. ft. of outside air or design minimum outside air rate determined until a total of 14000 cu. ft./sq. ft. of outside

air has been delivered to the space. During each day of flush-out period, ventilation must begin a minimum of three hours prior to occupancy and continue during occupancy.

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SECTION 02 41 20
SELECTIVE BUILDING DEMOLITION

PART 1- GENERAL

1.1 SUMMARY

A. Section Includes:

1. Removal of designated building construction, equipment, and fixtures.
2. Salvaging selected materials
3. Identification of utilities.
4. Coordination with new construction and project phasing

B. Related Sections:

1. Division 01 – General Requirements
2. Section 03 30 00 – Cast-in-Place Concrete
3. Section 04 20 00 – Unit Masonry
4. Section 22 00 00 – Plumbing
5. Section 23 00 00 – HVAC
6. Section 26 00 00 – Electrical

1.2 SUBMITTALS

A. Submittals for Review:

1. Shop Drawings: Provide drawings that indicate areas for demolition, removal sequence, project phasing, storage areas and location and construction of temporary work.

1.3 REGULATORY REQUIREMENTS

A. Conform to applicable code for demolition work, safety of structure, and dust control.

B. Notify the VA COR and utility companies before starting work and comply with their requirements.

C. Conform to applicable codes when hazardous or contaminated materials are discovered.

D. Do not close or obstruct exits.

1.4 PROJECT CONDITIONS

A. Coordinate any proposed demolition phasing with the Owner.

B. Review demolition requirements in Plumbing, HVAC, & Electrical specification sections.

C. Minimize interference with Medical Center's streets, walks, public rights-of-way, and adjacent facilities. Coordinate interior building access needs for personnel with VA COR.

D. If hazardous materials are discovered, notify VA COR and await instructions.

E. If any of the following conditions are encountered, cease work immediately, notify VA COR and Architect, and await instructions:

1. Materials or conditions encountered differ from those designated in the Contract Documents.

PART 2- PRODUCTS

Not used

PART 3- EXECUTION

3.1 PREPARATION

A. Erect temporary partitions, barricades, warning devices, and controls as required to maintain a safe site and protect the existing structure to remain. Coordinate requirements with the VA COR.

B. Provide protective coverings and supports for construction designated to remain.

C. Protect existing structure from damage during demolition and construction.

D. Temporarily / permanently disconnect utilities as required.

E. Identify and confirm all materials to be salvaged with the VA COR and Architect prior to beginning demolition. Determine methods for protection and storage of salvaged items during construction as approved by the VA COR.

3.2 DEMOLITION

A. Remove existing construction to extent indicated and as necessary to join new work to existing. Do not remove more than is necessary to allow for new construction.

B. Salvage, store and protect from damage all materials designated by the owner to remain or designated for reuse or relocation. Review requirements with the VA COR prior to commencing demolition.

C. Do not damage work designated to remain.

D. Minimize noise and spread of dirt and dust within the existing building. See Division 01 specifications for noise and dust control requirements.

E. Assign work to trades skilled in procedures involved.

F. Concrete Floor: Grind smooth uneven areas of concrete floor under masonry or other walls that have been demolished. Prepare concrete floor to receive new flooring.

G. Masonry: Saw cut clean openings without damage to remaining masonry units and mortar joints. Tooth-in new masonry units into newly cut openings, re-mortar as required.

H. Plug ends of disconnected utilities with threaded or welded caps.

I. Protect and support active utilities designated to remain. Post warning signs showing location and type of utility and type of hazard.

J. Remove and dispose of waste materials off site and in a sustainable manner.

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SECTION 02 82 11
ASBESTOS ABATEMENT

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ASBESTOS ABATEMENT SPECIFICATIONS

PART 1 - GENERAL

1.1 SUMMARY OF THE WORK

1.1.1 CONTRACT DOCUMENTS AND RELATED REQUIREMENTS

Drawings, general provisions of the contract, including general and supplementary conditions and other Division 01 specifications, shall apply to the work of this section. The contract documents show the work to be done under the contract and related requirements and conditions impacting the project. Related requirements and conditions include applicable codes and regulations, notices and permits, existing site conditions and restrictions on use of the site, requirements for partial owner occupancy during the work, coordination with other work and the phasing of the work. In the event the Asbestos Abatement Contractor discovers a conflict in the contract documents and/or requirements or codes, the conflict shall be brought to the immediate attention of the Contracting Officer for resolution. Whenever there is a conflict or overlap in the requirements, the most stringent shall apply. Any actions taken by the Contractor without obtaining guidance from the Contracting Officer shall become the sole risk and responsibility of the Asbestos Abatement Contractor. All costs incurred due to such action are also the responsibility of the Asbestos Abatement Contractor.

1.1.2 EXTENT OF WORK

A. Below is a brief description of the estimated quantities of asbestos containing materials to be abated. These quantities are for informational purposes only and are based on the best information available at the time of the specification preparation. The Contractor shall satisfy himself as the actual quantities to be abated. Nothing in this section shall be interpreted as limiting the extent of work otherwise required by this contract and related documents.

B. Removal, clean-up and disposal of asbestos-containing materials (ACM) and asbestos/waste contaminated elements in appropriately regulated areas for the following materials and approximate quantities.

ACM Description	Material Location	% and Type Asbestos	Estimated Quantity
Building 27			
White Mastic on Non-Asbestos-Containing Fiberglass Pipe Insulation	Various Locations Throughout Building 27	1.0% Chrysotile by Point Count (PC)	~550 Linear Feet (LF)
Air-Cell Pipe Insulation and Associated Fitting Insulation	Pipe Chase in Room 252	Assumed (out of reach to sample)	~20 LF
Building 30			
White Mastic on Non-Asbestos-Containing Fiberglass Pipe Insulation	Various Locations Throughout Building 30	1.3% Chrysotile PC	~900 LF

ACM Description	Material Location	% and Type Asbestos	Estimated Quantity
Building 256 – Items to Remain			
White Interior Window Caulk	Pump Room, Chemical Feed Room	1.5% Chrysotile PC	~15 Square Feet (SF) or 5 Windows
White Exterior Window Glazing *see below		1.0% Chrysotile PC	~20 SF or 5 Windows
White Interior Expansion Caulking	Throughout Building	1.3% Chrysotile PC	~50 SF
White Interior Door Caulking	Throughout Building *see below	1.5% Chrysotile PC	~36 SF or 12 Doors
White Interior Window Glazing	3rd Floor Stairwell Landing	0.75% Chrysotile PC	~3 SF or 1 Window
White Interior Window Caulking	Lab Windows	Trace Chrysotile PC	~8 SF or 2 Windows
Joint Compound within Drywall Ceiling System	Elevator Equipment Room	0.75% Chrysotile by Point Count (PC) in Joint Compound; Trace Chrysotile by PC in Composite Samples of Gypsum and Joint Compound Analyzed Together	~75 SF (of drywall system)
Building 256 – Items to be Abated			
White Interior Window Caulk	Pump Room, Chemical Feed Room	1.5% Chrysotile PC	~15 Square Feet (SF) or 5 Windows
White Exterior Window Glazing	Only windows shown to be demolished	1.0% Chrysotile PC	~20 SF or 5 Windows
White Interior Expansion Caulking	Throughout Building	1.3% Chrysotile PC	~50 SF
White Interior Door Caulking	Only doors shown to be demolished	1.5% Chrysotile PC	~36 SF or 12 Doors
White Interior Window Glazing	3rd Floor Stairwell Landing	0.75% Chrysotile PC	~3 SF or 1 Window
9”x9” Grey Floor Tile with Black Mastic	Lab Entry, Toilet Room, Lab	Floor Tile: 1.3% Chrysotile PC, Mastic: 2.1% Chrysotile PC	~350 SF
White Interior Window Caulking	Lab Windows	Trace Chrysotile PC	~8 SF or 2 Windows
Lab Drying Rack	East Wall of Lab	25% Chrysotile	~4 SF
Joint Compound within Drywall Ceiling System	Elevator Equipment Room	0.75% Chrysotile by Point Count (PC) in Joint Compound; Trace Chrysotile by PC in Composite Samples of Gypsum and Joint Compound Analyzed Together	~75 SF (of drywall system)

It shall be noted that the information above does not include inaccessible pipe insulation which may be concealed behind walls/ceilings (walls/ceilings without access hatches/panels or movable ceiling tile). If concealed insulation is encountered during activities, work shall immediately cease, and the VA representative contacted.

C. The general contractor (not the abatement contractor) shall hire an independent industrial hygienist to provide the duties of the Veteran’s

Professional Industrial Hygienist (VPIH). The required duties of the VPIH are indicated in this specification.

1.1.3 RELATED WORK

A. Section 07 84 00, FIRESTOPPING.
B. Section 02 41 00, DEMOLITION.
C. Division 09, FINISHES
D. Division 22, PLUMBING.
E. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING
F. Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING
G. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING
H. Section 22 11 00, FACILITY WATER DISTRIBUTION.
I. Section 23 05 11, COMMON WORK RESULTS FOR HVAC

1.1.4 TASKS

The work tasks are summarized briefly as follows:

A. Pre-abatement activities including pre-abatement meeting(s), inspection(s), notifications, permits, submittal approvals, regulated area preparations, emergency procedures arrangements, and standard operating procedures for asbestos abatement work.
B. Abatement activities including removal, encapsulation, clean-up and disposal of ACM waste, recordkeeping, security, monitoring, and inspections.
C. Cleaning and decontamination activities including final visual inspection, air monitoring and certification of decontamination.

1.1.5 CONTRACTORS USE OF PREMISES

A. The Contractor and Contractor's personnel shall cooperate fully with the VA representative/consultant to facilitate efficient use of buildings and areas within buildings. The Contractor shall perform the work in accordance with the VA specifications, drawings, phasing plan and in compliance with any/all applicable Federal, State and Local regulations and requirements.
B. The Contractor shall use the existing facilities in the building strictly within the limits indicated in contract documents as well as the approved VA Design and Construction Procedures. VA Design and Construction Procedures drawings of partially occupied buildings shall show the limits of regulated areas; the placement of decontamination facilities; the temporary location of bagged waste ACM; the path of transport to outside the building; and the temporary waste storage area for each building/regulated area. Any variation from the arrangements shown on drawings shall be secured in writing from the VA representative through the pre-abatement plan of action. Limitations of use, if any, shall apply to existing facilities as shown on drawings.

1.2 VARIATIONS IN QUANTITY

The quantities and locations of ACM as indicated on the drawings and the extent of work included in this section are estimated which are limited by the physical constraints imposed by occupancy of the buildings and accessibility to ACM. Accordingly, minor variations (+/- 5%) in quantities of ACM within the regulated area are considered as having no impact on

contract price and time requirements of this contract. Where additional work is required beyond the above variation, the contractor shall provide unit prices for newly discovered ACM and those prices shall be used for additional work required under the contractor.

1.3 STOP ASBESTOS REMOVAL

If the Contracting Officer; their field representative; (the facility Safety Officer/Manager or their designee, or the VA Professional Industrial Hygienist/Certified Industrial Hygienist (VPIH/CIH) presents a verbal **Stop Asbestos Removal Order**, the Contractor/Personnel shall immediately stop all asbestos removal and maintain HEPA filtered negative pressure air flow in the containment and adequately wet any exposed ACM. If a verbal Stop Asbestos Removal Order is issued, the VA shall follow-up with a written order to the Contractor as soon as it is practicable. The Contractor shall not resume any asbestos removal activity until authorized to do so in writing by the VA Contracting Officer. A stop asbestos removal order may be issued at any time the VA Contracting Officer determines abatement conditions/activities are not within VA specification, regulatory requirements or that an imminent hazard exists to human health or the environment. Work stoppage shall continue until conditions have been corrected to the satisfaction of the VA. Standby time and costs for corrective actions shall be borne by the Contractor, including the VPIH/CIH time. The occurrence of any of the following events shall be reported immediately by the Contractor's competent person to the VA Contracting Office or field representative using the most expeditious means (e.g., verbal or telephonic), followed up with written notification to the Contracting Officer as soon as practical. The Contractor shall immediately stop asbestos removal/disturbance activities and initiate fiber reduction activities:

A. Airborne PCM analysis results equal to or greater than 0.01 f/cc outside a regulated area or >0.05 f/cc inside a regulated area;
B. breach or break in regulated area containment barrier(s);
C. less than -0.02" WCG pressure in the regulated area;
D. serious injury/death at the site;
E. fire/safety emergency at the site;
F. respiratory protection system failure;
G. power failure or loss of wetting agent; or
H. any visible emissions observed outside the regulated area.

1.4 DEFINITIONS

1.4.1 GENERAL

Definitions and explanations here are neither complete nor exclusive of all terms used in the contract documents, but are general for the work to the extent they are not stated more explicitly in another element of the contract documents. Drawings shall be recognized as diagrammatic in nature and not completely descriptive of the requirements indicated therein.

1.4.2 GLOSSARY

Abatement - Procedures to control fiber release from asbestos-containing materials. Includes removal, encapsulation, enclosure, demolition, and renovation activities related to asbestos containing materials (ACM).

Aerosol - Solid or liquid particulate suspended in air.

Adequately wet - Sufficiently mixed or penetrated with liquid to prevent the release of particulates. If visible emissions are observed coming from the ACM, then that material has not been adequately wetted.

Aggressive method - Removal or disturbance of building material by sanding, abrading, grinding, or other method that breaks, crumbles, or disintegrates intact ACM.

Aggressive sampling - EPA AHERA defined clearance sampling method using air moving equipment such as fans and leaf blowers to aggressively disturb and maintain in the air residual fibers after abatement.

AHERA - Asbestos Hazard Emergency Response Act. Asbestos regulations for schools issued in 1987.

Aircell - Pipe or duct insulation made of corrugated cardboard which contains asbestos.

Air monitoring - The process of measuring the fiber content of a known volume of air collected over a specified period of time. The NIOSH 7400 Method, Issue 2 is used to determine the fiber levels in air. For personal samples and clearance air testing using Phase Contrast Microscopy (PCM) analysis. NIOSH Method 7402 can be used when it is necessary to confirm fibers counted by PCM as being asbestos. The AHERA TEM analysis may be used for background, area samples and clearance samples when required by this specification, or at the discretion of the VPIH/CIH as appropriate.

Air sample filter - The filter used to collect fibers which are then counted. The filter is made of mixed cellulose ester membrane for PCM (Phase Contrast Microscopy) and polycarbonate for TEM (Transmission Electron Microscopy)

Amended water - Water to which a surfactant (wetting agent) has been added to increase the penetrating ability of the liquid.

Asbestos - Includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that have been chemically treated or altered. Asbestos also includes PACM, as defined below.

Asbestos Hazard Abatement Plan (AHAP) - Asbestos work procedures required to be submitted by the contractor before work begins.

Asbestos-containing material (ACM) - Any material containing more than one percent of asbestos.

Asbestos contaminated elements (ACE) - Building elements such as ceilings, walls, lights, or ductwork that are contaminated with asbestos.

Asbestos-contaminated soil (ACS) - Soil found in the work area or in adjacent areas such as crawlspaces or pipe tunnels which is contaminated with asbestos-containing material debris and cannot be easily separated from the material.

Asbestos-containing waste (ACW) material - Asbestos-containing material or asbestos contaminated objects requiring disposal.

Asbestos Project Monitor - Some states require that any person conducting asbestos abatement clearance inspections and clearance air sampling be licensed as an asbestos project monitor.

Asbestos waste decontamination facility - A system consisting of drum/bag washing facilities and a temporary storage area for cleaned containers of asbestos waste. Used as the exit for waste and equipment leaving the regulated area. In an emergency, it may be used to evacuate personnel.

Authorized person - Any person authorized by the VA, the Contractor, or government agency and required by work duties to be present in regulated areas.

Authorized visitor - Any person approved by the VA; the contractor; or any government agency representative having jurisdiction over the regulated area (e.g., OSHA, Federal and State EPA.

Barrier - Any surface the isolates the regulated area and inhibits fiber migration from the regulated area.

Containment Barrier - An airtight barrier consisting of walls, floors, and/or ceilings of sealed plastic sheeting which surrounds and seals the outer perimeter of the regulated area.

Critical Barrier - The barrier responsible for isolating the regulated area from adjacent spaces, typically constructed of plastic sheeting secured in place at openings such as doors, windows, or any other opening into the regulated area.

Primary Barrier – Plastic barriers placed over critical barriers and exposed directly to abatement work.

Secondary Barrier - Any additional plastic barriers used to isolate and provide protection from debris during abatement work.

Breathing zone - The hemisphere forward of the shoulders with a radius of about 150 - 225 mm (6 - 9 inches) from the worker's nose.

Bridging encapsulant - An encapsulant that forms a layer on the surface of the ACM.

Building/facility owner - The legal entity, including a lessee, which exercises control over management and recordkeeping functions relating to a building and/or facility in which asbestos activities take place.

Bulk testing - The collection and analysis of suspect asbestos containing materials.

Certified Industrial Hygienist (CIH) - A person certified in the comprehensive practice of industrial hygiene by the American Board of Industrial Hygiene.

Class I asbestos work - Activities involving the removal of Thermal System Insulation (TSI) and surfacing ACM and Presumed Asbestos Containing Material (PACM).

Class II asbestos work - Activities involving the removal of ACM which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastic.

Clean room/Changing room - An uncontaminated room having facilities for the storage of employee's street clothing and uncontaminated materials and equipment.

Clearance sample - The final air sample taken after all asbestos work has been done and visually inspected. Performed by the VA's professional industrial hygiene consultant/Certified Industrial Hygienist (VPIH/CIH).

Closely resemble - The major workplace conditions which have contributed to the levels of historic asbestos exposure, are no more protective than conditions of the current workplace.

Competent person - In addition to the definition in 29 CFR 1926.32(f), one who is capable of identifying existing asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them, as specified in 29 CFR 1926.32(f); in addition, for Class I and II work who is specially trained in a training course which meets the criteria of EPA's Model Accreditation Plan (40 CFR 763) for supervisor.

Contractor's Professional Industrial Hygienist (CPIH/CIH) - The asbestos abatement contractor's industrial hygienist. The industrial hygienist shall meet the qualification requirements of a PIH and may be a certified industrial hygienist (CIH).

Count - Refers to the fiber count or the average number of fibers greater than five microns in length with a length-to-width (aspect) ratio of at least 3 to 1, per cubic centimeter of air.

Crawlspace – An area which can be found either in or adjacent to the work area. This area has limited access and egress and may contain asbestos materials and/or asbestos contaminated soil.

Decontamination area/unit – An enclosed area adjacent to and connected to the regulated area and consisting of an equipment room, shower room, and clean room, which is used for the decontamination of workers, materials, and equipment that are contaminated with asbestos.

Demolition - The wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos products.

VA Total – means a building or substantial part of the building is completely removed, torn or knocked down, bulldozed, flattened, or razed, including removal of building debris.

Disposal bag - Typically 6 mil thick sift-proof, dustproof, leak-tight container used to package and transport asbestos waste from regulated areas to the approved landfill. Each bag/container shall be labeled/marked in accordance with EPA, OSHA and DOT requirements.

Disturbance - Activities that disrupt the matrix of ACM or PACM, crumble or pulverize ACM or PACM, or generate visible debris from ACM or PACM. Disturbance includes cutting away small amounts of ACM or PACM, no greater than the amount that can be contained in one standard sized glove bag or waste bag in order to access a building component. In no event shall the amount of ACM or PACM so disturbed exceed that which can be contained in one glove bag or disposal bag which shall not exceed 60 inches in length or width.

Drum - A rigid, impermeable container made of cardboard fiber, plastic, or metal which can be sealed in order to be sift-proof, dustproof, and leak-tight.

Employee exposure – The exposure to airborne asbestos that would occur if the employee were not wearing respiratory protection equipment.

Encapsulant - A material that surrounds or embeds asbestos fibers in an adhesive matrix and prevents the release of fibers.

Encapsulation - Treating ACM with an encapsulant.

Enclosure - The construction of an air tight, impermeable, permanent barrier around ACM to control the release of asbestos fibers from the material and also eliminate access to the material.

Equipment room - A contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.

Fiber - A particulate form of asbestos, 5 microns or longer, with a length to width (aspect) ratio of at least 3 to 1.

Fibers per cubic centimeter (f/cc) - Abbreviation for fibers per cubic centimeter, used to describe the level of asbestos fibers in air.

Filter - Media used in respirators, vacuums, or other machines to remove particulate from air.

Firestopping - Material used to close the open parts of a structure in order to prevent a fire from spreading.

Friable asbestos containing material - Any material containing more than one (1) percent or asbestos as determined using the method specified in appendix A, Subpart F, 40 CFR 763, section 1, Polarized Light Microscopy, that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure.

Glovebag - Not more than a 60 x 60 inch impervious plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which materials and tools may be handled.

High efficiency particulate air (HEPA) filter – An ASHRAE MERV 17 filter capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter.

HEPA vacuum - Vacuum collection equipment equipped with a HEPA filter system capable of collecting and retaining asbestos fibers.

Homogeneous area - An area of surfacing, thermal system insulation or miscellaneous ACM that is uniform in color, texture and date of application.

HVAC - Heating, Ventilation and Air Conditioning

Industrial hygienist (IH) - A professional qualified by education, training, and experience to anticipate, recognize, evaluate and develop controls for occupational health hazards. Meets definition requirements of the American Industrial Hygiene Association (AIHA).

Industrial hygienist technician (IH Technician) - A person working under the direction of an IH or CIH who has special training, experience, certifications and licenses required for the industrial hygiene work assigned. Some states require that an industrial hygienist technician conducting asbestos abatement clearance inspection and clearance air sampling be licensed as an asbestos project monitor.

Intact - The ACM has not crumbled, been pulverized, or otherwise deteriorated so that the asbestos is no longer likely to be bound with its matrix.

Lockdown - Applying encapsulant, after a final visual inspection, on all abated surfaces at the conclusion of ACM removal prior to removal of critical barriers.

National Emission Standards for Hazardous Air Pollutants (NESHAP) - EPA's rule to control emissions of asbestos to the environment (40 CFR part 61, Subpart M).

Negative initial exposure assessment – A demonstration by the employer which complies with the criteria in 29 CFR 1926.1101 (f)(2)(iii), that employee exposure during an operation is expected to be consistently below the PEL.

Negative pressure - Air pressure which is lower than the surrounding area, created by exhausting air from a sealed regulated area through HEPA equipped filtration units. OSHA requires maintaining -0.02" water column gauge inside the negative pressure enclosure.

Negative pressure respirator - A respirator in which the air pressure inside the facepiece is negative during inhalation relative to the air pressure outside the respirator facepiece.

Non-friable ACM - Material that contains more than 1 percent asbestos but cannot be crumbled, pulverized, or reduced to powder by hand pressure.

Organic vapor cartridge - The type of cartridge used on air purifying respirators to remove organic vapor hazardous air contaminants.

Outside air - The air outside buildings and structures, including, but not limited to, the air under a bridge or in an open ferry dock.

Owner/operator - Any person who owns, leases, operates, controls, or supervises the facility being demolished or renovated or any person who owns, leases, operates, controls, or supervises the demolition or renovation operation, or both.

Penetrating encapsulant - Encapsulant that is absorbed into the ACM matrix without leaving a surface layer.

Personal sampling/monitoring - Representative air samples obtained in the breathing zone for one or workers within the regulated area using a filter cassette and a calibrated air sampling pump to determine asbestos exposure.

Permissible exposure limit (PEL) - The level of exposure OSHA allows for an 8 hour time weighted average. For asbestos fibers, the eight (8) hour time weighted average PEL is 0.1 fibers per cubic centimeter (0.1 f/cc) of air and the 30-minute Excursion Limit is 1.0 fibers per cubic centimeter (1 f/cc).

Personal protective equipment (PPE) – equipment designed to protect user from injury and/or specific job hazard. Such equipment may include protective clothing, hard hats, safety glasses, and respirators.

Pipe tunnel – An area, typically located adjacent to mechanical spaces or boiler rooms in which the pipes servicing the heating system in the building are routed to allow the pipes to access heating elements. These areas may contain asbestos pipe insulation, asbestos fittings, or asbestos-contaminated soil.

Polarized light microscopy (PLM) - Light microscopy using dispersion staining techniques and refractive indices to identify and quantify the type(s) of asbestos present in a bulk sample.

Polyethylene sheeting - Strong plastic barrier material 4 to 6 mils thick, semi-transparent, flame retardant per NFPA 241.

Positive/negative fit check - A method of verifying the seal of a facepiece respirator by temporarily occluding the filters and breathing in (inhaling) and then temporarily occluding the exhalation valve and breathing out (exhaling) while checking for inward or outward leakage of the respirator respectively.

Presumed ACM (PACM) - Thermal system insulation, surfacing, and flooring material installed in buildings prior to 1981. If the building owner has actual knowledge, or should have known through the exercise of due diligence that other materials are ACM, they too shall be treated as PACM. The designation of PACM may be rebutted pursuant to 29 CFR 1926.1101 (b).

Professional IH - An IH who meets the definition requirements of AIHA; meets the definition requirements of OSHA as a "Competent Person" at 29 CFR 1926.1101 (b); has completed two specialized EPA approved courses on management and supervision of asbestos abatement projects; has formal training in respiratory protection and waste disposal; and has a minimum of four projects of similar complexity with this project of which at least three projects serving as the supervisory IH. The PIH may be either the VA's PIH (VPIH) or Contractor's PIH (CPIH/CIH).

Project designer - A person who has successfully completed the training requirements for an asbestos abatement project designer as required by 40 CFR 763 Appendix C, Part I; (B)(5).

Assigned protection factor - A value assigned by OSHA/NIOSH to indicate the expected protection provided by each respirator class, when the respirator is properly selected and worn correctly. The number indicates the reduction of exposure level from outside to inside the respirator facepiece.

Qualitative fit test (QLFT) - A fit test using a challenge material that can be sensed by the wearer if leakage in the respirator occurs.

Quantitative fit test (QNFT) - A fit test using a challenge material which is quantified outside and inside the respirator thus allowing the determination of the actual fit factor.

Regulated area - An area established by the employer to demarcate where Class I, II, III asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work may accumulate; and a work area within which airborne concentrations of asbestos exceed, or there is a reasonable possibility they may exceed the PEL.

Regulated ACM (RACM) - Friable ACM; Category I non-friable ACM that has become friable; Category I non-friable ACM that shall be or has been

subjected to sanding, grinding, cutting, or abrading or; Category II non-friable ACM that has a high probability of becoming or has become crumbled, pulverized, or reduced to powder by the forces expected to act on the material in the course of the demolition or renovation operation.

Removal - All operations where ACM, PACM and/or RACM is taken out or stripped from structures or substrates, including demolition operations.

Renovation - Altering a facility or one or more facility components in any way, including the stripping or removal of asbestos from a facility component which does not involve demolition activity.

Repair - Overhauling, rebuilding, reconstructing, or reconditioning of structures or substrates, including encapsulation or other repair of ACM or PACM attached to structures or substrates.

Shower room - The portion of the PDF where personnel shower before leaving the regulated area.

Supplied air respirator (SAR) - A respiratory protection system that supplies minimum Grade D respirable air per ANSI/Compressed Gas Association Commodity Specification for Air, G-7.1-1989.

Surfacing ACM - A material containing more than 1 percent asbestos that is sprayed, troweled on or otherwise applied to surfaces for acoustical, fireproofing and other purposes.

Surfactant - A chemical added to water to decrease water's surface tension thus making it more penetrating into ACM.

Thermal system ACM - A material containing more than 1 percent asbestos applied to pipes, fittings, boilers, breeching, tanks, ducts, or other structural components to prevent heat loss or gain.

Transmission electron microscopy (TEM) - A microscopy method that can identify and count asbestos fibers.

VA Professional Industrial Hygienist (VPIH/CIH) – The Department of Veterans Affairs Professional Industrial Hygienist shall meet the qualifications of a PIH, and may be a Certified Industrial Hygienist (CIH).

VA Representative - The VA official responsible for on-going project work.

Visible emissions - Any emissions, which are visually detectable without the aid of instruments, coming from ACM/PACM/RACM/ACS or ACM waste material.

Waste/Equipment decontamination facility (W/EDF) – The area in which equipment is decontaminated before removal from the regulated area.

Waste generator - Any owner or operator whose act or process produces asbestos-containing waste material.

Waste shipment record - The shipping document, required to be originated and signed by the waste generator, used to track and substantiate the disposition of asbestos-containing waste material.

Wet cleaning - The process of thoroughly eliminating, by wet methods, any asbestos contamination from surfaces or objects.

1.4.3 REFERENCED STANDARDS ORGANIZATIONS

The following acronyms or abbreviations as referenced in contract/specification documents are defined to mean the associated names. Names and addresses may be subject to change.

A. VA Department of Veterans Affairs
810 Vermont Avenue, NW
Washington, DC 20420

B. AIHA American Industrial Hygiene Association
2700 Prosperity Avenue, Suite 250
Fairfax, VA 22031
703-849-8888

C. ANSI American National Standards Institute
1430 Broadway
New York, NY 10018
212-354-3300

D. ASTM American Society for Testing and Materials
1916 Race St.
Philadelphia, PA 19103
215-299-5400

E. CFR Code of Federal Regulations
Government Printing Office
Washington, DC 20420

F. CGA Compressed Gas Association
1235 Jefferson Davis Highway
Arlington, VA 22202
703-979-0900

G. CS Commercial Standard of the National Institute of Standards and Technology (NIST)
U. S. Department of Commerce
Government Printing Office
Washington, DC 20420

H. EPA Environmental Protection Agency
401 M St., SW
Washington, DC 20460
202-382-3949

I. MIL-STD Military Standards/Standardization Division
Office of the Assistant Secretary of Defense
Washington, DC 20420

J. NIST National Institute for Standards and Technology
U. S. Department of Commerce
Gaithersburg, MD 20234
301-921-1000

K. NEC National Electrical Code (by NFPA)

L. NEMA National Electrical Manufacturer's Association
2101 L Street, N.W.
Washington, DC 20037

M. NFPA National Fire Protection Association
1 Batterymarch Park
P.O. Box 9101
Quincy, MA 02269-9101
800-344-3555

N. NIOSH National Institutes for Occupational Safety and Health
4676 Columbia Parkway
Cincinnati, OH 45226
513-533-8236

O. OSHA Occupational Safety and Health Administration
U.S. Department of Labor
Government Printing Office
Washington, DC 20402

P. UL Underwriters Laboratory
333 Pfingsten Rd.
Northbrook, IL 60062
312-272-8800

1.5 APPLICABLE CODES AND REGULATIONS

1.5.1 GENERAL APPLICABILITY OF CODES, REGULATIONS, AND STANDARDS

A. All work under this contract shall be done in strict accordance with all applicable Federal, State, and local regulations, standards and codes governing asbestos abatement, and any other trade work done in conjunction with the abatement. All applicable codes, regulations and standards are adopted into this specification and shall have the same force and effect as this specification.
B. The most recent edition of any relevant regulation, standard, document or code shall be in effect. Where conflict among the requirements or with these specifications exists, the most stringent requirement(s) shall be utilized.
C. Copies of all standards, regulations, codes and other applicable documents, including this specification and those listed in Section 1.5 shall be available at the worksite in the clean change area of the worker decontamination system.

1.5.2 ASBESTOS ABATEMENT CONTRACTOR RESPONSIBILITY

The Asbestos Abatement Contractor (Contractor) shall assume full responsibility and liability for compliance with all applicable Federal, State and Local regulations related to any and all aspects of the asbestos abatement project. The Contractor is responsible for providing and maintaining training, accreditations, medical exams, medical records, personal protective equipment (PPE) including respiratory protection including respirator fit testing, as required by applicable Federal, State and Local regulations. The Contractor shall hold the VA and VPIH/CIH consultants harmless for any Contractor’s failure to comply with any applicable work, packaging, transporting, disposal, safety, health, or environmental requirement on the part of himself, his employees, or his subcontractors. The Contractor shall incur all costs of the CPIH/CIH, including all sampling/analytical costs to assure compliance with OSHA/EPA/State requirements related to failure to comply with the regulations applicable to the work.

1.5.3 FEDERAL REQUIREMENTS

Federal requirements which govern of asbestos abatement include, but are not limited to, the following regulations.

A. Occupational Safety and Health Administration **(OSHA)**
1. Title 29 CFR 1926.1101 - Construction Standard for Asbestos

2. Title 29 CFR 1910 Subpart I - Personal Protective Equipment
3. Title 29 CFR 1910.134 - Respiratory Protection
4. Title 29 CFR 1926 - Construction Industry Standards
5. Title 29 CFR 1910.1020 - Access to Employee Exposure and Medical Records
6. Title 29 CFR 1910.1200 - Hazard Communication
7. Title 29 CFR 1910 Subpart K - Medical and First Aid

B. Environmental Protection Agency **(EPA):**
1. 40 CFR 61 Subpart A and M (Revised Subpart B) - National Emission Standard for Hazardous Air Pollutants - Asbestos.
2. 40 CFR 763.80 - Asbestos Hazard Emergency Response Act (AHERA)

C. Department of Transportation **(DOT)**
Title 49 CFR 100 - 185 – Transportation

1.5.4 STATE REQUIREMENTS

State requirements that apply to the asbestos abatement work, disposal, and clearance, include, the following:

a. Asbestos Worker Accreditation Act - Act 440 of 1988, as amended.
b. Asbestos Abatement Contractors Licensing Act - Act 135 of 1986, as amended.
c. Michigan Occupational Safety and Health Act - Act 154 of 1974, as amended.

1.5.5 LOCAL REQUIREMENTS

If local requirements are more stringent than federal or state standards, the local standards shall be followed.

1.5.6 STANDARDS

A. Standards which govern asbestos abatement activities include, but are not limited to, the following:
1. American National Standards Institute (ANSI) Z9.2-79 - Fundamentals Governing the Design and Operation of Local Exhaust Systems and ANSI Z88.2 - Practices for Respiratory Protection.
2. Underwriters Laboratories (UL) 586-90 - UL Standard for Safety of HEPA Filter Units, 7th Edition.

B. Standards which govern encapsulation work include, but are not limited to the following:
1. American Society for Testing and Materials (ASTM)

C. Standards which govern the fire and safety concerns in abatement work include, but are not limited to, the following:
1. National Fire Protection Association (NFPA) 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.
2. NFPA 701 - Standard Methods for Fire Tests for Flame Resistant Textiles and Film.
3. NFPA 101 - Life Safety Code

1.5.7 EPA GUIDANCE DOCUMENTS

A. EPA guidance documents which discuss asbestos abatement work activities are listed below. These documents are made part of this section by reference. EPA publications can be ordered from (800) 424-9065.
B. Guidance for Controlling ACM in Buildings (Purple Book) EPA 560/5-85-024
C. Asbestos Waste Management Guidance EPA 530-SW-85-007
D. A Guide to Respiratory Protection for the Asbestos Abatement Industry EPA-560-OPTS-86-001
E. Guide to Managing Asbestos in Place (Green Book) TS 799 20T July 1990

1.5.8 NOTICES

A. State and Local agencies: Send written notification as required by state and local regulations including the local fire department prior to beginning any work on ACM as follows:
B. Copies of notifications shall be submitted to the VA for the facility's records in the same time frame notification are given to EPA, State, and Local authorities.

1.5.9 PERMITS/LICENSES

A. The contractor shall apply for and have all required permits and licenses to perform asbestos abatement work as required by Federal, State, and Local regulations. This shall include the 10-day prior start of abatement notification to the proper federal and or state EPA NESHAP-authority.

1.5.10 POSTING AND FILING OF REGULATIONS

A. Maintain two (2) copies of applicable federal, state, and local regulations. Post one copy of each in the clean room at the regulated area where workers shall have daily access to the regulations and keep another copy in the Contractor's office.

1.5.11 VA RESPONSIBILITIES

Prior to commencement of work:

A. Notify occupants adjacent to regulated areas of project dates and requirements for relocation, if needed. Arrangements shall be made prior to starting work for relocation of desks, files, equipment and personal possessions to avoid unauthorized access into the regulated area. **Note: Notification of adjacent personnel is required by OSHA in 29 CFR 1926.1101 (k) to prevent unnecessary or unauthorized access to the regulated area.**
B. Submit to the Contractor results of background air sampling; including location of samples, person who collected the samples, equipment utilized, calibration data and method of analysis. During abatement, submit to the Contractor, results of bulk material analysis and air sampling data collected during the course of the abatement. This information shall not release the Contractor from any responsibility for OSHA compliance.

1.5.12 EMERGENCY ACTION PLAN AND ARRANGEMENTS

A. An Emergency Action Plan shall be developed prior to commencing abatement activities and shall be agreed to by the Contractor and the VA. The Plan shall meet the requirements of 29 CFR 1910.38 (a);(b).
B. Emergency procedures shall be in written form and prominently posted in the clean room and equipment room of the decontamination unit. Everyone, prior to entering the regulated area, shall read and sign these procedures

to acknowledge understanding of the regulated area layout, location of emergency exits and emergency procedures.

C. Emergency planning shall include written notification of police, fire, and emergency medical personnel of planned abatement activities; work schedule; layout of regulated area; and access to the regulated area, particularly barriers that may affect response capabilities.

D. Emergency planning shall include consideration of fire, explosion, hazardous atmospheres, electrical hazards, slips/trips and falls, confined spaces, and heat stress illness. Written procedures for response to emergency situations shall be developed and employee training in procedures shall be provided.

E. Employees shall be trained in regulated area/site evacuation procedures in the event of workplace emergencies.
   1. For non-life-threatening situations - employees injured or otherwise incapacitated shall decontaminate following normal procedures with assistance from fellow workers, if necessary, before exiting the regulated area to obtain proper medical treatment.
   2. For life-threatening injury or illness, worker decontamination shall take least priority after measures to stabilize the injured worker, remove them from the regulated area, and secure proper medical treatment.

F. Telephone numbers of any/all emergency response personnel shall be prominently posted in the clean room, along with the location of the nearest telephone.

G. The Contractor shall provide verification of first aid/CPR training for personnel responsible for providing first aid/CPR. OSHA requires medical assistance within 3-4 minutes of a life-threatening injury/illness. Bloodborne Pathogen training shall also be verified for those personnel required to provide first aid/CPR.

H. The Emergency Action Plan shall provide for a Contingency Plan in the event that an incident occurs that may require the modification of the standard operating procedures during abatement. Such incidents include, but are not limited to, fire; accident; power failure; negative pressure failure; and supplied air system failure. The Contractor shall detail procedures to be followed in the event of an incident assuring that asbestos abatement work is stopped and wetting is continued until correction of the problem.

1.5.13 PRE-CONSTRUCTION MEETING

Prior to commencing the work, the Contractor shall meet with the VA Certified Industrial Hygienist (VPCIH) to present and review, as appropriate, the items following this paragraph. The Contractor's Competent Person(s) who shall be on-site shall participate in the pre-start meeting. The pre-start meeting is to discuss and determine procedures to be used during the project. At this meeting, the Contractor shall provide:

A. Proof of Contractor licensing.

B. Proof the Competent Person(s) is trained and accredited and approved for working in this State. Verification of the experience of the Competent Person(s) shall also be presented.

C. A list of all workers who shall participate in the project, including experience and verification of training and accreditation.

D. A list of and verification of training for all personnel who have current first-aid/CPR training. A minimum of one person per shift shall have adequate training.
E. Current medical written opinions for all personnel working on-site meeting the requirements of 29 CFR 1926.1101 (m).
F. Current fit-tests for all personnel wearing respirators on-site meeting the requirements of 29 CFR 1926.1101 (h) and Appendix C.
G. A copy of the Contractor's Asbestos Hazard Abatement Plan. In these procedures, the following information shall be detailed, specific for this project.
   1. Regulated area preparation procedures;
   2. Notification requirements procedure of Contractor as required in 29 CFR 1926.1101 (d);
   3. Decontamination area set-up/layout and decontamination procedures for employees;
   4. Abatement methods/procedures and equipment to be used;
   5. Personal protective equipment to be used;
H. At this meeting the Contractor shall provide all submittals as required.
I. Procedures for handling, packaging and disposal of asbestos waste.
J. Emergency Action Plan and Contingency Plan Procedures.

1.6 PROJECT COORDINATION

The following are the minimum administrative and supervisory personnel necessary for coordination of the work.

1.6.1 PERSONNEL

A. Administrative and supervisory personnel shall consist of a qualified Competent Person(s) as defined by OSHA in the Construction Standards and the Asbestos Construction Standard; Contractor Professional Industrial Hygienist and Industrial Hygiene Technicians. These employees are the Contractor's representatives responsible for compliance with these specifications and all other applicable requirements.
B. Non-supervisory personnel shall consist of an adequate number of qualified personnel to meet the schedule requirements of the project. Personnel shall meet required qualifications. Personnel utilized on-site shall be pre-approved by the VA representative. A request for approval shall be submitted for any person to be employed during the project giving the person's name; social security number; qualifications; accreditation card with color picture; Certificate of Worker's Acknowledgment; and Affidavit of Medical Surveillance and Respiratory Protection and current Respirator Fit Test.
C. Minimum qualifications for Contractor and assigned personnel are:
   1. The Contractor has conducted within the last three (3) years, three (3) projects of similar complexity and dollar value as this project; has not been cited and penalized for serious violations of federal (and state as applicable) EPA and OSHA asbestos regulations in the past three (3) years; has adequate liability/occurrence insurance for asbestos work as required by the state; is licensed in applicable states; has adequate and qualified personnel available to complete the work; has comprehensive standard operating procedures for asbestos work; has adequate materials, equipment and supplies to perform the work.
   2. The Competent Person has three (3) years of abatement experience of which two (2) years were as the Competent Person on the project; meets the OSHA definition of a Competent Person; has been the Competent

Person on two (2) projects of similar size and complexity as this project within the past three (3) years; has completed EPA AHERA/OSHA/State/Local training requirements/accreditation(s) and refreshers; and has all required OSHA documentation related to medical and respiratory protection.

3. The Contractor Professional Industrial Hygienist/CIH (CPIH/CIH) shall have three (3) years of monitoring experience and supervision of asbestos abatement projects; has participated as senior IH on five (5) abatement projects, three (3) of which are similar in size and complexity as this project; has developed at least one complete standard operating procedure for asbestos abatement; has trained abatement personnel for three (3) years; has specialized EPA AHERA/OSHA training in asbestos abatement management, respiratory protection, waste disposal and asbestos inspection; has completed the NIOSH 582 Course or equivalent, Contractor/Supervisor course; and has appropriate medical/respiratory protection records/documentation.
4. The Abatement Personnel shall have completed the EPA AHERA/OSHA abatement worker course; have training on the standard operating procedures of the Contractor; has one year of asbestos abatement experience within the past three (3) years of similar size and complexity; has applicable medical and respiratory protection documentation; has certificate of training/current refresher and State accreditation/license.

All personnel shall be in compliance with OSHA construction safety training as applicable and submit certification.

1.7 RESPIRATORY PROTECTION

1.7.1 GENERAL - RESPIRATORY PROTECTION PROGRAM

The Contractor shall develop and implement a written Respiratory Protection Program (RPP) which is in compliance with the January 8, 1998 OSHA requirements found at 29 CFR 1926.1101 and 29 CFR 1910.Subpart I;134. ANSI Standard Z88.2-1992 provides excellent guidance for developing a respiratory protection program. All respirators used shall be NIOSH approved for asbestos abatement activities. The written RPP shall, at a minimum, contain the basic requirements found at 29 CFR 1910.134 (c)(1)(i - ix) - Respiratory Protection Program.

1.7.2 RESPIRATORY PROTECTION PROGRAM COORDINATOR

The Respiratory Protection Program Coordinator (RPPC) shall be identified and shall have two (2) years of experience coordinating RPP of similar size and complexity. The RPPC shall submit a signed statement attesting to the fact that the program meets the above requirements.

1.7.3 SELECTION AND USE OF RESPIRATORS

The procedure for the selection and use of respirators shall be submitted to the VA as part of the Contractor's qualifications. The procedure shall be written clearly enough for workers to understand. A copy of the Respiratory Protection Program shall be available in the clean room of the decontamination unit for reference by employees or authorized visitors.

1.7.4 MINIMUM RESPIRATORY PROTECTION

Minimum respiratory protection shall be a full face powered air purifying respirator when fiber levels are maintained consistently at or below 0.5 f/cc. A higher level of respiratory protection may be provided or required, depending on fiber levels. Respirator selection shall meet the requirements of 29 CFR 1926.1101 (h); Table 1, except as indicated in this paragraph. Abatement personnel shall have a respirator for their exclusive use.

1.7.5 MEDICAL WRITTEN OPINION

No employee shall be allowed to wear a respirator unless a physician or other licensed health care professional has provided a written determination they are medically qualified to wear the class of respirator to be used on the project while wearing whole body impermeable garments and subjected to heat or cold stress.

1.7.6 RESPIRATOR FIT TEST

All personnel wearing respirators shall have a current qualitative/quantitative fit test which was conducted in accordance with 29 CFR 1910.134 (f) and Appendix A. Quantitative fit tests shall be done for PAPRs which have been put into a motor/blower failure mode.

1.7.7 RESPIRATOR FIT CHECK

The Competent Person shall assure that the positive/negative pressure user seal check is done each time the respirator is donned by an employee. Head coverings shall cover respirator head straps. Any situation that prevents an effective facepiece to face seal as evidenced by failure of a user seal check shall preclude that person from wearing a respirator inside the regulated area until resolution of the problem.

1.7.8 MAINTENANCE AND CARE OF RESPIRATORS

The Respiratory Protection Program Coordinator shall submit evidence and documentation showing compliance with 29 CFR 1910.134 (h) Maintenance and Care of Respirators.

1.7.9 SUPPLIED AIR SYSTEMS

If a supplied air system is used, the system shall meet all requirements of 29 CFR 1910.134 and the ANSI/Compressed Gas Association (CGA) Commodity Specification for Air current requirements for Type 1 - Grade D breathing air. Low pressure systems shall not be used on asbestos abatement projects. Supplied Air respirator use shall be in accordance with EPA/NIOSH publication EPA-560-OPTS-86-001 "A Guide to Respiratory Protection for the Asbestos Abatement Industry". The competent person on site shall be responsible for the supplied air system to ensure the safety of the worker.

1.8 WORKER PROTECTION

1.8.1 TRAINING OF ABATEMENT PERSONNEL

Prior to beginning any abatement activity, all personnel shall be trained in accordance with OSHA 29 CFR 1926.1101 (k)(9) and any additional State/Local requirements. Training shall include, at a minimum, the elements listed at 29 CFR 1926.1101 (k)(9)(viii). Training shall have

been conducted by a third party, EPA/State approved trainer meeting the requirements of EPA 40 CFR 763 Appendix C (AHERA MAP). Initial training certificates and current refresher and accreditation proof shall be submitted for each person working at the site.

1.8.2 MEDICAL EXAMINATIONS

Medical examinations meeting the requirements of 29 CFR 1926.1101 (m) shall be provided for all personnel working in the regulated area, regardless of exposure levels. A current physician's written opinion as required by 29 CFR 1926.1101 (m)(4) shall be provided for each person and shall include in the medical opinion the person has been evaluated for working in a heat and cold stress environment while wearing personal protective equipment (PPE) and is able to perform the work without risk of material health impairment.

1.8.3 REGULATED AREA ENTRY PROCEDURE

The Competent Person shall ensure that each time workers enter the regulated area; they remove ALL street clothes in the clean room of the decontamination unit and put on new disposable coveralls, head coverings, a clean respirator, and then proceed through the shower room to the equipment room where they put on non-disposable required personal protective equipment.

1.8.4 DECONTAMINATION PROCEDURE

The Competent Person shall require all personnel to adhere to following decontamination procedures whenever they leave the regulated area.

A. When exiting the regulated area, remove disposable coveralls, and ALL other clothes, disposable head coverings, and foot coverings or boots in the equipment room.
B. Still wearing the respirator and completely naked, proceed to the shower. Showering is MANDATORY. Care shall be taken to follow reasonable procedures in removing the respirator to avoid inhaling asbestos fibers while showering. The following procedure is required as a minimum:
   1. Thoroughly wet body including hair and face. If using a PAPR hold blower above head to keep filters dry.
   2. With respirator still in place, thoroughly decontaminate body, hair, respirator face piece, and all other parts of the respirator except the blower and battery pack on a PAPR. Pay particular attention to cleaning the seal between the face and respirator facepiece and under the respirator straps.
   3. Take a deep breath, hold it and/or exhale slowly, completely wetting hair, face, and respirator. While still holding breath, remove the respirator and hold it away from the face before starting to breathe.
C. Carefully decontaminate the facepiece of the respirator inside and out. If using a PAPR, shut down using the following sequence: a) first cap inlets to filters; b) turn blower off to keep debris collected on the inlet side of the filter from dislodging and contaminating the outside of the unit; c) thoroughly decontaminate blower and hoses; d) carefully decontaminate battery pack with a wet rag being cautious of getting water in the battery pack thus preventing destruction. **(THIS PROCEDURE IS NOT A SUBSTITUTE FOR RESPIRATOR CLEANING!)**
D. Shower and wash body completely with soap and water. Rinse thoroughly.
E. Rinse shower room walls and floor to drain prior to exiting.

F. Proceed from shower to clean room; dry off and change into street clothes or into new disposable work clothing.

1.8.5 REGULATED AREA REQUIREMENTS

The Competent Person shall meet all requirements of 29 CFR 1926.1101 (o) and assure that all requirements for regulated areas at 29 CFR 1926.1101 (e) are met. All personnel in the regulated area shall not be allowed to eat, drink, smoke, chew tobacco or gum, apply cosmetics, or in any way interfere with the fit of their respirator.

1.9 DECONTAMINATION FACILITIES

1.9.1 DESCRIPTION

Provide each regulated area with separate personnel decontamination facilities (PDF) and waste/equipment decontamination facilities (W/EDF). Ensure that the PDF are the only means of ingress and egress to the regulated area and that all equipment, bagged waste, and other material exit the regulated area only through the W/EDF.

1.9.2 GENERAL REQUIREMENTS

All personnel entering or exiting a regulated area shall go through the PDF and shall follow the requirements at 29 CFR 1926.1101 (j)(1) and these specifications. All waste, equipment and contaminated materials shall exit the regulated area through the W/EDF and be decontaminated in accordance with these specifications. Walls and ceilings of the PDF and W/EDF shall be constructed of a minimum of 3 layers of 6 mil opaque fire retardant polyethylene sheeting and be securely attached to existing building components and/or an adequate temporary framework. A minimum of 3 layers of 6 mil poly shall also be used to cover the floor under the PDF and W/EDF units. Construct doors so that they overlap and secure to adjacent surfaces. Weight inner doorway sheets with layers of duct tape so that they close quickly after release. Put arrows on sheets so they show direction of travel and overlap. If the building adjacent area is occupied, construct a solid barrier on the occupied side(s) to protect the sheeting and reduce potential for non-authorized personnel entering the regulated area.

1.9.3 TEMPORARY FACILITIES TO THE PDF AND W/EDF

The Competent Person shall provide temporary water service connections to the PDF and W/EDF. Backflow prevention shall be provided at the point of connection to the VA system. Water supply shall be of adequate pressure and meet requirements of 29 CFR 1910.141(d)(3). Provide adequate temporary overhead electric power with ground fault circuit interruption (GFCI) protection. Provide a sub-panel equipped with GFCI protection for all temporary power in the clean room. Provide adequate lighting to provide a minimum of 50 foot candles in the PDF and W/EDF. Provide temporary heat, if needed, to maintain 70°F throughout the PDF and W/EDF.

1.9.4 PERSONNEL DECONTAMINATION FACILITY (PDF)

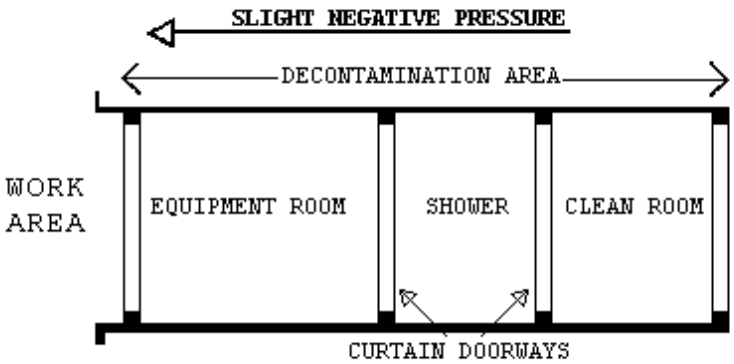
The Competent Person shall provide a PDF consisting of shower room which is contiguous to a clean room and equipment room which is connected to the regulated area. The PDF shall be sized to accommodate the number of personnel scheduled for the project. The shower room, located in the center of the PDF, shall be fitted with as many portable showers as necessary to insure all employees can complete the entire decontamination

procedure within 15 minutes. The PDF shall be constructed of opaque poly for privacy. The PDF shall be constructed to eliminate any parallel routes of egress without showering.

1. Clean Room: The clean room shall be physically and visually separated from the rest of the building to protect the privacy of personnel changing clothes. The clean room shall be constructed of at least 3 layers of 6 mil opaque fire retardant poly to provide an air tight room. Provide a minimum of 2 - 900 mm (3 foot) wide 6 mil poly opaque fire retardant doorways. One doorway shall be the entry from outside the PDF and the second doorway shall be to the shower room of the PDF. The floor of the clean room shall be maintained in a clean, dry condition. Shower overflow shall not be allowed into the clean room. Provide 1 storage locker per person. A portable fire extinguisher, minimum 10 pounds capacity, Type ABC, shall be provided in accordance with OSHA and NFPA Standard 10. All persons entering the regulated area shall remove all street clothing in the clean room and dress in disposable protective clothing and respiratory protection. Any person entering the clean room does so either from the outside with street clothing on or is coming from the shower room completely naked and thoroughly washed. Females required to enter the regulated area shall be ensured of their privacy throughout the entry/exit process by posting guards at both entry points to the PDF so no male can enter or exit the PDF during her stay in the PDF.
2. Shower Room: The Competent Person shall assure that the shower room is a completely water tight compartment to be used for the movement of all personnel from the clean room to the equipment room and for the showering of all personnel going from the equipment room to the clean room. Each shower shall be constructed so water runs down the walls of the shower and into a drip pan. Install a freely draining smooth floor on top of the shower pan. The shower room shall be separated from the rest of the building and from the clean room and equipment room using air tight walls made from at least 3 layers of 6 mil opaque fire retardant poly. The shower shall be equipped with a shower head and controls, hot and cold water, drainage, soap dish and continuous supply of soap, and shall be maintained in a sanitary condition throughout its use. The controls shall be arranged so an individual can shower without assistance. Provide a flexible hose shower head, hose bibs and all other items shown on Shower Schematic. Waste water shall be pumped to a drain after being filtered through a minimum of a 100 micron sock in the shower drain; a 20 micron filter; and a final 5 micron filter. Filters shall be changed a minimum of daily or more often as needed. Filter changes shall be done in the shower to prevent loss of contaminated water. Hose down all shower surfaces after each shift and clean any debris from the shower pan. Residue shall be disposed of as asbestos waste.
3. Equipment Room: The Competent Person shall provide an equipment room which shall be an air tight compartment for the storage of work equipment/tools, reusable personal protective equipment, except for a respirator and for use as a gross decontamination area for personnel exiting the regulated area. The equipment room shall be separated from the regulated area by a minimum 3 foot wide door made with 2 layers of 6 mil opaque fire retardant poly. The equipment room shall be separated from the regulated area, the shower room and the rest of the building by air tight walls and ceiling constructed of a minimum of 3 layers of 6 mil opaque fire retardant poly. Damp wipe all surfaces of the equipment room after each shift change. Provide an additional loose

layer of 6 mil fire retardant poly per shift change and remove this layer after each shift. If needed, provide a temporary electrical sub-panel equipped with GFCI in the equipment room to accommodate any equipment required in the regulated area.

4. The PDF shall be as follows: Clean room at the entrance followed by a shower room followed by an equipment room leading to the regulated area. Each doorway in the PDF shall be a minimum of 2 layers of 6 mil opaque fire retardant poly.



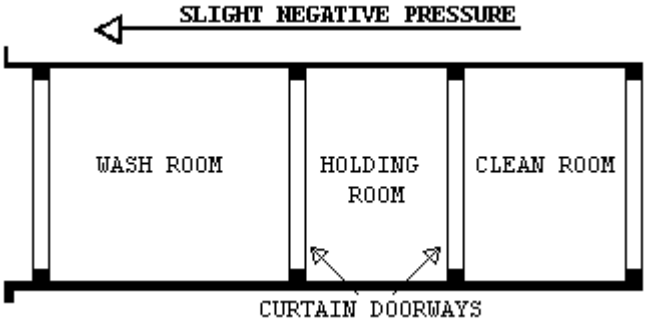
1.9.5 WASTE/EQUIPMENT DECONTAMINATION FACILITY (W/EDF)

The Competent Person shall provide an W/EDF consisting of a wash room, holding room, and clean room for removal of waste, equipment and contaminated material from the regulated area. Personnel shall not enter or exit the W/EDF except in the event of an emergency. Clean debris and residue in the W/EDF daily. All surfaces in the W/EDF shall be wiped/hosed down after each shift and all debris shall be cleaned from the shower pan. The W/EDF shall consist of the following:

1. Wash Down Station: Provide an enclosed shower unit in the regulated area just outside the Wash Room as an equipment bag and container cleaning station.
2. Wash Room: Provide a wash room for cleaning of bagged or containerized asbestos containing waste materials passed from the regulated area. Construct the wash room using 50 x 100 mm (2" x 4") wood framing and 3 layers of 6 mil fire retardant poly. Locate the wash room so that packaged materials, after being wiped clean, can be passed to the Holding Room. Doorways in the wash room shall be constructed of 2 layers of 6 mil fire retardant poly.
3. Holding Room: Provide a holding room as a drop location for bagged materials passed from the wash room. Construct the holding room using 50 x 100 mm (2" x 4") wood framing and 3 layers of 6 mil fire retardant poly. The holding room shall be located so that bagged material cannot be passed from the wash room to the clean room unless it goes through the holding room. Doorways in the holding room shall be constructed of 2 layers of 6 mil fire retardant poly.
4. Clean Room: Provide a clean room to isolate the holding room from the exterior of the regulated area. Construct the clean room using 2 x 4 wood framing and 2 layers of 6 mil fire retardant poly. The clean room shall be located so as to provide access to the holding room from the building exterior. Doorways to the clean room shall be constructed of 2 layers of 6 mil fire retardant poly. When a negative pressure

differential system is used, a rigid enclosure separation between the W/EDF clean room and the adjacent areas shall be provided.

5. The W/EDF shall be as follows: Wash Room leading to a Holding Room followed by a Clean Room leading to outside the regulated area. See diagram.



1.9.6 WASTE/EQUIPMENT DECONTAMINATION PROCEDURES

At the washdown station in the regulated area, thoroughly wet clean contaminated equipment and/or sealed polyethylene bags and pass into Wash Room after visual inspection. When passing anything into the Wash Room, close all doorways of the W/EDF, other than the doorway between the washdown station and the Wash Room. Keep all outside personnel clear of the W/EDF. Once inside the Wash Room, wet clean the equipment and/or bags. After cleaning and inspection, pass items into the Holding Room. Close all doorways except the doorway between the Holding Room and the Clean Room. Workers from the Clean Room/Exterior shall enter the Holding Room and remove the decontaminated/cleaned equipment/bags for removal and disposal. These personnel shall not be required to wear PPE. At no time shall personnel from the clean side be allowed to enter the Wash Room.

PART 2 - PRODUCTS, MATERIALS AND EQUIPMENT

2.1 MATERIALS AND EQUIPMENT

2.1.1 GENERAL REQUIREMENTS

Prior to the start of work, the contractor shall provide and maintain a sufficient quantity of materials and equipment to assure continuous and efficient work throughout the duration of the project. Work shall not start unless the following items have been delivered to the site and the CPIH/CIH has submitted verification to the VA's representative.

A. All materials shall be delivered in their original package, container or bundle bearing the name of the manufacturer and the brand name (where applicable).
B. Store all materials subject to damage off the ground, away from wet or damp surfaces and under cover sufficient enough to prevent damage or contamination. Flammable and combustible materials cannot be stored inside buildings. Replacement materials shall be stored outside of the regulated area until abatement is completed.
C. The Contractor shall not block or hinder use of buildings by patients, staff, and visitors to the VA in partially occupied buildings by placing materials/equipment in any unauthorized location.

D. The Competent Person shall inspect for damaged, deteriorating or previously used materials. Such materials shall not be used and shall be removed from the worksite and disposed of properly.
E. Polyethylene sheeting for walls in the regulated area shall be a minimum of 4-mils. For floors and all other uses, sheeting of at least 6-mil shall be used in widths selected to minimize the frequency of joints. Fire retardant poly shall be used throughout.
F. The method of attaching polyethylene sheeting shall be agreed upon in advance by the Contractor and the VA and selected to minimize damage to equipment and surfaces. Method of attachment may include any combination of moisture resistant duct tape furring strips, spray glue, staples, nails, screws, lumber and plywood for enclosures or other effective procedures capable of sealing polyethylene to dissimilar finished or unfinished surfaces under both wet and dry conditions.
G. Polyethylene sheeting utilized for the PDF shall be opaque white or black in color, 6 mil fire retardant poly.
H. Installation and plumbing hardware, showers, hoses, drain pans, sump pumps and waste water filtration system shall be provided by the Contractor.
I. An adequate number of HEPA vacuums, scrapers, sprayers, nylon brushes, brooms, disposable mops, rags, sponges, staple guns, shovels, ladders and scaffolding of suitable height and length as well as meeting OSHA requirements, fall protection devices, water hose to reach all areas in the regulated area, airless spray equipment, and any other tools, materials or equipment required to conduct the abatement project. All electrically operated hand tools, equipment, electric cords shall be connected to GFCI protection.
J. Special protection for objects in the regulated area shall be detailed (e.g., plywood over carpeting or hardwood floors to prevent damage from scaffolds, water and falling material).
K. Disposal bags – 2 layers of 6 mil poly for asbestos waste shall be pre-printed with labels, markings and address as required by OSHA, EPA and DOT regulations.
L. The VA shall be provided an advance copy of the MSDS as required for all hazardous chemicals under OSHA 29 CFR 1910.1200 - Hazard Communication in the pre-start meeting submittal. Chlorinated compounds shall not be used with any spray adhesive, mastic remover or other product. Appropriate encapsulant(s) shall be provided.
M. OSHA DANGER demarcation signs, as many and as required by OSHA 29 CFR 1926.1101(k)(7) shall be provided and placed by the Competent Person. All other posters and notices required by Federal and State regulations shall be posted in the Clean Room.
N. Adequate and appropriate PPE for the project and number of personnel/shifts shall be provided. All personal protective equipment issued shall be based on a written hazard assessment conducted under 29 CFR 1910.132(d).

2.2 MONITORING, INSPECTION AND TESTING

2.2.1 GENERAL

A. Perform throughout abatement work monitoring, inspection and testing inside and around the regulated area in accordance with the OSHA requirements and these specifications. OSHA requires that the employee exposure to asbestos shall not exceed 0.1 fiber per cubic centimeter (f/cc) of air, averaged over an 8-hour work shift. The CPIH/CIH is responsible for and shall inspect and oversee the performance of the Contractor IH Technician. The IH Technician shall continuously inspect and monitor conditions inside the regulated area to ensure compliance with these specifications. In addition, the CPIH/CIH shall personally manage air sample collection, analysis, and evaluation for personnel, regulated area, and adjacent area samples to satisfy OSHA requirements. Additional inspection and testing requirements are also indicated in other parts of this specification.

B. The VA shall employ an independent industrial hygienist (VPIH/CIH) consultant and/or use its own IH to perform various services on behalf of the VA. The VPIH/CIH shall perform the necessary monitoring, inspection, testing, and other support services to ensure that VA patients, employees, and visitors shall not be adversely affected by the abatement work, and that the abatement work proceeds in accordance with these specifications, that the abated areas or abated buildings have been successfully decontaminated. The work of the VPIH/CIH consultant in no way relieves the Contractor from their responsibility to perform the work in accordance with contract/specification requirements, to perform continuous inspection, monitoring and testing for the safety of their employees, and to perform other such services as specified. The cost of the VPIH/CIH and their services shall be borne by the VA except for any repeat of final inspection and testing that may be required due to unsatisfactory initial results. Any repeated final inspections and/or testing, if required, shall be paid for by the Contractor.

C. If fibers counted by the VPIH/CIH during abatement work, either inside or outside the regulated area, utilizing the NIOSH 7400 air monitoring method, exceed the specified respective limits, the Contractor shall stop work. The Contractor may request confirmation of the results by analysis of the samples by TEM. Request shall be in writing and submitted to the VA's representative. Cost for the confirmation of results shall be borne by the Contractor for both the collection and analysis of samples and for the time delay that may/does result for this confirmation. Confirmation sampling and analysis shall be the responsibility of the CPIH with review and approval of the VPIH/CIH. An agreement between the CPIH/CIH and the VPIH/CIH shall be reached on the exact details of the confirmation effort, in writing, including such things as the number of samples, location, collection, quality control on-site, analytical laboratory, interpretation of results and any follow-up actions. This written agreement shall be co-signed by the IH's and delivered to the VA's representative.

2.2.2 SCOPE OF SERVICES OF THE VPIH/CIH CONSULTANT

A. The purpose of the work of the VPIH/CIH is to: assure quality; adherence to the specification; resolve problems; prevent the spread of contamination beyond the regulated area; and assure clearance at the end of the project. In addition, their work includes performing the final

inspection and testing to determine whether the regulated area or building has been adequately decontaminated. All air monitoring shall be done utilizing PCM/TEM. The VPIH/CIH shall perform the following tasks:

1. Task 1: Establish background levels before abatement begins by collecting background samples. Retain samples for possible TEM analysis.
2. Task 2: Perform continuous air monitoring, inspection, and testing outside the regulated area during actual abatement work to detect any faults in the regulated area isolation and any adverse impact on the surroundings from regulated area activities.
3. Task 3: Perform unannounced visits to spot check overall compliance of work with contract/specifications. These visits may include any inspection, monitoring, and testing inside and outside the regulated area and all aspects of the operation except personnel monitoring.
4. Task 4: Provide support to the VA representative such as evaluation of submittals from the Contractor, resolution of conflicts, and interpret data.
5. Task 5: Perform , in the presence of the VA representative, final inspection and testing of a decontaminated regulated area at the conclusion of the abatement to certify compliance with all regulations and VA requirements/specifications in the final project monitoring report.
6. Task 6: Issue certificate of acceptable visual inspection and passing air clearance for each regulated area and a final project monitoring report.

B. All documentation, inspection results and testing results generated by the VPIH/CIH shall be available to the Contractor for information and consideration. The Contractor shall cooperate with and support the VPIH/CIH for efficient and smooth performance of their work.

C. The monitoring and inspection results of the VPIH/CIH shall be used by the VA to issue any Stop Removal orders to the Contractor during abatement work and to accept or reject a regulated area or building as decontaminated.

2.2.3 MONITORING, INSPECTION AND TESTING BY CONTRACTOR CPIH/CIH

The Contractor’s CPIH/CIH is responsible for managing all monitoring, inspections, and testing required by these specifications, as well as any and all regulatory requirements adopted by these specifications. The CPIH/CIH is responsible for the continuous monitoring of all subsystems and procedures which could affect the health and safety of the Contractor’s personnel. Safety and health conditions and the provision of those conditions inside the regulated area for all persons entering the regulated area is the exclusive responsibility of the Contractor/Competent Person. The person performing the personnel and area air monitoring inside the regulated area shall be an IH Technician, who shall be trained and shall have specialized field experience in sampling and analysis. The IH Technician shall have successfully completed a NIOSH 582 Course or equivalent and provide documentation. The IH Technician shall participate in the AIHA Asbestos Analysis Registry or participate in the Proficiency Analytic Testing program of AIHA for fiber counting quality control assurance. The IH Technician shall also be an accredited EPA AHERA/State Contractor/Supervisor or Abatement Worker and Building Inspector. The IH Technician shall have participated in five abatement projects collecting personal and area samples as well as responsibility

for documentation on substantially similar projects in size and scope. The analytic laboratory used by the Contractor to analyze the samples shall be AIHA accredited for asbestos PAT and approved by the VA prior to start of the project. A daily log shall be maintained by the CPIH/CIH or IH Technician, documenting all OSHA requirements for air personal monitoring for asbestos in 29 CFR 1926.1101(f), (g) and Appendix A. This log shall be made available to the VA representative and the VPIH/CIH upon request. The log shall contain, at a minimum, information on personnel or area samples, other persons represented by the sample, the date of sample collection, start and stop times for sampling, sample volume, flow rate, and fibers/cc. The CPIH/CIH shall collect and analyze samples for each representative job being done in the regulated area, i.e., removal, wetting, clean-up, and load-out. No fewer than two personal samples per shift shall be collected and one area sample per 1,000 square feet of regulated area where abatement is taking place and one sample per shift in the clean room area shall be collected. In addition to the continuous monitoring required, the CPIH/CIH shall perform inspection and testing at the final stages of abatement for each regulated area as specified in the CPIH/CIH responsibilities. Additionally, the CPIH/CIH shall monitor and record pressure readings within the containment daily with a minimum of two readings at the beginning and at the end of a shift, and submit the data in the daily report.

2.3 ASBESTOS HAZARD ABATEMENT PLAN

The Contractor shall have established an Asbestos Hazard Abatement Plan (AHAP) in printed form and loose leaf folder consisting of simplified text, diagrams, sketches, and pictures that establish and explain clearly the procedures to be followed during all phases of the work by the Contractor's personnel. The AHAP shall be modified as needed to address specific requirements of this project and the specifications. The AHAP shall be submitted for review and approval to the VA prior to the start of any abatement work. The minimum topics and areas to be covered by the AHAPs are:

A. Minimum Personnel Qualifications
B. Emergency Action Plan/Contingency Plans and Arrangements
C. Security and Safety Procedures
D. Respiratory Protection/Personal Protective Equipment Program and Training
E. Medical Surveillance Program and Recordkeeping
F. Regulated Area Requirements - Containment Barriers/Isolation of Regulated Area
G. Decontamination Facilities and Entry/Exit Procedures (PDF and W/EDF)
H. Negative Pressure Systems Requirements
I. Monitoring, Inspections, and Testing
J. Removal Procedures for ACM
K. Removal of Contaminated Soil (if applicable)
L. Encapsulation Procedures for ACM
M. Disposal of ACM waste/equipment
N. Regulated Area Decontamination/Clean-up
O. Regulated Area Visual and Air Clearance
P. Project Completion/Closeout

2.4 SUBMITTALS

2.4.1 PRE-START MEETING SUBMITTALS

Submit to the VA a minimum of 14 days prior to the pre-start meeting the following for review and approval. Meeting this requirement is a prerequisite for the pre-start meeting for this project:

A. Submit a detailed work schedule for the entire project reflecting contract documents and the phasing/schedule requirements from the CPM chart.
B. Submit a staff organization chart showing all personnel who shall be working on the project and their capacity/function. Provide their qualifications, training, accreditations, and licenses, as appropriate. Provide a copy of the "Certificate of Worker's Acknowledgment" and the "Affidavit of Medical Surveillance and Respiratory Protection" for each person.
C. Submit Asbestos Hazard Abatement Plan developed specifically for this project, incorporating the requirements of the specifications, prepared, signed and dated by the CPIH/CIH.
D. Submit the specifics of the materials and equipment to be used for this project with manufacturer names, model numbers, performance characteristics, pictures/diagrams, and number available for the following:
   1. Supplied air system, negative air machines, HEPA vacuums, air monitoring pumps, calibration devices, pressure differential monitoring device and emergency power generating system.
   2. Waste water filtration system, shower system, containment barriers.
   3. Encapsulants, surfactants, hand held sprayers, airless sprayers, glovebags, and fire extinguishers.
   4. Respirators, protective clothing, personal protective equipment.
   5. Fire safety equipment to be used in the regulated area.
E. Submit the name, location, and phone number of the approved landfill; proof/verification the landfill is approved for ACM disposal; the landfill's requirements for ACM waste; the type of vehicle to be used for transportation; and name, address, and phone number of subcontractor, if used. Proof of asbestos training for transportation personnel shall be provided.
F. Submit required notifications and arrangements made with regulatory agencies having regulatory jurisdiction and the specific contingency/emergency arrangements made with local health, fire, ambulance, hospital authorities and any other notifications/arrangements.
G. Submit the name, location and verification of the laboratory and/or personnel to be used for analysis of air and/or bulk samples. Personal air monitoring shall be done in accordance with OSHA 29 CFR 1926.1101(f) and Appendix A. Area or clearance air monitoring shall be conducted in accordance with EPA AHERA protocols.
H. Submit qualifications verification: Submit the following evidence of qualifications. Make sure that all references are current and verifiable by providing current phone numbers and documentation.
   1. Asbestos Abatement Company: Project experience within the past 3 years; listing projects first most similar to this project: Project Name; Type of Abatement; Duration; Cost; Reference Name/Phone Number; Final Clearance; Completion Date
   2. List of project(s) halted by owner, A/E, IH, regulatory agency in the last 3 years: Project Name; Reason; Date; Reference Name/Number; Resolution
   3. List asbestos regulatory citations (e.g., OSHA), notices of violations (e.g., Federal and state EPA), penalties, and legal actions taken against the company including and of the company’s officers (including

damages paid) in the last 3 years. Provide copies and all information needed for verification.

I. Submit information on personnel: Provide a resume; address each item completely; copies of certificates, accreditations, and licenses. Submit an affidavit signed by the CPIH/CIH stating that all personnel submitted below have medical records in accordance with OSHA 29 CFR 1926.1101(m) and 29 CFR 1910.20 and that the company has implemented a medical surveillance program and written respiratory protection program, and maintains recordkeeping in accordance with the above regulations. Submit the phone number and doctor/clinic/hospital used for medical evaluations.
   1. CPIH/CIH and IH Technician: Name; years of abatement experience; list of projects similar to this one; certificates, licenses, accreditations for proof of AHERA/OSHA specialized asbestos training; professional affiliations; number of workers trained; samples of training materials; samples of AHAPs developed; medical opinion; and current respirator fit test.
   2. Competent Person(s)/Supervisor(s): Number; names; social security numbers; years of abatement experience as Competent Person/Supervisor; list of similar projects in size/complexity as Competent Person/Supervisor; as a worker; certificates, licenses, accreditations; proof of AHERA/OSHA specialized asbestos training; maximum number of personnel supervised on a project; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.
   3. Workers: Numbers; names; social security numbers; years of abatement experience; certificates, licenses, accreditations; training courses in asbestos abatement and respiratory protection; medical opinion (asbestos surveillance and respirator use); and current respirator fit test.

J. Submit copies of State license for asbestos abatement; copy of insurance policy, including exclusions with a letter from agent stating in plain language the coverage provided and the fact that asbestos abatement activities are covered by the policy; copy of AHAPs incorporating the requirements of this specification; information on who provides your training, how often; who provides medical surveillance, how often; who performs and how is personal air monitoring of abatement workers conducted; a list of references of independent laboratories/IH's familiar with your air monitoring and standard operating procedures; and copies of monitoring results of the five referenced projects listed and analytical method(s) used.

K. Rented equipment shall be decontaminated prior to returning to the rental agency.

L. Submit, before the start of work, the manufacturer's technical data for all types of encapsulants, all MSDS and application instructions.

2.4.2 SUBMITTALS DURING ABATEMENT

A. The Competent Person shall maintain and submit a daily log at the regulated area documenting the dates and times of the following: purpose, attendees and summary of meetings; all personnel entering/exiting the regulated area; document and discuss the resolution of unusual events such as barrier breeching, equipment failures, emergencies, and any cause for stopping work; and representative air monitoring and results/TWA's/EL's. Submit this information daily to the VPIH/CIH.

B. The CPIH/CIH shall document and maintain the inspection and approval of the regulated area preparation prior to start of work and daily during work.
   1. Removal of any poly barriers.
   2. Visual inspection/testing by the CPIH/CIH or IH Technician prior to application of lockdown encapsulant.
   3. Packaging and removal of ACM waste from regulated area.
   4. Disposal of ACM waste materials; copies of Waste Shipment Records/landfill receipts to the VA's representative on a weekly basis.

2.4.3 SUBMITTALS AT COMPLETION OF ABATEMENT

The CPIH/CIH shall submit a project report consisting of the daily log book requirements and documentation of events during the abatement project including Waste Shipment Records signed by the landfill's agent. It shall also include information on the containment and transportation of waste from the containment with applicable Chain of Custody forms. The report shall include a certificate of completion, signed and dated by the CPIH/CIH, in accordance with Attachment #1. All clearance and perimeter area samples shall be submitted. The VA Representative shall retain the abatement report after completion of the project and provide copies of the abatement report to VAMC Office of Engineer and the Safety Office.

2.5 ENCAPSULANTS

2.5.1 TYPES OF ENCAPSULANTS

A. The following four types of encapsulants, if used, shall comply with comply with performance requirements as stated in paragraph 2.6.2:
   1. Removal encapsulant - used as a wetting agent to remove ACM.
   2. Bridging encapsulant - provides a tough, durable coating on ACM.
   3. Penetrating encapsulant - penetrates/encapsulates ACM at least 13 mm (1/2").
   4. Lockdown encapsulant - seals microscopic fibers on surfaces after ACM removal.

2.5.2 PERFORMANCE REQUIREMENTS

Encapsulants shall meet the latest requirements of EPA; shall not contain toxic or hazardous substances; or solvents; and shall comply with the following performance requirements:

A. General Requirements for all Encapsulants:
   1. ASTM E84: Flame spread of 25; smoke emission of 50.
   2. University of Pittsburgh Protocol: Combustion Toxicity; zero mortality.
   3. ASTM C732: Accelerated Aging Test; Life Expectancy - 20 years.
   4. ASTM E96: Permeability - minimum of 0.4 perms.
B. Bridging/Penetrating Encapsulants:
   1. ASTM E736: Cohesion/Adhesion Test - 24 kPa (50 lbs/ft^2).
   2. ASTM E119: Fire Resistance - 3 hours (Classified by UL for use on fibrous/cementitious fireproofing).
   3. ASTM D2794: Gardner Impact Test; Impact Resistance - minimum 11.5 kg-mm (43 in/lb).
   4. ASTM D522: Mandrel Bend Test; Flexibility - no rupture or cracking.
C. Lockdown Encapsulants:
   1. ASTM E119: Fire resistance - 3 hours (tested with fireproofing over encapsulant applied directly to steel member).

2. ASTM E736: Bond Strength - 48 kPa (100 lbs/ft^2) (test compatibility with cementitious and fibrous fireproofing).
3. In certain situations, encapsulants may have to be applied to hot pipes/equipment. The encapsulant shall be able to withstand high temperatures without cracking or off-gassing any noxious vapors during application.

2.5.3 CERTIFICATES OF COMPLIANCE

The Contractor shall submit to the VA representative certification from the manufacturer indicating compliance with performance requirements for encapsulants when applied according to manufacturer recommendations.

PART 3 - EXECUTION

3.1 REGULATED AREA PREPARATIONS

3.1.1 SITE SECURITY

A. Regulated area access shall be restricted only to authorized, trained/accredited and protected personnel. These may include the Contractor's employees, employees of Subcontractors, VA employees and representatives, State and local inspectors, and any other designated individuals. A list of authorized personnel shall be established prior to commencing the project and be posted in the clean room of the decontamination unit.

B. Entry into the regulated area by unauthorized individuals shall be reported immediately to the Competent Person by anyone observing the entry. The Competent Person shall immediately require any unauthorized person to leave the regulated area and then notify the VA Contracting Officer or VA Representative using the most expeditious means.

C. A log book shall be maintained in the clean room of the decontamination unit. Anyone who enters the regulated area shall record their name, affiliation, time in, and time out for each entry.

D. Access to the regulated area shall be through a single decontamination unit. All other access (doors, windows, hallways,) shall be sealed or locked to prevent entry to or exit from the regulated area. The only exceptions for this requirement are the waste/equipment load-out area which shall be sealed except during the removal of containerized asbestos waste from the regulated area, and emergency exits. Emergency exits shall <u>not</u> be locked from the inside; however, they shall be sealed with poly sheeting and taped until needed. In any situation where exposure to high temperatures which may result in a flame hazard, fire retardant poly sheeting shall be used.

E. The Contractor's Competent Person shall control site security during abatement operations in order to isolate work in progress and protect adjacent personnel. A 24 hour security system shall be provided at the entrance to the regulated area to assure that all entrants are logged in/out and that only authorized personnel are allowed entrance.

F. The Contractor shall have the VA's assistance in notifying adjacent personnel of the presence, location and quantity of ACM in the regulated area and enforcement of restricted access by the VA's employees.

G. The regulated area shall be locked during non-working hours and secured by VA Representative or Competent Person. The VA Police shall be informed of asbestos abatement regulated areas to provide security checks during facility rounds and emergency response.

3.1.2. SIGNAGE AND POWER MANAGEMENT

A. Post OSHA DANGER signs meeting the specifications of OSHA 29 CFR 1926.1101 at any location and approaches to the regulated area where airborne concentrations of asbestos may exceed the PEL. Signs shall be posted at a distance sufficiently far enough away from the regulated area to permit any personnel to read the sign and take the necessary measures to avoid exposure. Additional signs shall be posted following construction of the regulated area enclosure.

B. Shut down and lock out/tag out electric power to the regulated area. Provide temporary power and lighting. Insure safe installation including GFCI of temporary power sources and equipment by compliance with all applicable electrical code and OSHA requirements for temporary electrical systems. Electricity shall be provided by the VA.

C. Shut down and lock out/tag out heating, cooling, and air conditioning system (HVAC) components that are in, supply or pass through the regulated area. Investigate the regulated area and agree on pre-abatement condition with the VA's representative. Seal all intake and exhaust vents in the regulated area with duct tape and 2 layers of 6-mil poly. Also, seal any seams in system components that pass through the regulated area. Remove all contaminated HVAC system filters and place in labeled 6-mil polyethylene disposal bags for staging and eventual disposal as asbestos waste.

3.1.3 NEGATIVE PRESSURE FILTRATION SYSTEM

The Contractor shall provide enough HEPA negative air machines to effect > - 0.02” WCG pressure. The Competent Person shall determine the number of units needed for the regulated area by dividing the cubic feet in the regulated area by 15 and then dividing that result by the cubic feet per minute (CFM) for each unit to determine the number of units needed to effect > - 0.02” WCG pressure. Provide a standby unit in the event of machine failure and/or emergency in an adjacent area.
NIOSH has done extensive studies and has determined that negative air machines typically operate at ~50% efficiency. The contractor shall consider this in their determination of number of units needed to provide > - 0.02” WCG pressure. The contractor shall use double the number of machines, based on their calculations, or submit proof their machines operate at stated capacities, at a 2" pressure drop across the filters.

3.1.3.1 DESIGN AND LAYOUT

A. Before start of work submit the design and layout of the regulated area and the negative air machines. The submittal shall indicate the number of, location of and size of negative air machines. The point(s) of exhaust, air flow within the regulated area, anticipated negative pressure differential, and supporting

calculations for sizing shall be provided. In addition, submit the following:

1. Method of supplying power to the units and designation/location of the panels.
2. Description of testing method(s) for correct air volume and pressure differential.
3. If auxiliary power supply is to be provided for the negative air machines, provide a schematic diagram of the power supply and manufacturer's data on the generator and switch.

3.1.3.2 NEGATIVE AIR MACHINES (HEPA UNITS)

A. Negative Air Machine Cabinet: The cabinet shall be constructed of steel or other durable material capable of withstanding potential damage from rough handling and transportation. The width of the cabinet shall be less than 30" in order to fit in standard doorways. The cabinet shall be factory sealed to prevent asbestos fibers from being released during use, transport, or maintenance. Any access to and replacement of filters shall be from the inlet end. The unit shall be on casters or wheels.

B. Negative Air Machine Fan: The rating capacity of the fan shall indicate the CFM under actual operating conditions. Manufacturer's typically use "free-air" (no resistance) conditions when rating fans. The fan shall be a centrifugal type fan.

C. Negative Air Machine Final Filter: The final filter shall be a HEPA filter. The filter media shall be completely sealed on all edges within a structurally rigid frame. The filter shall align with a continuous flexible gasket material in the negative air machine housing to form an air tight seal. Each HEPA filter shall be certified by the manufacturer to have an efficiency of not less than 99.97%. Testing shall have been done in accordance with Military Standard MIL-STD-282 and Army Instruction Manual 136-300-175A. Each filter shall bear a UL586 label to indicate ability to perform under specified conditions. Each filter shall be marked with the name of the manufacturer, serial number, air flow rating, efficiency and resistance, and the direction of test air flow.

D. Negative Air Machine Pre-filters: The pre-filters, which protect the final HEPA filter by removing larger particles, are required to prolong the operating life of the HEPA filter. Two stages of pre-filtration are required. A first stage pre-filter shall be a low efficiency type for particles 10 µm or larger. A second stage pre-filter shall have a medium efficiency effective for particles down to 5 µm or larger. Pre-filters shall be installed either on or in the intake opening of the NAM and the second stage filter shall be held in place with a special housing or clamps.

E. Negative Air Machine Instrumentation: Each unit shall be equipped with a gauge to measure the pressure drop across the filters and to indicate when filters have become loaded and need to be changed. A table indicating the cfm for various pressure readings on the gauge shall be affixed near the gauge for reference or the reading shall indicate at what point the filters

shall be changed, noting cfm delivery. The unit shall have an elapsed time meter to show total hours of operation.

F. Negative Air Machine Safety and Warning Devices: An electrical/ mechanical lockout shall be provided to prevent the fan from being operated without a HEPA filter. Units shall be equipped with an automatic shutdown device to stop the fan in the event of a rupture in the HEPA filter or blockage in the discharge of the fan. Warning lights are required to indicate normal operation; too high a pressure drop across filters; or too low of a pressure drop across filters.

G. Negative Air Machine Electrical: All electrical components shall be approved by the National Electrical Manufacturer's Association (NEMA) and Underwriters Laboratories (UL). Each unit shall be provided with overload protection and the motor, fan, fan housing, and cabinet shall be grounded.

H. It is essential that replacement HEPA filters be tested using an "in-line" testing method, to ensure the seal around the periphery was not damaged during replacement. Damage to the outer HEPA filter seal could allow contaminated air to bypass the HEPA filter and be discharged to an inappropriate location. Contractor shall provide written documentation of test results for negative air machine units with HEPA filters changed by the contractor or documentation when changed and tested by the contractor filters

3.1.3.3 PRESSURE DIFFERENTIAL

The fully operational negative air system within the regulated area shall continuously maintain a pressure differential of -0.02" water column gauge. Before any disturbance of any asbestos material, this shall be demonstrated to the VA by use of a pressure differential meter/manometer as required by OSHA 29 CFR 1926.1101(e)(5)(i). The Competent Person shall be responsible for providing, maintaining, and documenting the negative pressure and air changes as required by OSHA and this specification.

3.1.3.4 MONITORING

The pressure differential shall be continuously monitored and recorded between the regulated area and the area outside the regulated area with a monitoring device that incorporates a strip chart recorder. The strip chart recorder shall become part of the project log and shall indicate at least -0.02" water column gauge for the duration of the project.

3.1.3.5 AUXILIARY GENERATOR

If the building is occupied during abatement, provide an auxiliary gasoline/diesel generator located outside the building in an area protected from the weather. In the event of a power failure of the general power grid and the VAMC emergency power grid, the generator shall automatically start and supply power to a minimum of 50% of the negative air machines in operation.

3.1.3.6 SUPPLEMENTAL MAKE-UP AIR INLETS

Provide, as needed for proper air flow in the regulated area, in a location approved by the VA, openings in the plastic sheeting

to allow outside air to flow into the regulated area. Auxiliary makeup air inlets shall be located as far from the negative air machines as possible, off the floor near the ceiling, and away from the barriers that separate the regulated area from the occupied clean areas. Cover the inlets with weighted flaps which shall seal in the event of failure of the negative pressure system.

3.1.3.7 TESTING THE SYSTEM

The negative pressure system shall be tested before any ACM is disturbed in any way. After the regulated area has been completely prepared, the decontamination units set up, and the negative air machines installed, start the units up one at a time. Demonstrate and document the operation and testing of the negative pressure system to the VA using smoke tubes and a negative pressure gauge. Verification and documentation of adequate negative pressure differential across each barrier shall be done at the start of each work shift.

3.1.3.8 DEMONSTRATION OF THE NEGATIVE PRESSURE FILTRATION SYSTEM

The demonstration of the operation of the negative pressure system to the VA shall include, but not be limited to, the following:

A. Plastic barriers and sheeting move lightly in toward the regulated area.
B. Curtains of the decontamination units move in toward regulated area.
C. There is a noticeable movement of air through the decontamination units. Use the smoke tube to demonstrate air movement from the clean room to the shower room to the equipment room to the regulated area.
D. Use smoke tubes to demonstrate air is moving across all areas in which work is to be done. Use a differential pressure gauge to indicate a negative pressure of at least -0.02" across every barrier separating the regulated area from the rest of the building. Modify the system as necessary to meet the above requirements.

3.1.3.9 USE OF THE NEGATIVE PRESSURE FILTRATION SYSTEM DURING ABATEMENT OPERATIONS

A. Start units before beginning any disturbance of ACM occurs. After work begins, the units shall run continuously, maintaining 4 actual air changes per hour at a negative pressure differential of -0.02" water column gauge, for the duration of the work until a final visual clearance and final air clearance has been successfully completed.
   No negative air units shall be shut down at any time unless authorized by the VA Contracting Officer, verbally and in writing.
B. Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area. After items have been pre-cleaned and decontaminated, they may be removed from the

work area for storage until the completion of abatement in the work area.

C. Abatement work shall begin at a location farthest from the units and proceed towards them. If an electric failure occurs, the Competent Person shall stop all abatement work and immediately begin wetting all exposed asbestos materials for the duration of the power outage. Abatement work shall not resume until power is restored and all units are operating properly again.

D. The negative air machines shall continue to run after all work is completed and until a final visual clearance and a final air clearance has been successfully completed for that regulated area.

3.1.3.10 DISMANTLING THE SYSTEM

After completion of the final visual and final air clearance has been obtained by the VPIH/CIH, the units may be shut down. The unit exterior surfaces shall have been completely decontaminated; pre-filters shall not be removed and the units inlet/outlet sealed with 2 layers of 6 mil poly immediately after shut down. No filter removal shall occur at the VA site following successful completion of site clearance. OSHA/EPA/DOT asbestos shall be attached to the units.

3.1.4 CONTAINMENT BARRIERS AND COVERINGS IN THE REGULATED AREA

3.1.4.1 GENERAL

Seal off the perimeter to the regulated area to completely isolate the regulated area from adjacent spaces. All surfaces in the regulated area shall be covered to prevent contamination and to facilitate clean-up. Should adjacent areas become contaminated as a result of the work, shall immediately stop work and clean up the contamination at no additional cost to the VA. Provide firestopping and identify all fire barrier penetrations due to abatement work as specified in Section 3.1.4.8; FIRESTOPPING.

3.1.4.2 PREPARATION PRIOR TO SEALING THE REGULATED AREA

Place all tools, scaffolding, materials and equipment needed for working in the regulated area prior to erecting any plastic sheeting. All uncontaminated removable furniture, equipment and/or supplies shall be removed by the VA from the regulated area before commencing work. Any objects remaining in the regulated area shall be completely covered with 2 layers of 6-mil fire retardant poly sheeting and secured with duct tape. Lock out and tag out any HVAC/electrical systems in the regulated area.

3.1.4.3 CONTROLLING ACCESS TO THE REGULATED AREA

Access to the regulated area is allowed only through the personnel decontamination facility (PDF). All other means of access shall be eliminated and OSHA DANGER demarcation signs posted as required by OSHA. If the regulated area is adjacent to, or within view of an occupied area, provide a visual barrier

of 6 mil opaque fire retardant poly to prevent building occupant observation. If the adjacent area is accessible to the public, the barrier shall be solid and capable of withstanding the negative pressure.

3.1.4.4 CRITICAL BARRIERS

Completely separate any operations in the regulated area from adjacent areas using 2 layers of 6 mil fire retardant poly and duct tape. Individually seal with 2 layers of 6 mil poly and duct tape all HVAC openings into the regulated area. Individually seal all lighting fixtures, clocks, doors, windows, convectors, speakers, or any other objects/openings in the regulated area. Heat shall be shut off any objects covered with poly.

3.1.4.5 PRIMARY BARRIERS

A. Cover the regulated area with two layers of 6 mil fire retardant poly on the floors and two layers of 6 mil, fire retardant poly on the walls, unless otherwise directed in writing by the VA representative. Floor layers shall form a right angle with the wall and turn up the wall at least 300 mm (12"). Seams shall overlap at least 1800 mm (6') and shall be spray glued and taped. Install sheeting so that layers can be removed independently from each other. Carpeting shall be covered with three layers of 6 mil poly. Corrugated cardboard sheets shall be placed between the bottom and middle layers of poly. Mechanically support and seal with duct tape and glue all wall layers.

B. If stairs and ramps are covered with 6 mil plastic, two layers shall be used. Provide 19 mm (3/4") exterior grade plywood treads held in place with duct tape/glue on the plastic. Do not cover rungs or rails with any isolation materials.

3.1.4.6 SECONDARY BARRIERS

A loose layer of 6 mil shall be used as a drop cloth to protect the primary layers from debris generated during the abatement. This layer shall be replaced as needed during the work and at a minimum once per work day.

3.1.4.7 EXTENSION OF THE REGULATED AREA

If the enclosure of the regulated area is breached in any way that could allow contamination to occur, the affected area shall be included in the regulated area and constructed as per this section. Decontamination measures shall be started immediately and continue until air monitoring indicates background levels are met.

3.1.4.8 FIRESTOPPING

A. Through penetrations caused by cables, cable trays, pipes, sleeves, and conduits shall be firestopped with a fire-rated firestop system providing an air tight seal.

B. Firestop materials that are not equal to the wall or ceiling penetrated shall be brought to the attention of the VA Representative. The contractor shall list all areas of penetration, the type of sealant used, and whether or not the location is fire rated. Any discovery of penetrations during abatement shall be brought to the attention of the VA representative immediately. All walls, floors and ceilings are considered fire rated unless otherwise determined by the VA Representative or Fire Marshall.

C. Any visible openings whether or not caused by a penetration shall be reported by the Contractor to the VA Representative for a sealant system determination. Firestops shall meet ASTM E814 and UL 1479 requirements for the opening size, penetrant, and fire rating needed.

3.1.5 SANITARY FACILITIES

The Contractor shall provide sanitary facilities for abatement personnel and maintain them in a clean and sanitary condition throughout the abatement project.

3.1.6 PERSONAL PROTECTIVE EQUIPMENT

Provide whole body clothing, head coverings, gloves and foot coverings and any other personal protective equipment as determined by conducting the hazard assessment required by OSHA at 29 CFR 1910.132 (d). The Competent Person shall ensure the integrity of personal protective equipment worn for the duration of the project. Duct tape shall be used to secure all suit sleeves to wrists and to secure foot coverings at the ankle.

3.1.7 PRE-CLEANING

The VA shall provide water for abatement purposes. The Contractor shall connect to the existing VA system. The service to the shower(s) shall be supplied with backflow prevention.

Pre-cleaning of ACM contaminated items shall be performed after the enclosure has been erected and negative pressure has been established in the work area. All workers performing pre-cleaning activities shall don appropriate personal protective equipment (PPE), as specified throughout this document and as approved in the Contractor’s work plan. After items have been pre-cleaned and decontaminated, they may be removed from the work area for storage until the completion of abatement in the work area.

Pre-clean all movable objects within the regulated area using a HEPA filtered vacuum and/or wet cleaning methods as appropriate. After cleaning, these objects shall be removed from the regulated area and carefully stored in an uncontaminated location. Drapes, clothing, upholstered furniture and other fabric items shall be disposed of as asbestos contaminated waste. Cleaning these asbestos contaminated items utilizing HEPA vacuum techniques and off-premises steam cleaning is very difficult and cannot guarantee decontamination. Carpeting shall be disposed of prior to abatement if in the regulated area. If ACM floor tile is attached to the carpet while the Contractor is removing the carpet that section of the carpet shall be disposed of as asbestos waste.

Pre-clean all surfaces in the regulated area using HEPA filtered vacuums and/or wet cleaning methods as appropriate. Do not use any methods that would raise dust such as dry sweeping or vacuuming with equipment not equipped with HEPA filters. Do not disturb asbestos-containing materials during this pre-cleaning phase. Careful attention shall be paid to machinery behind grills or gratings where access may be difficult, but contamination may be significant. Also, pay particular attention to wall, floor and ceiling penetration behind fixed items. After pre-cleaning, enclose fixed objects with 2 layers of 6-mil poly and seal securely in place with duct tape. Objects (e.g., permanent fixtures, shelves, electronic equipment, laboratory tables, sprinklers, alarm systems, closed circuit TV equipment and computer cables) which shall remain in the regulated area and that require special ventilation or enclosure requirements should be designated here along with specified means of protection. Contact the manufacturer for special protection requirements.
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3.1.8 PRE-ABATEMENT ACTIVITIES

3.1.8.1 PRE-ABATEMENT MEETING

The VA representative, upon receipt, review, and substantial approval of all pre-abatement submittals and verification by the CPIH/CIH that all materials and equipment required for the project are on the site, shall arrange for a pre-abatement meeting between the Contractor, the CPIH/CIH, Competent Person(s), the VA representative(s), and the VPIH/CIH. The purpose of the meeting is to discuss any aspect of the submittals needing clarification or amplification and to discuss any aspect of the project execution and the sequence of the operation. The Contractor shall be prepared to provide any supplemental information/documentation to the VA's representative regarding any submittals, documentation, materials or equipment. Upon satisfactory resolution of any outstanding issues, the VA's representative shall issue a written order to proceed to the Contractor. No abatement work of any kind described in the following provisions shall be initiated prior to the VA written order to proceed.

3.1.8.2 PRE-ABATEMENT CONSTRUCTION AND OPERATIONS

A. Perform all preparatory work for the first regulated area in accordance with the approved work schedule and with this specification.
B. Upon completion of all preparatory work, the CPIH/CIH shall inspect the work and systems and shall notify the VA's representative when the work is completed in accordance with this specification. The VA's representative may inspect the regulated area and the systems with the VPIH/CIH and may require that upon satisfactory inspection, the Contractor's employees perform all major aspects of the approved AHAP(s), especially worker protection, respiratory systems, contingency plans, decontamination procedures, and monitoring to demonstrate satisfactory operation. The operational systems for respiratory protection and the negative pressure system shall be demonstrated for proper performance.
C. The CPIH/CIH shall document the pre-abatement activities described above and deliver a copy to the VA's representative.

D. Upon satisfactory inspection of the installation of and operation of systems the VA's representative shall notify the Contractor in writing to proceed with the asbestos abatement work in accordance with this specification and all applicable regulations.

3.1.8.3 PRE-ABATEMENT INSPECTIONS AND PREPARATIONS

Before any work begins on the construction of the regulated area, the Contractor shall:

A. Conduct a space-by-space inspection with an authorized VA representative and prepare a written inventory of all existing damage in those spaces where asbestos abatement shall occur. Still or video photography may be used to supplement the written damage inventory. Document shall be signed and certified as accurate by both parties.
B. A NESHAPS (destructive) ACM inspection shall be conducted on all building structures that will be demolished. Ensure the following areas are inspected on the project: lay-in ceilings concealing ACM; ACM behind walls/windows from previous renovations; inside utility chases/walls; transite piping/ductwork/sheets; behind radiators; lab fume hoods; transite lab countertops; roofing materials; below window sills; water/sewer lines; electrical conduit coverings; crawlspaces (previous abatement contamination); flooring/mastic covered by carpeting/new flooring; exterior insulated wall panels; on underground fuel tanks; and steam line trench coverings.
C. Ensure that all furniture, machinery, equipment, curtains, drapes, blinds, and other movable objects required to be removed from the regulated area have been cleaned and removed or properly protected from contamination. The VA shall remove any items not contaminated prior to start of work.

D. If present and required, remove and dispose of carpeting from floors in the regulated area, unless asbestos-containing flooring is being removed, then the carpet shall be removed inside the regulated work area given the chance flooring may be loosened with carpet removal.
E. Inspect existing firestopping in the regulated area. Correct as needed.

3.2 REMOVAL OF ACM

3.2.1 WETTING ACM

A. Use amended water for the wetting of ACM prior to removal. The Competent Person shall assure the wetting of ACM meets the definition of "adequately wet" in the EPA NESHAP regulation and OSHA’s “wet methods” for the duration of the project. A removal encapsulant may be used instead of amended water with written approval of the VA's representative.
B. Amended Water: Provide water to which a surfactant has been added shall be used to wet the ACM and reduce the potential for fiber release during disturbance of ACM. The mixture shall be equal to or greater than the wetting provided by water amended by a surfactant consisting one ounce of 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with 5 gallons (19L) of water.

C. Removal Encapsulant: When authorized by VA, provide a penetrating encapsulant designed specifically for the removal of ACM. The material shall, when used, result in adequate wetting of the ACM and retard fiber release during removal.

3.2.2 SECONDARY BARRIER AND WALKWAYS

A. Install as a drop cloth a 6 mil poly sheet at the beginning of each work shift where removal is to be done during that shift. Completely cover floors and any walls within 10 feet (3 meters) of the area where work is to done. Secure the secondary barrier with duct tape to prevent it from moving or debris from getting behind it. Remove the secondary barrier at the end of the shift or as work in the area is completed. Keep residue on the secondary barrier wetted. When removing, fold inward to prevent spillage and place in a disposal bag.
B. Install walkways using 6 mil black poly between the regulated area and the decontamination facilities (PDF and W/EDF) to protect the primary layers from contamination and damage. Install the walkways at the beginning of each shift and remove at the end of each shift.

3.2.3 WET REMOVAL OF ACM

A. Adequately and thoroughly wet the ACM to be removed prior to removal with amended water or when authorized by VA, removal encapsulant to reduce/prevent fiber release to the air. Adequate time (at a minimum two hours) shall be allowed for the amended water or removal encapsulant to saturate the ACM. Abatement personnel shall not disturb dry ACM. Use a fine spray of amended water or removal encapsulant. Saturate the material sufficiently to wet to the substrate without causing excessive dripping. The material shall be sprayed repeatedly/continuously during the removal process in order to maintain adequately wet conditions. Removal encapsulants shall be applied in accordance with the manufacturer's written instructions. Perforate or carefully separate, using wet methods, an outer covering that is painted or jacketed in order to allow penetration and wetting of the material. Where necessary, carefully remove covering while wetting to minimize fiber release. **In no event shall dry removal occur except when authorized in writing by the VPIH/CIH and VA when a greater safety hazard (e.g., electricity) is present.**
B. If ACM does not wet well with amended water due to composition, coating or jacketing, remove as follows:
   1. Mist work area continuously with amended water whenever necessary to reduce airborne fiber levels.
   2. Remove saturated ACM in small sections. Do not allow material to dry out. As material is removed, bag material, while still wet into disposal bags. Twist the bag neck tightly, bend over (gooseneck) and seal with a minimum of three tight wraps of duct tape. Clean /decontaminate the outside of the bag of any residue and move to washdown station adjacent to W/EDF.
   3. Fireproofing or Architectural Finish on Scratch Coat: Spray with a fine mist of amended water or removal encapsulant. Allow time for saturation to the substrate. Do not over saturate causing excess dripping. Scrape material from substrate. Remove material in manageable quantities and control falling to staging or floor. If the falling distance is over 20 feet (6M), use a drop chute to contain material through descent. Remove residue remaining on the scratch coat after scraping is done using a stiff bristle hand brush. If a removal encapsulant is used, remove residue completely before the encapsulant

dries. Periodically re-wet the substrate with amended water as needed to prevent drying of the material before the residue is removed from the substrate.

4. Fireproofing or Architectural Finish on Wire Lath: Spray with a fine mist of amended water or removal encapsulant. Allow time to completely saturate the material. Do not over saturate causing excess dripping. If the surface has been painted or otherwise coated, cut small holes as needed and apply amended water or removal encapsulant from above. Cut saturated wire lath into 2' x 6' (50mm x 150mm) sections and cut hanger wires. Roll up complete with ACM, cover in burlap and hand place in disposal bag. Do not drop to floor. After removal of lath/ACM, remove any overspray on decking and structure using stiff bristle nylon brushes. Depending on hardness of overspray, scrapers may be needed for removal.
5. Pipe/Tank/Vessel/Boiler Insulation: Remove the outer layer of wrap while spraying with amended water in order to saturate the ACM. Spray ACM with a fine mist of amended water or removal encapsulant. Allow time to saturate the material to the substrate. Cut bands holding pre-formed pipe insulation sections. Slit jacketing at the seams, remove and hand place in a disposal bag. Do not allow dropping to the floor. Remove molded fitting insulation/mud in large pieces and hand place in a disposal bag. Remove any residue on pipe or fitting with a stiff bristle nylon brush. In locations where pipe fitting insulation is removed from fibrous glass or other non-asbestos insulated straight runs of pipe, remove fibrous material at least 6" from the point it contacts the ACM.

3.2.4 WET REMOVAL OF AMOSITE

A. The following areas shown on drawings indicate locations of amosite ACM which shall require local exhaust ventilation and collection as described below, in addition to wet removal. Provide specific description /locations/ drawings.

B. Provide local exhaust ventilation and collection systems to assure collection of amosite fibers at the point of generation. A 300 mm (12") flexible rigid non-collapsing duct shall be shall be located no more than 600 mm (2') from any scraping/brushing activity. Primary filters shall be replaced every 30 minutes on the negative air machines. Each scraping/brushing activity shall have a negative air machine devoted to it. For pre-molded pipe insulation or cutting wire lathe attach a 1200 mm (4') square flared end piece on the intake of the duct. Support the duct horizontally at a point 600 mm (2') below the work to effect capture. One person in the crew shall be assigned to operate the duct collection system on a continual basis.

C. Amosite does not wet well with amended water. Submit full information/documentation on the wetting agent proposed prior to start for review and approval by the VPIH/CIH and VA Contracting Officer. Insure that the material is worked on in small sections and is thoroughly and continuously wetted. Package as soon as possible while wet. Remove as required.

3.2.5 REMOVAL OF ACM/DIRT FLOORS AND OTHER SPECIAL PROCEDURES

A. MAJOR ABATEMENT ON DIRT FLOORS:
When working on dirt floors, remove all visible asbestos debris using wet methods after set-up of PDF, W/EDF, negative air systems as required.

Perform work and decontaminate/clean-up; perform lockdown as needed and complete work as required in these specifications. The asbestos contaminated soil (ACS) shall be removed and/or enclosed.

Options for abatement of asbestos contaminated soil include: Removal of top 6 inches of soil; encapsulated the soil using shotcrete or other spray applied concrete materials. Considerations for which option to be used shall be made by the VA representative. Factors which may affect which option to be used may include: access to the work area; height of the area (such as is there sufficient height to use concrete materials in the area). Soils covered with permanent barriers **SHALL HAVE PERMANENT SIGNAGE INSTALLED TO WARN AGAINST PENETRATION ASSOCIATED WITH POTENTIAL DISTURBANCE OF ASBESTOS.**

1. Remove ACS as shown on drawings to a minimum depth of 6 using wet methods. After wetting with amended water to minimize dust, shovel dirt into disposal bags. The CPIH/CIH shall closely monitor work conditions and take appropriate action to protect workers from over exposure to asbestos and heat stress. The minimum number of air changes per hour shall be six using negative air machines. Use special vacuum truck equipped with HEPA filtration to remove soil
2. Enclosure of ACS using a concrete layer of 4” over the entire surface may also be done. Thoroughly dampen soil first with amended water before pouring concrete. Personnel shall be proficient in concrete finishing as well as asbestos trained.

B. Crawlspaces/Pipe Tunnels:
When working in crawlspaces or pipe tunnels, remove all visible asbestos debris using wet methods (if possible) after set-up of PDF, W/EDF, and after establishing negative air systems as required. Perform work and decontaminate/clean-up; perform lockdown as needed and complete work as required in these specifications. The asbestos contaminated soil (ACS) shall be removed and/or enclosed. Clearance requirements include confirmation sampling of affected soil by Polarized Light Microscopy (PLM). Clearance sampling requirements are specified in Sections 3.6.4 and 3.6.5.

Options for abatement of asbestos contaminated soil include: Removal of top 6 inches of soil; encapsulated the soil using shotcrete or other spray applied concrete materials. Considerations for which option to be used shall be made by the VA representative. Factors which may affect which option to be used may include: access to the work area; height of the area (such as is there sufficient height to use concrete materials in the area)

3.3 GLOVEBAG REMOVAL PROCEDURES

3.3.1 GENERAL

All applicable OSHA requirements and glovebag manufacturer’s recommendations shall be met during glove bagging operations. In cases where live steam lines are present, the lines shall be shut down prior to any work being performed on the system. **No abatement work shall be conducted on live, pressurized steam lines.** The Contractor may choose to use a High Temperature Glovebag in which a temperature rating ranges from 300˚F to 700˚F on steam lines that have recently been shut down and remain at high temperature for some time. In the case where a glovebag is not feasible, the Contractor shall need to build a full negative pressure containment of sufficient size and follow all regulations as it pertains to removal.

3.3.2 NEGATIVE PRESSURE GLOVEBAG PROCEDURE

1. In addition to the above requirements, the HEPA vacuum shall be run continuously during the glovebag procedure until completion at which time the glovebag shall be collapsed by the HEPA vacuum prior to removal from the pipe/component.
2. The HEPA vacuum shall be attached and operated as needed to prevent collapse of the glovebag during the removal process.

3.3.3 REMOVAL OF CLASS II MATERIALS

All applicable requirements of OSHA, EPA, and DOT shall be followed during Class II work. Keep materials intact; do not break up materials; wet while working with it; wrap as soon as possible with 2 layers of 6 mil plastic for disposal, and maintain good housekeeping in work areas during abatement.

Except for outdoor work, the Contractor shall provide enough HEPA negative air machines to effect > - 0.02” WCG pressure in each work area. Provide a standby unit in the event of machine failure and/or emergency in an adjacent area. The contractor shall use double the number of machines, based on their calculations, or submit proof their machines operate at stated capacities, at a 2" pressure drop across the filters.

3.3.3.1 OUTDOOR WORK AREAS

On some projects, work shall be performed on exterior areas of the building. If outdoor work is to be performed, all applicable OSHA, state and local regulations shall be followed to ensure that outdoor work areas are in compliance so that workers, the general public and the environment are protected.

3.3.3.2 SCAFFOLD FALL PROTECTION

Each employee more than 6 feet above the base work level shall be protected from falls by guardrails or a fall arrest system. Fall arrest system includes harnesses, components of the harness/belt such as Dee-rings, and snap hooks, lifelines, and anchorage points. Lifelines shall be independent of supports lines and suspension ropes and not attached to the same anchorage point as the support or suspension rope. OSHA’s scaffolding standard defines a competent person as “one who is capable of identifying existing and predictable hazards in the surroundings or working conditions, which are unsanitary, hazardous to employees, and who has authorization to take prompt corrective measures to eliminate them.” The competent person will determine if it is safe for employees to work on or from a scaffold or roof during storms or high winds and to ensure that a personal fall arrest system will protect the employees. The competent person will also inspect the scaffold and scaffold components for visible defects before each work shift and after any occurrence which could affect the structural integrity and to authorize prompt corrective measures.

3.3.3.3 ROOF/ELEVATED WORK AREA PROTECTION

The competent person shall determine if the walking/working surfaces on which the employees are to work on have the strength and structural integrity to support the employees safely. Each employee on a

walking/working surface (horizontal and vertical surface) with an unprotected side or edge which is 6 feet or more above a lower level shall be protected from falling by the use of guardrail systems, safety net systems, or personal fall arrest system.

3.3.3.4 EXCAVATION/TRENCHING WORK AREA PROTECTION

Each employee who is working in excavation/trenching work areas to alter or remove materials such as underground piping shall be protected from hazards arising from such work areas. A competent person who is OSHA trained in excavation/trenching operations shall be present on site at all time in which work in these areas occurs. The competent person will determine if it is safe for employees to work on or in excavation/trenching work areas and to ensure that all applicable safety measures will protect the employees. The competent person will also inspect the excavation/trenching areas for visible defects before each work shift and after any occurrence which could affect the structural integrity of the excavation/trenching areas and to authorize prompt corrective measures.

3.3.3.5 REMOVAL OF TRANSITE:

A. All transite shall be wetted prior to removal. Unfasten transite panels without disturbance. Keep transite intact.
B. All waste shall be wrapped in two layers of 6 mil poly and lowered carefully to the ground.
C. Materials may not be dropped from any height. Unless the material is carried or passed to the ground by hand, it shall be lowered to the ground via covered, dust-tight chute, crane or hoist.

3.3.3.6 REMOVAL OF FLOORING MATERIALS

A. All requirements of OSHA Class II Asbestos Work shall be followed.
B. The Contractor shall provide enough HEPA negative air machines to effect > - 0.02” WCG pressure. Provide a standby unit in the event of machine failure and/or emergency in an adjacent area. The contractor shall use double the number of machines, based on their calculations, or submit proof their machines operate at stated capacities, at a 2" pressure drop across the filters.
C. Flooring shall be removed wet and intact, as much as possible. Do not rip or tear flooring.
D. Mechanical chipping or sanding is not allowed.
E. Wet clean and HEPA vacuum the floor before and after removal of flooring.
A. Package all waste in double 6 mil poly disposal bags.

3.3.3.7 REMOVAL OF FLOOR MASTIC MATERIALS

Mastic shall be removed completely from the concrete floor substrate; if floor level compound is present, it should be removed as well in an effort to remove mastic underneath (if present).

A. All chemical mastic removers shall be low in volatile organic compound (VOC) content, have a flash point greater than 200° Fahrenheit, contain no chlorinated solvents, and comply with California Air Resources Board (CARB) thresholds for VOCs (effective January 1, 2010).
B. A negative air machine shall be provided as noted above

C. Follow all manufacturers' instructions in the use of the mastic removal material.
D. Package all waste in double 6 mil poly disposal bags.
Prior to application of any liquid material, check the floor for penetrations and seal before removing mastic.
E. **IMPORTANT:** Prior to application of any liquid material, check the floor for penetrations and seal before removing mastic. In an effort to prevent leaks to the floor below, a sufficient but minimal amount of mastic remover shall be utilized; an overabundance and liquid pooling shall be prohibited. The Contractor will be responsible for the cleanup associated with any leaks that occur at no additional expense.

3.4 LOCKDOWN ENCAPSULATION

3.4.1 GENERAL

Lockdown encapsulation is an integral part of the ACM removal. At the conclusion of ACM removal and before removal of the primary barriers, the contractor shall encapsulate all surfaces with a bridging encapsulant.

3.4.2 DELIVERY AND STORAGE

Deliver materials to the job site in original, new and unopened containers bearing the manufacturer's name and label as well as the following information: name of material, manufacturer's stock number, date of manufacture, thinning instructions, application instructions and the MSDS for the material.

3.4.3 WORKER PROTECTION

Before beginning work with any material for which an MSDS has been submitted, provide workers with any required personal protective equipment. The required personal protective equipment shall be used whenever exposure to the material might occur. In addition to OSHA/specification requirements for respiratory protection, a paint pre-filter and an organic vapor cartridge, at a minimum, shall used in addition to the HEPA filter when an organic solvent based encapsulant is used. The CPIH/CIH shall be responsible for provision of adequate respiratory protection. Note: Flammable and combustible encapsulants shall not be used, unless authorized in writing by the VA.

3.4.4 ENCAPSULATION OF SCRATCH COAT PLASTER OR PIPING

A. Apply two coats of lockdown encapsulant to the scratch coat plaster or piping after all ACM has been removed. Apply in strict accordance with the manufacturer's instructions. Any deviation from the instructions shall be approved by the VA's representative in writing prior to commencing the work.
B. Apply the lockdown encapsulant with an airless sprayer at a pressure and using a nozzle orifice as recommended by the manufacturer. Apply the first coat while the while the scratch coat is still damp from the asbestos removal process, after passing the visual inspection. If the surface has been allowed to dry, wet wipe or HEPA vacuum prior to spraying with encapsulant. Apply a second coat over the first coat in strict conformance with the manufacturer's instructions. Color the lockdown encapsulant and contrast the color in the second coat so that visual confirmation of completeness and uniform coverage of each coat is possible. Adhere to the manufacturer's instructions for coloring. At the completion of the

encapsulation, the surface shall be a uniform third color produced by the mixture.

3.4.5 SEALING EXPOSED EDGES

Seal edges of ACM exposed by removal work which is inaccessible, such as a sleeve or wall penetration with two coats of bridging encapsulant. Prior to sealing, permit the exposed edges to dry completely to permit penetration of the bridging encapsulant. Apply in accordance with 3.3.4 (B).

3.5 DISPOSAL OF ACM WASTE MATERIALS

3.5.1 GENERAL

Dispose of waste ACM and debris which is packaged in accordance with these specifications, OSHA, EPA and DOT. The landfill requirements for packaging shall also be met. Transport shall be in compliance with 49 CFR 100-185 regulations. Disposal shall be done at an approved landfill. Disposal of non-friable ACM shall be done in accordance with applicable regulations.

3.5.2 PROCEDURES

A. The VA shall be notified at least 24 hours in advance of any waste removed from the containment.
B. Asbestos waste shall be packaged and moved through the W/EDF into a covered transport container in accordance with procedures is this specification. Waste shall be double-bagged and wetted with amended water prior to disposal. Wetted waste can be very heavy. Bags shall not be overfilled. Bags shall be securely sealed to prevent accidental opening and/or leakage. The top shall be tightly twisted and goose necked prior to tightly sealing with at least three wraps of duct tape. Ensure that unauthorized persons do not have access to the waste material once it is outside the regulated area. All transport containers shall be covered at all times when not in use. NESHAP signs shall be on containers during loading and unloading. Material shall not be transported in open vehicles. If drums are used for packaging, the drums shall be labeled properly and shall not be re-used.
C. Waste Load Out: Waste load out shall be done in accordance with the procedures in W/EDF Decontamination Procedures. Sealed waste bags shall be decontaminated on exterior surfaces by wet cleaning and/or HEPA vacuuming before being placed in the second waste bag and sealed, which then shall also be wet wiped or HEPA vacuumed.
D. Asbestos waste with sharp edged components, i.e., nails, screws, lath, strapping, tin sheeting, jacketing, and metal mesh, which might tear poly bags shall be wrapped securely in burlap before packaging and, if needed, use a poly lined fiber drum as the second container, prior to disposal.

3.6 PROJECT DECONTAMINATION

3.6.1 GENERAL

A. The entire work related to project decontamination shall be performed under the close supervision and monitoring of the CPIH/CIH.
B. If the asbestos abatement work is in an area which was contaminated prior to the start of abatement, the decontamination shall be done by cleaning the primary barrier poly prior to its removal and cleanings of the surfaces of the regulated area after the primary barrier removal.

C. If the asbestos abatement work is in an area which was uncontaminated prior to the start of abatement, the decontamination shall be done by cleaning the primary barrier poly prior to its removal, thus preventing contamination of the building when the regulated area critical barriers are removed.

3.6.2 REGULATED AREA CLEARANCE

Clearance air testing and other requirements which must be met before release of the Contractor and re-occupancy of the regulated area space are specified in Final Testing Procedures.

3.6.3 WORK DESCRIPTION

Decontamination includes the clearance air testing in the regulated area and the decontamination and removal of the enclosures/facilities installed prior to the abatement work including primary/critical barriers, PDF and W/EDF facilities, and negative pressure systems.

3.6.4 PRE-DECONTAMINATION CONDITIONS

A. Before decontamination starts, all ACM waste from the regulated area shall be collected and removed, and the loose 6 mil layer of poly removed while being adequately wetted with amended water and disposed of along with any gross debris generated by the work.
B. At the start of decontamination, the following shall be in place:
   1. Primary barriers consisting of 2 layers of 6 mil poly on the floor and 4 mil poly on the walls.
   2. Critical barriers consisting of 2 layers of 6 mil poly which is the sole barrier between the regulated area and openings to the rest of the building or outside.
   3. Decontamination facilities for personnel and equipment in operating condition and the negative pressure system in operation.

3.6.5 FIRST CLEANING

Carry out a first cleaning of all surfaces of the regulated area including items of remaining poly sheeting, tools, scaffolding, ladders/staging by wet methods and/or HEPA vacuuming. Do not use dry dusting/sweeping/air blowing methods. Use each surface of a wetted cleaning cloth one time only and then dispose of as contaminated waste. Continue this cleaning until there is no visible residue from abated surfaces or poly or other surfaces. Remove all filters in the air handling system and dispose of as ACM waste in accordance with these specifications. The negative pressure system shall remain in operation during this time. Additional cleaning(s) may be needed as determined by the CPIH/VPIH/CIH.

3.6.6 PRE-CLEARANCE INSPECTION AND TESTING

The CPIH/CIH and VPIH/CIH shall perform a thorough and detailed visual inspection at the end of the cleaning to determine whether there is any visible residue in the regulated area. If the visual inspection is acceptable, the CPIH/CIH shall perform pre-clearance sampling using aggressive clearance as detailed in 40 CFR 763 Subpart E (AHERA) Appendix A (III)(B)(7)(d). If the sampling results show values below 0.01 f/cc, then the Contractor shall notify the VA's representative of the results with a brief report from the CPIH/CIH documenting the inspection and sampling results and a statement verifying that the regulated area is

ready for lockdown encapsulation. The VA reserves the right to utilize their own VPIH/CIH to perform a pre-clearance inspection and testing for verification.

3.6.7 LOCKDOWN ENCAPSULATION OF ABATED SURFACES

With the express written permission of the VA's representative, perform lockdown encapsulation of all surfaces from which asbestos was abated in accordance with the procedures in this specification. Negative pressure shall be maintained in the regulated area during the lockdown application.

3.7 FINAL VISUAL INSPECTION AND AIR CLEARANCE TESTING

3.7.1 GENERAL

Notify the VA representative 24 hours in advance for the performance of the final visual inspection and testing. The final visual inspection and testing shall be performed by the VPIH/CIH starting after the final cleaning.

3.7.2 FINAL VISUAL INSPECTION

Final visual inspection shall include the entire regulated area, the PDF, all poly sheeting, seals over HVAC openings, doorways, windows, and any other openings. If any debris, residue, dust or any other suspect material is detected, the final cleaning shall be repeated at no cost to the VA. Dust/material samples may be collected and analyzed at no cost to the VA at the discretion of the VPIH/CIH to confirm visual findings. When the regulated area is visually clean the final testing can be done.

3.7.3 FINAL AIR CLEARANCE TESTING

A. After an acceptable final visual inspection by the VPIH/CIH and VA Representative, the VPIH/CIH shall perform the final clearance testing. Air samples shall be collected and analyzed in accordance with procedures for AHERA in this specification. If work is less than 260 lf/160 sf/35 cf, 5 PCM samples shall be collected for clearance and a minimum of one field blank. If work is equal to or more than 260 lf/160 sf/35 cf, AHERA TEM sampling shall be performed for clearance. TEM analysis shall be done in accordance with procedures for EPA AHERA in this specification. If the release criteria are not met, the Contractor shall repeat the final cleaning and continue decontamination procedures until clearance is achieved. **All Additional inspection and testing costs shall be borne by the Contractor.**
B. If release criteria are met, proceed to perform the abatement closeout and to issue the certificate of completion in accordance with these specifications.

3.7.4 FINAL AIR CLEARANCE PROCEDURES

A. Contractor's Release Criteria: Work in a regulated area is complete when the regulated area is visually clean and airborne fiber levels have been reduced to or below 0.01 f/cc as measured by the AHERA PCM protocol, or 70 AHERA structures per square millimeter (s/mm^2) by AHERA TEM.
B. Air Monitoring and Final Clearance Sampling: To determine if the elevated airborne fiber counts encountered during abatement operations have been reduced to the specified level, the VPIH/CIH shall secure samples and analyze them according to the following procedures:

1. Fibers Counted: "Fibers" referred to in this section shall be either all fibers regardless of composition as counted in the NIOSH 7400 PCM method or asbestos fibers counted using the AHERA TEM method.
2. Aggressive Sampling: All final air testing samples shall be collected using aggressive sampling techniques except where soil is not encapsulated or enclosed. Samples shall be collected on 0.8µ MCE filters for PCM analysis and 0.45µ Polycarbonate filters for TEM. A minimum of 1200 Liters of using calibrated pumps shall be collected for clearance samples. Before pumps are started, initiate aggressive air mixing sampling as detailed in 40 CFR 763 Subpart E (AHERA) Appendix A (III)(B)(7)(d). Air samples shall be collected in areas subject to normal air circulation away from corners, obstructed locations, and locations near windows, doors, or vents. After air sampling pumps have been shut off, circulating fans shall be shut off. The negative pressure system shall continue to operate.
3. Final clearance for soil that is not encapsulated, samples shall be collected on 0.8µ MCE filters for PCM analysis and 0.45µ Polycarbonate filters for TEM. A minimum of 1200 Liters of using calibrated pumps shall be collected for clearance samples. Air clearance of work areas where contaminated soil has been removed is in addition to the requirement for clearance by bulk sample analysis discussed within these specifications. There shall be no aggressive air sampling for the clearance of soil due to the fact that aggressive air sampling may overload the cassettes.
4. Random samples shall be collected from areas of soil which have been abated to ensure that the soil has been properly decontaminated. The total number of samples to be collected from the soil areas shall be; <1000 SF of soil – 3 samples; >1000 to <5000 SF of soil – 5 samples; and >5000 SF of soil – 7 samples. The soil samples shall be collected in a statistically random manner and shall be analyzed by PLM method. The clearance level to determine the soil clean is <1% asbestos by weight as analyzed by PLM method. If this level is achieved, the soil areas shall be considered clear. If the levels are >1% asbestos, the areas shall be re-cleaned until the sample results are <1%.

3.7.5 CLEARANCE SAMPLING USING PCM – LESS THAN 260LF/160SF:

A. The VPIH/CIH shall perform clearance samples as indicated by the specification.
B. The NIOSH 7400 PCM method shall be used for clearance sampling with a minimum collection volume of 1200 Liters of air. A minimum of 5 PCM clearance samples shall be collected. All samples shall be equal to or less than 0.01 f/cc to clear the regulated area.
C. If soil removal is to occur, random samples shall be collected from areas of soil which have been abated to ensure that the soil has been properly decontaminated. The total number of samples to be collected from the soil areas shall be; <1000 SF of soil – 3 samples; >1000 to <5000 SF of soil – 5 samples; and >5000 SF of soil – 7 samples. The soil samples shall be collected in a statistically random manner and shall be analyzed by PLM method. The clearance level to determine the soil clean is <1% asbestos by weight as analyzed by PLM method. If this level is achieved, the soil areas shall be considered clear. If the levels are >1% asbestos, the areas shall be re-cleaned until the sample results are <1%.

3.7.6 CLEARANCE SAMPLING USING TEM – EQUAL TO OR MORE THAN 260LF/160SF: TEM

A. Clearance requires 13 samples be collected; 5 inside the regulated area; 5 outside the regulated area; and 3 field blanks.
B. The TEM method shall be used for clearance sampling with a minimum collection volume of 1200 Liters of air. A minimum of 13 clearance samples shall be collected. All samples shall be equal to or less than 70 AHERA structures per square millimeter (s/mm^2) AHERA TEM.

3.7.7 LABORATORY TESTING OF PCM CLEARANCE SAMPLES

The services of an AIHA accredited laboratory shall be employed by the VA to perform analysis for the PCM air samples. The accredited laboratory shall be successfully participating in the AIHA Proficiency Analytical Testing (PAT) program. Samples shall be sent daily by the VPIH/CIH so that verbal/faxed reports can be received within 24 hours. A complete record, certified by the laboratory, of all air monitoring tests and results shall be furnished to the VA’s representative and the Contractor.

3.7.8 LABORATORY TESTING OF TEM SAMPLES

Samples shall be sent by the VPIH/CIH to a NIST accredited laboratory for analysis by TEM. The laboratory shall be successfully participating in the NIST Airborne Asbestos Analysis (TEM) program. Verbal/faxed results from the laboratory shall be available within 24 hours after receipt of the samples. A complete record, certified by the laboratory, of all TEM results shall be furnished to the VA's representative and the Contractor.

3.7.9 LABORATORY TESTING OF BULK SAMPLES

Samples shall be sent by the VPIH/CIH or CPIH/CIH to a NIST accredited laboratory for analysis by PLM. The laboratory shall be successfully participating in the NIST Bulk Asbestos Analysis (PLM) program. Verbal/faxed results from the laboratory shall be available within 24 hours after receipt of the samples. A complete record, certified by the laboratory, of all TEM results shall be furnished to the VA's representative and the Contractor.

3.8 ABATEMENT CLOSEOUT AND CERTIFICATE OF COMPLIANCE

3.8.1 COMPLETION OF ABATEMENT WORK

After thorough decontamination, seal negative air machines with 2 layers of 6 mil poly and duct tape to form a tight seal at the intake/outlet ends before removal from the regulated area. Complete asbestos abatement work upon meeting the regulated area visual and air clearance criteria and fulfilling the following:

A. Remove all equipment and materials from the project area.
B. Dispose of all packaged ACM waste as required.
C. Repair or replace all interior finishes damaged during the abatement work, as required.
D. Fulfill other project closeout requirements as required in this specification.

3.8.2 CERTIFICATE OF COMPLETION BY CONTRACTOR

The CPIH/CIH shall complete and sign the "Certificate of Completion" in accordance with Attachment 1 at the completion of the abatement and decontamination of the regulated area. This shall be included as part of the abatement contractor’s final closeout documentation submitted to the VA.

3.8.3 WORK SHIFTS

All work shall be done during administrative hours (8:00 AM to 4:30 PM) Monday -Friday excluding Federal Holidays. Any change in the work schedule shall be approved in writing by the VA Representative.

3.8.4 RE-INSULATION

If required as part of the contract, replace all asbestos containing insulation/fire-proofing with suitable non-asbestos material. Provide MSDS's for all replacement materials in advance of installation for VA approval. Refer to Section 23 07 11, HVAC, PLUMBING, AND BOILER PLANT INSULATION.

ATTACHMENT #1 CERTIFICATE OF COMPLETION

DATE: _____ VA Project #:_____

PROJECT NAME:_____Abatement Contractor:_____

VAMC/ADDRESS:_____

1. I certify that I have personally inspected, monitored and supervised the abatement work of (specify regulated area or Building):

   which took place from / / to / /

2. That throughout the work all applicable requirements/regulations and the VA's specifications were met.
3. That any person who entered the regulated area was protected with the appropriate personal protective equipment and respirator and that they followed the proper entry and exit procedures and the proper operating procedures for the duration of the work.
4. That all employees of the Abatement Contractor engaged in this work were trained in respiratory protection, were experienced with abatement work, had proper medical surveillance documentation, were fit-tested for their respirator, and were not exposed at any time during the work to asbestos without the benefit of appropriate respiratory protection.
5. That I performed and supervised all inspection and testing specified and required by applicable regulations and VA specifications.
6. That the conditions inside the regulated area were always maintained in a safe and healthy condition and the maximum fiber count never exceeded 0.5 f/cc, except as described below.
7. That all abatement work was done in accordance with OSHA requirements and the manufacturer’s recommendations.

CPIH/CIH Signature/Date:_____

CPIH/CIH Print Name:_____

Abatement Contractor Signature/Date:_____

Abatement Contractor Print Name:_____

ATTACHMENT #2 CERTIFICATE OF WORKER'S ACKNOWLEDGMENT

PROJECT NAME:_____DATE: _____

PROJECT ADDRESS:_____

ABATEMENT CONTRACTOR'S NAME:_____

WORKING WITH ASBESTOS CAN BE HAZARDOUS TO YOUR HEALTH. INHALING ASBESTOS HAS BEEN LINKED WITH VARIOUS TYPES OF CANCERS. IF YOU SMOKE AND INHALE ASBESTOS FIBERS, YOUR CHANCES OF DEVELOPING LUNG CANCER IS GREATER THAN THAT OF THE NON-SMOKING PUBLIC.

Your employer's contract with the owner for the above project requires that: You must be supplied with the proper personal protective equipment including an adequate respirator and be trained in its use. You must be trained in safe and healthy work practices and in the use of the equipment found at an asbestos abatement project. You must receive/have a current medical examination for working with asbestos. These things shall be provided at no cost to you. By signing this certificate you are indicating to the owner that your employer has met these obligations.

RESPIRATORY PROTECTION: I have been trained in the proper use of respirators and have been informed of the type of respirator to be used on the above indicated project. I have a copy of the written Respiratory Protection Program issued by my employer. I have been provided for my exclusive use, at no cost, with a respirator to be used on the above indicated project.

TRAINING COURSE: I have been trained by a third party, State/EPA accredited trainer in the requirements for an AHERA/OSHA Asbestos Abatement Worker training course, 32 hours minimum duration. I currently have a valid State accreditation certificate. The topics covered in the course include, as a minimum, the following:

Physical Characteristics and Background Information on Asbestos
Potential Health Effects Related to Exposure to Asbestos
Employee Personal Protective Equipment
Establishment of a Respiratory Protection Program
State of the Art Work Practices
Personal Hygiene
Additional Safety Hazards
Medical Monitoring
Air Monitoring
Relevant Federal, State and Local Regulatory Requirements, Procedures, and Standards
Asbestos Waste Disposal

MEDICAL EXAMINATION: I have had a medical examination within the past 12 months which was paid for by my employer. This examination included: health history, occupational history, pulmonary function test, and may have included a chest x-ray evaluation. The physician issued a positive written opinion after the examination.

Signature:_____

Printed Name:_____

Social Security Number:_____

Witness:_____

ATTACHMENT #3 AFFIDAVIT OF MEDICAL SURVEILLANCE, RESPIRATORY PROTECTION AND TRAINING/ACCREDITATION

VA PROJECT NAME AND NUMBER:_____

VA MEDICAL FACILITY:_____

ABATEMENT CONTRACTOR'S NAME AND ADDRESS:_____

1. I verify that the following individual

   Name:_____Social Security Number:_____

   who is proposed to be employed in asbestos abatement work associated with the above project by the named Abatement Contractor, is included in a medical surveillance program in accordance with 29 CFR 1926.1101(m), and that complete records of the medical surveillance program as required by 29 CFR 1926.1101(m)(n) and 29 CFR 1910.20 are kept at the offices of the Abatement Contractor at the following address.

   Address:_____

2. I verify that this individual has been trained, fit-tested and instructed in the use of all appropriate respiratory protection systems and that the person is capable of working in safe and healthy manner as expected and required in the expected work environment of this project.

3. I verify that this individual has been trained as required by 29 CFR 1926.1101(k). This individual has also obtained a valid State accreditation certificate. Documentation shall be kept on-site.

4. I verify that I meet the minimum qualifications criteria of the VA specifications for a CPIH.

Signature of CPIH/CIH:_____Date:_____

Printed Name of CPIH/CIH:_____

Signature of Contractor:_____Date:_____

Printed Name of Contractor:_____

ATTACHMENT #4 ABATEMENT CONTRACTOR/COMPETENT PERSON(S) REVIEW AND ACCEPTANCE OF THE VA'S ASBESTOS SPECIFICATIONS

VA Project Location:_____

VA Project #:_____

VA Project Description:_____

This form shall be signed by the Asbestos Abatement Contractor Owner and the Asbestos Abatement Contractor's Competent Person(s) prior to any start of work at the VA related to this Specification. If the Asbestos Abatement Contractor's/Competent Person(s) has not signed this form, they shall not be allowed to work on-site.

I, the undersigned, have read VA's Asbestos Specification regarding the asbestos abatement requirements. I understand the requirements of the VA's Asbestos Specification and agree to follow these requirements as well as all required rules and regulations of OSHA/EPA/DOT and State/Local requirements. I have been given ample opportunity to read the VA's Asbestos Specification and have been given an opportunity to ask any questions regarding the content and have received a response related to those questions. I do not have any further questions regarding the content, intent and requirements of the VA's Asbestos Specification.

At the conclusion of the asbestos abatement, I shall certify that all asbestos abatement work was done in accordance with the VA's Asbestos Specification and all ACM was removed properly and no fibrous residue remains on any abated surfaces.

Abatement Contractor Owner's Signature_____Date_____

Abatement Contractor Competent Person(s)_____Date_____

ATTACHMENTS #5 AND 6 HAZARDOUS MATERIAL SURVEYS

TTL Associates Survey dated December 10, 2014

Terracon Asbestos Survey date September 27, 2019

- - END - -

1915 North 12th Street
Toledo, OH 43604-5305
T 419-324-2222
F 419-241-1808
www.ttlassoc.com

December 10, 2014 Project No. 12091.06

Mr. William Wooden
Chillicothe Veterans Affairs Medical Center
17273 State Route 104
Chillicothe, Ohio 45601

AHERA 6 Month Surveillance
Chillicothe Veterans Affairs Medical Center
17273 State Route 104
Chillicothe, Ohio

Dear Mr. Wooden,

This report documents the results of the United States Environmental Protection Agency's (U.S. EPA) Asbestos Hazard Emergency Response Act (AHERA) six-month periodic surveillance conducted on November 18 through November 21, 2014 by TTL Associates, Inc. (TTL) for Chillicothe Veterans Affairs Medical Center (VAMC). TTL conducted an inspection of the VAMC's facilities and a review of previous AHERA reports to evaluate the condition of remaining asbestos containing materials (ACM) within the facilities. The report includes the following information:

1. A list of damaged materials identified during the assessment populated from the access database with recommended response action.
2. A list of ACM that has been removed from the site that was observed during the assessment.
3. A list of remodeled areas observed during the assessment that requires abatement documentation.
4. Maps with photos of damaged materials.
5. Asbestos surveillance findings forms

These lists are to be added to the Operations and Maintenance Plan on file at the VAMC.

An updated database will be provided to the VAMC.

The attached damaged materials list includes the location of ACM that was noted as damaged, the quantity of damage and the recommended response action. The following is a list of recommended response actions.

1. Encapsulate—This refers to any cement wall shingles (transite) material that was damaged. Be sure to appropriately clean-up loose pieces and apply an encapsulant to the damaged transite pieces.

2. Patch and Repair, Debris Clean-up—This refers to damaged thermal system insulation (TSI). The debris requires appropriate clean-up and the damaged area requires patch and repair with rewettable lag cloth.
3. Remove Loose Material and Reinstall—This refers to the damaged window caulk or glazing and floor tile. Remove any loose pieces by appropriate methods and reinstall caulk where needed to ensure the windows remain in place.
4. Remove—The material is in a state that repair is not an option and removal is recommended.
5. Debris Cleanup—All loose ACM requires cleanup by wet methods and High Efficiency Air Particulate (HEPA) vacuuming.
6. Encapsulate and Enclose—This refers to the contaminated soil under Building 21. If this crawlspace is not frequently used the material may be encapsulated and covered in 6 mil polyethylene sheeting. If this area is frequently used the soil will require removal.

The attached remodeled areas observed during the assessment shows the areas where new flooring material was installed. There is no documentation that shows if asbestos abatement was conducted. Therefore this information will stay in the database.

TTL appreciates the continued opportunity to provide the Chillicothe VAMC with our environmental testing and consulting services. If you have any questions concerning this report, or require more information, please contact Ms. Sara Vogelpohl at (419) 214-5090.

Sincerely,

TTL Associates, Inc.

Rhiley Roberts
Asbestos Hazard Evaluation Specialist
ES385836

Sara Vogelpohl
Manager, Asbestos Services

Attachments

V:\Toledo\VA\Chillicothe OH\12091 On-Call IH Services\12091.06 6 mo. Reinspection November 2014\Report November 2014 \12091.06 6 month AHERA Report November 2014.docx

APPENDIX A

TTL CERTIFICATIONS

State of Ohio
Department of Health
Division of Quality Assurance - Asbestos Program

Asbestos Hazard Evaluation Specialist

Adam G Mead

1651 Gilbert Rd
Toledo OH 43614

DOB: 03/26/1980

Certification Number	Expiration Date
ES34615	**02/25/2015**

This certification is issued pursuant to Chapter 3710 of the Revised Code and 3701-34 of the Ohio Administrative Code

Certification Card is not valid if altered

State of Ohio
Department of Health
Division of Quality Assurance - Asbestos Program

Asbestos Hazard Evaluation Specialist

Rhiley K Robert

1015 Grasser St
Oregon OH 43616

DOB: 03/20/1986

Certification Number
ES35836

Expiration Date
10/23/2015

This certification is issued pursuant to Chapter 3710 of the Revised Code and 3701-34 of the Ohio Administrative Code

Certification Card is not valid if altered

APPENDIX B

DAMAGED LIST FROM DATABASE WITH RESPONSE ACTIONS

Chillicothe Veterans Affairs Medical Center
Six Month Periodic Asbestos Surveillance
Damaged List with Response Actions from Database
November 2014

Building Number	HSA Number	Material Description	Material Location (Floor)	Room / Location	Sample Results	aterial Conditi	Damage Quantity	Damage Units	Response Action
1	18	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	Basement	Throughout	Positive	Poor	1	l.f.	Patch and repair
1	08	Fittings	Pipe Basement	2	Positive	Poor	1	each	Patch and repair
1	22	Mastic associated with 12" x 12" Tan and White Floor Tile	Basement	Hallway 10	Positive	Good	1	s.f.	Remove and replace
1	30	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	Basement	1	Positive	Fair	1	l.f.	Remove and Replace
1	30	Grey Thermal Pipe Insulation with Cloth Wrap	First Floor	121	Positive	Poor	1	l.f.	Patch and repair
2	09	9" x 9" Green and White Checkered Pattern Floor Tile and associated Mastic	Second Floor	207A	Positive	Good	1	s.f.	Remove and replace
2	15	9" x 9" Black and Brown (Checker Pattern) Floor Tile and associated Mastic	First Floor	129B	Positive	Fair	1	s.f.	Remove and replace
2	13	12" x 12" Light Brown Floor Tile with Red and White Smudges and associated Mastic	Basement	BB108	Positive	Poor	2	s.f.	Remove and replace
2	13	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	Basement	Tank Room	Positive	Good	2	l.f.	Patch and repair
2	13	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	First Floor	105	Positive	Poor	2	l.f.	Patch and repair
2	14	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	First Floor	106	Positive	Poor	2	l.f	Patch and repair, debris clean up
2	06	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	Basement		Positive	Poor	2	l.f.	Patch and repair
2	08	Fittings	Pipe Basement	Crawl Space	Positive	Poor	2	s.f.	Debris clean up
2	17	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	First Floor	108	Positive	Poor	2	l.f.	Remove and Replace
2	17	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap-Removed	First Floor	Hallway	Positive	Poor	2	l.f.	Encapsulate end of pipe
3	24	12" x 12" Beige, Grey and Brown Floor Tile and associated Mastic	Basement	4A	Positive	Poor	2	s.f.	Remove and replace
4	12	Mastic associated with Light Brown Floor Tile with Brown, White and Red Smudges	First Floor	1-208	Positive	Good	2	s.f.	Remove and repair
4	03	12" x 12" Grey and White Floor Tile and associated Mastic	First Floor	North Hallway	Positive	Good	2	s.f.	Remove and replace
4	12	9" x 9" Black, White, and Green (Checker Pattern) Floor Tile and associated Mastic	First Floor	South Hallway	Positive	Fair	2	s.f.	Remove and replace
4	13	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	Basement	5A	Positive	Good	2	l.f.	Patch and repair, encapsulate end of pipe
4	14	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	Basement	Throughout	Positive	Good	2	l.f.	Patch and repair, encapsulate end of pipe
4	18	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	Basement	12	Positive	Poor	3	l.f.	Patch and repair
4	10	Grey Thermal Pipe Insualtion and Fittings with Cloth Wrap	First Floor	111/112	Positive	Poor	3	l.f.	Patch and repair, debris clean up
5	15	9" x 9" Black and Brown (Checker Pattern) Floor Tile and associated Mastic	First Floor	125	Positive	Fair	3	s.f	
5	06	Grey Thermal Pipe Insulation with Metal Jacket	Walkway between Buildings T51 and T52		Positive	Poor	3	l.f.	Patch and repair
5	13	12" x 12" Light Brown Floor Tile with Red and White Smudges and associated Mastic	Basement	BB103	Positive	Poor	4	s.f.	Remove loose material and reinstall

Chillicothe Veterans Affairs Medical Center
Six Month Periodic Asbestos Surveillance
Damaged List with Response Actions from Database
November 2014

Building Number	HSA Number	Material Description	Material Location (Floor)	Room / Location	Sample Results	aterial Conditi	Damage Quantity	Damage Units	Response Action
5	18	9" x 9" Green and Black Floor Tile (checkered pattern) and Associated Mastic	Basement	Storage	Positive	Poor	4	s.f.	Remove and reinstall
5	16	12" x 12" Off-White Floor Tile with Brown Streaks and associated Mastic	Basement	5	Positive	Fair	4	s.f.	Remove and replace
5	16	12" x 12" Off-White Floor Tile with Brown Streaks and associated Mastic	Basement	12	Positive	Fair	4	s.f.	Remove and replace
5	19	9" x 9" Green and White (Checker Pattern) Floor Tile and associated Mastic - Under Beige Floor Tile with Brown Smudges	First Floor	122	Positive	Poor	4	s.f.	Remove loose material and reinstall
5	03	Mastic associated with 12" x 12" White Floor Tile with Dark Streaks	First Floor	109	Positive	Fair	4	s.f.	Remove and replace
5	09	9" x 9" Green and White Checkered Pattern Floor Tile and associated Mastic	Second Floor	209	Positive	Good	4	s.f.	Remove and replace
5	09	9" x 9" Green and White Checkered Pattern Floor Tile and associated Mastic	Second Floor	209A	Positive	Good	4	s.f.	Remove and replace
5	12	9" x 9" Black, White, and Green (Checker Pattern) Floor Tile and associated Mastic	First Floor	Center Hallway	Positive	Fair	4	s.f.	Remove and replace
5	15	9" x 9" Black and Brown (Checker Pattern) Floor Tile and associated Mastic	First Floor	126	Positive	Fair	4	s.f.	Remove and replace
5	09	Grey Thermal Pipe Insulation with Cloth Wrap	First Floor	105 Pipechase	Positive	Poor	4	l.f.	Patch and repair, debris clean up
5	09	9" x 9" Green and White Checkered Pattern Floor Tile and asssociated Mastic	First Floor	115	Positive	Good	5	s.f.	Remove loose material and reinstall
5	18	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	Basement	Center Stairwell	Positive	Good	6	l.f.	Patch and repair
5	13	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	Basement	6-6A	Positive	Poor	7	l.f.	Encapsulate end of pipe
5	14	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	First Floor	103	Positive	Poor	7	l.f.	Patch and repair, encapsulate end of pipe
5	17	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	Basement	3	Positive	Poor	8	l.f.	Encapsulate end of pipe
5	12	12" x 12" Beige Floor Tile with Multi-Colored Smudges and associated Mastic	Basement	West Stairwell	Positive	Good	10	s.f	Remove loose material and reinstall
5	13	12" x 12" Light Brown Floor Tile with Red and White Smudges and associated Mastic	Basement	Hallway CB-5	Positive	Poor	10	s.f.	Remove loose material and reinstall
6	10	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	First Floor	116	Positive	Poor	10	l.f.	Patch and repair
6	03	12" x 12" White Floor Tile with Brown Streaks and associated Mastic	First Floor	102	Positive	Good	10	s.f.	Remove and replace
6	10	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	First Floor	103 Pipechase	Positive	Poor	15	l.f.	Patch and repair, debris clean up
6	15	9" x 9" Black and Brown (Checker Pattern) Floor Tile and associated Mastic	First Floor	129A	Positive	Fair	15	s.f.	Remove and replace
6	10	Grey Thermal Pipe Wrap Insulation and Fittings with Cloth Wrap Debris	First Floor	113	Positive	Poor	16	l.f.	Patch and repair, debris clean up
6	06	12" x 12" Off-White Floor Tile with Dark Streaks and associated Mastic	First Floor	Stairwells	Positive	Good	20	s.f.	Remove loose material and reinstall
6	09	Grey Thermal Pipe Insulation with Cloth Wrap	First Floor	103 Pipechase	Positive	Poor	20	l.f.	Patch and repair, debris clean up

Chillicothe Veterans Affairs Medical Center
Six Month Periodic Asbestos Surveillance
Damaged List with Response Actions from Database
November 2014

Building Number	HSA Number	Material Description	Material Location (Floor)	Room / Location	Sample Results	aterial Conditi	Damage Quantity	Damage Units	Response Action
7	10	Grey Thermal Pipe Insualtion and Fittings with Cloth Wrap	First Floor	109	Positive	Poor	24	l.f.	Patch and repari, debris clean up
7	07	6" Black Cove Base and associated Black Mastic	Basement	Serving Kitchen	Positive	Poor	25	l.f.	Remove loose material and reinstall
7	18	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	Basement	8	Positive	Poor	34	l.f.	Patch and repair, debris clean up
8	13	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	Basement	Crawl Space	Positive	Poor	35	l.f.	Patch and repair
8	14	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	Basement	Throughout	Positive	Poor	36	l.f.	Patch and repair, debris clean up
9	13	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	Pipe Basement	Tank Room	Positive	Poor	40	l.f.	Patch and repair
9	12	12" x 12" Beige Floor Tile with Multi-Colored Smudges and associated Mastic	Basement	Hallway CB-4	Positive	Good	70	s.f.	Remove loose material and reinstall
9	03	12" x 12" Grey and White Floor Tile and associated Mastic	Second Floor	229	Positive	Poor	75	s.f.	Remove loose material and reinstall
10	12	12" x 12" Cream with Olive Streaks Floor Tile and Black Mastic	First Floor	118	Positive	Poor	100	s.f.	Remove and replace
10	13	12" x 12" Olive Floor Tile and Black Mastic	First Floor	118	Positive	Poor	100	s.f.	Remove and replace
10	06	12" x 12" Off-White Floor Tile with Dark Streaks and associated Mastic	Second Floor	207	Positive	Good	100	s.f.	Remove loose material and reinstall
11	16	9" x 9" Red and Tan (Checker Pattern) Floor Tile and associated Mastic	Second Floor	Center Hallway	Positive	Poor	100	s.f.	Remove loose material and reinstall
11	10	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	Pipe Basement	Tank Room	Positive	Poor	105	l.f.	Patch and repair
11	03	12" x 12" Grey and White Floor Tile and associated Mastic	Second Floor	226	Positive	Poor	115	s.f.	Remove loose material and reinstall
17	03	12" x 12" Grey and White Floor Tile and associated Mastic	Second Floor	224	Positive	Poor	115	s.f.	Remove loose material and reinstall
17	03	12" x 12" Grey and White Floor Tile and associated Mastic	Second Floor	225	Positive	Poor	115	s.f.	Remove loose material and reinstall
18	27	Debris on Floor	Third Floor		Positive	Poor	150	s.f.	Patch and repair, debris clean up
18	01	9" x 9" Floor Tile and associated Mastic	Greenhouse Garage		Positive	Poor	150	s.f.	Repair and replace
18	09	Grey Thermal Pipe Insulation with Cloth Wrap	First Floor	109	Positive	Poor	164	l.f.	Patch and repair, debris clean up
18	03	12" x 12" Grey and White Floor Tile and associated Mastic	Second Floor	229A	Positive	Poor	170	s.f.	Remove loose material and reinstall
20	03	12" x 12" Grey and White Floor Tile and associated Mastic	Second Floor	219	Positive	Poor	170	s.f.	Remove loose material and reinstall

Chillicothe Veterans Affairs Medical Center
Six Month Periodic Asbestos Surveillance
Damaged List with Response Actions from Database
November 2014

Building Number	HSA Number	Material Description	Material Location (Floor)	Room / Location	Sample Results	aterial Conditi	Damage Quantity	Damage Units	Response Action
20	05	Brown Cork Insulation and associated Black Mastic	Basement	18	Positive	Poor	195	s.f.	Encapsulate, debris clean up
23	1	Painted White Grey Exterior Cement Wall Shingles	All 4 Sides			Poor	200	s.f.	Encapsulate broken shingles, debris clean up on ground
25	32	Tank Insulation (debris on floor)	Third Floor		Assumed	Poor	200	s.f.	Patch and repair, debris clean up
25	03	12" x 12" Grey and White Floor Tile and associated Mastic	Second Floor	227	Positive	Poor	200	s.f.	Remove loose material and reinstall
25	19	Grey Thermal Pipe Insulation Fitting with Cloth Wrap	Basement	Crawlspace	Positive	Poor	237	l.f./s.f.	Patch and repair, debris clean up
28	05	Brown Cork Insulation and associated Black Mastic	Basement	17	Positive	Poor	240	s.f.	Encapsulate, debris clean up
28	03	12" x 12" Grey and White Floor Tile and associated Mastic	Second Floor	227A	Positive	Poor	255	s.f.	Remove loosee material and reinstall
28	03	12" x 12" Grey and White Floor Tile and associated Mastic	Second Floor	229B	Positive	Poor	260	s.f.	Remove loose material and reinstall
29	26	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	Basement	Crawlspace	Positive	Poor	265	l.f./s.f.	Parch and Repair, debris clean up
30	06	9" x 9" Grey Floor Tile and associated Mastic	Third Floor	301	Positive	Poor	300	s.f.	Remove and replace
30	11	Grey Thermal Pipe Insulation Fitting with Cloth Wrap and Debris	Crawlspace		Positive	Poor	300	l.f./s.f.	Patch and repair, debris clean up
30	03	12" x 12" Grey and White Floor Tile and associated Mastic	Second Floor	223	Positive	Poor	360	s.f.	Remove loose material and reinstall
30	06	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap and Debris	Basement	Crawlspace	Positive	Poor	400	l.f.	Patch and repair, debris clean up
31	05	Painted White Grey Exterior Cement Wall Shingles and Roof	All 4 Walls and Roof		Positive	Poor	400	s.f.	Encapsulate broken shingles, clean up debris on ground
35	14	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	Basement	Crawl Space	Positive	Poor	485	l.f./s.f.	Patch and repair, debris clean up
60	05	Brown Cork Insulation and associated Black Mastic	Basement	20	Positive	Poor	530	s.f.	Encapsulate, debris clean up
179	10	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	Pipe Basement	Crawlspace	Positive	Poor	560	l.f.	Patch and repair
212	13	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	Pipe Basement	Crawlspace	Positive	Poor	640	l.f.	Patch and repair, debris clean up
212	04	12" x 12" Off-White Floor Tile with Dark Streaks and associated Mastic	First Floor	114	Positive	Poor	795	s.f.	Remove and replace
212	10	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	Pipe Basement	Tank Room	Positive	Poor	1380	l.f.	Patch and repair
256	09	Grey Thermal Pipe Insulation with Cloth Wrap	Pipe Basement	Tank Room	Positive	Poor	1380	l.f.	Patch and repair, debris clean up

Chillicothe Veterans Affairs Medical Center
Six Month Periodic Asbestos Surveillance
Damaged List with Response Actions from Database
November 2014

Building Number	HSA Number	Material Description	Material Location (Floor)	Room / Location	Sample Results	aterial Conditi	Damage Quantity	Damage Units	Response Action
T-228	14	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	Crawlspace and Tank Room	Throughout	Positive	Poor	2725	l.f./s.f.	Patch and repair, debris clean up
T-236	10	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	Pipe Basement	Crawlspace	Positive	Poor	5400	s.f.	Debris clean up
T-41	11	Pipe Insulation Debris	Basement	Crawlspace	Positive	Poor	5400	s.f.	Debris clean up
T-51	09	Grey Thermal Pipe Insulation with Cloth Wrap	Pipe Basement	Crawlspace	Positive	Poor	5400	s.f.	Patch and repair, Debris clean up

APPENDIX C

REMOVED MATERIALS LIST FROM DATABASE

Chillicothe Veterans Affairs Medical Center
Six Month Periodic Asbestos Surveillance
Removed Materials List
November 2014

Building Number	Material Description	Material Location (Floor)	Room / Location	Sample Results
1	9" x 9" Floor Tile and associated Mastic underneath Carpet--Removed	First Floor	108	Remove
1	Floor Tile and associated Mastic underneath Carpet--Removed	Basement	Tank Room	Removed
1	Floor Tile and associated Mastic underneath Carpet--Removed	First Floor	152	Removed
1	Floor Tile and associated Mastic underneath Carpet--Removed	Second Floor	208	Removed
3	Floor Tile and associated Mastic underneath Carpet--Removed	Second FloorTTL	236	Removed
3	9" x 9" Floor Tile and associated Mastic underneath Carpet-Removed	Basement	7B	Removed
3	9" x 9" Floor Tile and associated Mastic underneath Carpet-Removed	Basement	7A	Removed
4	9" x 9" Floor Tile and associated Mastic underneath Carpet-Removed	Basement	7	Removed
4	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap-Removed	Basement	5	Removed
4	9" x 9" Floor Tile and associated Mastic underneath Carpet--Removed	First Floor	109	Removed
5	9" x 9" Floor Tile and associated Mastic underneath Carpet--Removed	First Floor	104	Removed
5	9" x 9" Floor Tile and associated Mastic underneath Carpet--Removed	First Floor	112	Removed
5	9" x 9" Floor Tile and associated Mastic underneath Carpet--Removed	First Floor	103	Removed
5	9" x 9" Floor Tile and associated Mastic underneath Carpet--Removed	First Floor	114	Removed
5	9" x 9" Floor Tile and associated Mastic underneath Carpet--Removed	First Floor	117	Removed
5	9" x 9" Floor Tile and associated Mastic underneath Carpet--Removed	First Floor	116	Removed
5	9" x 9" Floor Tile and associated Mastic underneath Carpet--Removed	First Floor	110	Removed
5	9" x 9" Floor Tile and associated Mastic underneath Carpet--Removed	First Floor	106	Removed
7	9" x 9" Floor Tile and associated Mastic underneath Carpet--Removed	First Floor	113	Removed
7	9" x 9" Floor Tile and associated Mastic underneath Carpet--Removed	First Floor	118	Removed
7	9" x 9" Floor Tile and associated Mastic underneath Carpet--Removed	First Floor	105	Removed
7	9" x 9" Floor Tile and associated Mastic underneath Carpet--Removed	First Floor	107	Removed
7	9" x 9" Floor Tile and associated Mastic underneath Carpet--Removed	First Floor	112	Removed
7	9" x 9" Brown Floor Tile and associated Mastic underneath Raised Floor--Removed	First Floor	Hallway	Removed
7	9" x 9" Floor Tile and associated Mastic underneath Carpet--Removed	Second Floor	213	Removed
7	9" x 9" Floor Tile and associated Mastic underneath Carpet--Removed	Second Floor	207	Removed
7	9" x 9" Floor Tile and associated Mastic underneath Carpet--Removed	Second Floor	219	Removed
7	9" x 9" Floor Tile and associated Mastic underneath Carpet--Removed	Second Floor	218	Removed
7	9" x 9" Floor Tile and associated Mastic underneath Carpet--Removed	Second Floor	214	Removed
7	9" x 9" Floor Tile and associated Mastic underneath Carpet--Removed	Second Floor	220	Removed
7	9" x 9" Floor Tile and associated Mastic underneath Carpet--Removed	Second Floor	220	Removed
7	9" x 9" Floor Tile and associated Mastic underneath Carpet--Removed	Second Floor	206	Removed
7	9" x 9" Floor Tile and associated Mastic underneath Carpet--Removed	Second Floor	208	Removed
8	Floor Tile and associated Mastic under Tan and Brown Sheet Flooring--Removed	First Floor	29	Removed
8	12" x 12" White Floor Tile with Brown Streaks and associated Mastic-Removed	Second Floor	104	Removed

Building Number	Material Description	Material Location (Floor)	Room / Location	Sample Results
9	Grey Thermal Pipe Insulation with Cloth Wrap--Removed	First Floor	118	Removed
9	Grey Thermal Pipe Insulation with Cloth Wrap--Removed	First Floor	124	Removed
18	9" x 9" Floor Tile and associated Mastic--Removed	First Floor	131D	Removed
18	9" x 9" Floor Tile and associated Mastic--Removed	First Floor	131E	Removed
18	9" x 9" Floor Tile and associated Mastic--Removed	First Floor	131A	Removed
18	9" x 9" Floor Tile and associated Mastic--Removed	First Floor	131B	Removed
18	9" x 9" Floor Tile and associated Mastic--Removed	First Floor	131C	Removed
18	9" x 9" Floor Tile and associated Mastic--Removed	First Floor	131	Removed
18	9" x 9" Floor Tile and associated Mastic--Removed	First Floor	131F	Removed
18	Mastic associated with 12" x 12" Grey Floor Tile with Blue and Maroon Splats--Removed	Basement	Hallway	Removed
18	Fiberglass Pipe Insulation and associated White Mastic--Removed	Crawlspace		Removed
18	Fiberglass Pipe Insulation and associated White Mastic--Removed	Crawlspace		Removed
18	Fiberglass Pipe Insulation and associated White Mastic--Removed	Each Hallway		Removed
18	Fiberglass Pipe Insulation and associated White Mastic--Removed	Each Hallway		Removed

Building Number	Material Description	Material Location (Floor)	Room / Location	Sample Results
18	Fiberglass Pipe Insulation and associated White Mastic--Removed	Every Room		Removed
18	Fiberglass Pipe Insulation and associated White Mastic--Removed	Every Room		Removed
18	9" x 9" Red Floor Tile and associated Black Mastic--Removed	First Floor	143	Removed
18	9" x 9" Red Floor Tile and associated Black Mastic--Removed	First Floor	117	Removed
18	9" x 9" Red Floor Tile and associated Black Mastic--Removed	First Floor	132	Removed
18	9" x 9" Red Floor Tile and associated Black Mastic--Removed	First Floor	122A	Removed
18	9" x 9" Red Floor Tile and associated Black Mastic--Removed	First Floor	160A	Removed
18	9" x 9" Brown Floor Tile and associated Black Mastic--Removed	First Floor	122A	Removed
18	9" x 9" Brown Floor Tile and associated Black Mastic--Removed	First Floor	132	Removed
18	9" x 9" Brown Floor Tile and associated Black Mastic--Removed	First Floor	117	Removed
18	9" x 9" Brown Floor Tile and associated Black Mastic--Removed	First Floor	160A	Removed
18	9" x 9" Brown Floor Tile and associated Black Mastic--Removed	First Floor	143	Removed
18	Brown Pebble Pattern Sheet Flooring--Removed	First Floor	111	Removed
18	12" x 12" Cream Floor Tile and associated Black Mastic--Removed	First Floor	Hallway	Removed

Building Number	Material Description	Material Location (Floor)	Room / Location	Sample Results
18	12" x 12" Cream Floor Tile and associated Black Mastic--Removed	First Floor	153	Removed
18	12" x 12" Cream Floor Tile and associated Black Mastic--Removed	First Floor	138	Removed
18	12" x 12" Cream Floor Tile and associated Black Mastic--Removed	First Floor	121	Removed
21	12" x 12" Cream Floor Tile and associated Black Mastic--Removed	First Floor	154	Removed
21	12" x 12" Cream Floor Tile and associated Black Mastic--Removed	First Floor	139	Removed
24	12" x 12" Cream Floor Tile and associated Black Mastic--Removed	First Floor	139B	Removed
24	12" x 12" Cream Floor Tile and associated Black Mastic--Removed	First Floor	139C	Removed
24	12" x 12" Cream Floor Tile and associated Black Mastic--Removed	First Floor	100A	Removed
24	12" x 12" Cream Floor Tile and associated Black Mastic--Removed	First Floor	100	Removed
24	12" x 12" Cream Floor Tile and associated Black Mastic--Removed	First Floor	139A	Removed
24	12" x 12" Cream Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	151	Removed
24	12" x 12" Blue Floor Tile and associated Black Mastic--Removed	First Floor	160B	Removed
24	12" x 12" Blue Floor Tile and associated Black Mastic--Removed	First Floor	160	Removed
24	12" x 12" Blue Floor Tile and associated Black Mastic--Removed	First Floor	Southwest Hallway	Removed

Building Number	Material Description	Material Location (Floor)	Room / Location	Sample Results
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	120	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	109	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	106	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	112	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	105	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	150	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	127	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	146	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	147	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	114	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	151	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	110	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	128	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	119	Removed

Building Number	Material Description	Material Location (Floor)	Room / Location	Sample Results
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	108	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	152	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	104	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	151B	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	156A	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	115	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	141	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	134	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	156	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	151A	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	101	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	145	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	125	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	133	Removed

Building Number	Material Description	Material Location (Floor)	Room / Location	Sample Results
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	140	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	122	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Black Mastic--Removed	First Floor	145A	Removed
24	Red Brick Pattern Sheet Flooring--Removed	First Floor	149	Removed
24	9" x 9" Floor Tile and associated Mastic--Removed	Hallway 131		Removed
24	Fiberglass Pipe Insulation and associated White Mastic--Removed	Mechanical Rooms		Removed
24	Fiberglass Pipe Insulation and associated White Mastic--Removed	Mechanical Rooms		Removed
24	Brown Wood Pattern Sheet Flooring--Removed	Second Floor	211	Removed
24	Brown Wood Pattern Sheet Flooring--Removed	Second Floor	247	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	250	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	251	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	218	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	Hallway	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	237	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	224	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	236	Removed

Building Number	Material Description	Material Location (Floor)	Room / Location	Sample Results
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	245	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	239	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	246	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	202	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	204	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	210	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	221	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	249	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	248	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	201	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	217	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	219	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	253	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	252	Removed

Building Number	Material Description	Material Location (Floor)	Room / Location	Sample Results
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	240	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	241	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	208	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	203	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	222	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	201B	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	201A	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	256	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	213	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	212	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks--Removed	Second Floor	254	Removed
24	Mastic associated wih Turquoise Sheet Flooring--Removed	Second Floor	209	Removed
24	9" x 9" Red Floor Tile and associated Black Mastic--Removed	Second Floor	222A	Removed
24	9" x 9" Red Floor Tile and associated Black Mastic--Removed	Second Floor	244A	Removed

Building Number	Material Description	Material Location (Floor)	Room / Location	Sample Results
24	9" x 9" Red Floor Tile and associated Black Mastic--Removed	Second Floor	226A	Removed
24	9" x 9" Red Floor Tile and associated Black Mastic--Removed	Second Floor	214A	Removed
24	9" x 9" Brown Floor Tile and associated Black Mastic--Removed	Second Floor	244A	Removed
24	9" x 9" Brown Floor Tile and associated Black Mastic--Removed	Second Floor	226A	Removed
24	9" x 9" Brown Floor Tile and associated Black Mastic--Removed	Second Floor	214A	Removed
24	9" x 9" Brown Floor Tile and associated Black Mastic--Removed	Second Floor	222A	Removed
24	Mastic associated with Grey Sheet Flooring--Removed	Second Floor	230A	Removed
24	Mastic associated with Grey Sheet Flooring--Removed	Second Floor	230	Removed
24	12" x 12" Cream Floor Tile with Smudges and associated Black Mastic--Removed	Second Floor	201A	Removed
24	Mastic associated with 12" x 12" Red and Brown Floor Tile--Removed	Stairwells		Removed
24	12" x 12" Cream Floor Tile and associated Black Mastic-Removed		Stairwells	Removed
24	12" x 12" Grey Floor Tile with Smudges and associated Mastic-Removed		Stairwells	Removed
24	Mastic Associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	Basement	Hallway	Removed
24	12" x 12" White Floor Tile with Brown Streaks and associated Mastic-Removed	Basement	Hallway	Removed
24	9" x 9" Floor Tile and associated Mastic underneath Carpet-Removed	Basement	14	Removed
24	9" x 9" Floor Tile and associated Mastic underneath Carpet-Removed	Basement	16	Removed
24	9" x 9" Floor Tile and associated Mastic underneath Carpet-Removed	Basement	15	Removed

Building Number	Material Description	Material Location (Floor)	Room / Location	Sample Results
24	9" x 9" Floor Tile and associated Mastic underneath Carpet-Removed	Basement	11	Removed
24	9" x 9" Floor Tile and associated Mastic underneath Carpet-Removed	Basement	12	Removed
24	Black Carpet Mastic-Removed	First Floor	158	Removed
24	Black Carpet Mastic-Removed	First Floor	126	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	131	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	145	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	140	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	103	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	133	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	132	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	146	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	102	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	134	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	129A	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	104A	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	105	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	150	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	112	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	118	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	148	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	153	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	113	Removed

Building Number	Material Description	Material Location (Floor)	Room / Location	Sample Results
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	129	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	159	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	130	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	1C1	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	137	Removed
24	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	155	Removed
26	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-removed	First Floor	139	Removed
27	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	144	Removed
27	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	Hallway	Removed
27	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	108	Removed
30	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	121	Removed
30	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	136	Removed
30	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	106	Removed
30	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	119	Removed
30	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	138	Removed
30	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	104	Removed
30	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	117	Removed
30	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	124	Removed
30	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	122	Removed
30	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	154	Removed
30	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	156	Removed
31	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	101	Removed

Building Number	Material Description	Material Location (Floor)	Room / Location	Sample Results
35	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	101A	Removed
35	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	152	Removed
35	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	1L1	Removed
35	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	151	Removed
35	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	107	Removed
35	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	149	Removed
35	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	141	Removed
35	Mastic associated with 12" x 12" Grey Floor Tile with Brown and Blue Specks-Removed	First Floor	125	Removed
35	Red Brick Pattern Sheet Flooring-Removed	First Floor	111	Removed
35	Red Brick Pattern Sheet Flooring-Removed	First Floor	147	Removed
35	Red Brick Pattern Sheet Flooring-Removed	First Floor	109	Removed
35	Red Brick Pattern Sheet Flooring-Removed	First Floor	110	Removed
35	12" x 12" Gold Floor Tile and associated Black Mastic-Removed	Second Floor	Hallway	Removed
35	12" x 12" Cream Floor Tile and associated Black Mastic-Removed	Second Floor	223	Removed
35	12" x 12" Cream Floor Tile and associated Black Mastic-Removed	Second Floor	232	Removed
35	12" x 12" Cream Floor Tile and associated Black Mastic-Removed	Second Floor	246	Removed
35	12" x 12" Cream Floor Tile and associated Black Mastic-Removed	Second Floor	253	Removed
35	12" x 12" Cream Floor Tile and associated Black Mastic-Removed	Second Floor	250	Removed
210	12" x 12" Cream Floor Tile and associated Black Mastic-Removed	Second Floor	249	Removed
210	12" x 12" Cream Floor Tile and associated Black Mastic-Removed	Second Floor	241	Removed
210	12" x 12" Cream Floor Tile and associated Black Mastic-Removed	Second Floor	221	Removed
210	12" x 12" Cream Floor Tile and associated Black Mastic-Removed	Second Floor	225	Removed

Building Number	Material Description	Material Location (Floor)	Room / Location	Sample Results
210	12" x 12" Cream Floor Tile and associated Black Mastic-Removed	Second Floor	240	Removed
210	12" x 12" Cream Floor Tile and associated Black Mastic-Removed	Second Floor	248	Removed
210	12" x 12" Cream Floor Tile and associated Black Mastic-Removed	Second Floor	251	Removed
210	12" x 12" Cream Floor Tile and associated Black Mastic-Removed	Second Floor	255	Removed
210	12" x 12" Cream Floor Tile and associated Black Mastic-Removed	Second Floor	245	Removed
210	12" x 12" Cream Floor Tile and associated Black Mastic-Removed	Second Floor	211	Removed
210	12" x 12" Off-White Floor Tile with Beige Streaks and associated Mastic-Removed	Second Floor	C-5	Removed
210	12" x 12" Off-White Floor Tile with Beige Streaks and associated Mastic-Removed	Second Floor	C-6	Removed
210	Black Carpet Mastic-Removed	Second Floor	228	Removed
210	Black Carpet Mastic-Removed	Second Floor	233	Removed
210	Black Carpet Mastic-Removed	Second Floor	224	Removed
210	12" x 12" Off-White Floor Tile with Brown Streaks and associated Mastic Under Carpet-Removed	Basement	15	Removed
210	12" x 12" Off-White Floor Tile with Brown Streaks and associated Mastic--Removed	Basement	13	Removed
210	12" x 12" Off-White Floor Tile with Brown Streaks and associated Mastic--Removed	Basement	13B	Removed
210	9" x 9" Green and White (Checker Pattern) Floor Tile and associated Mastic-Removed	First Floor	Elevator Hallway	Removed
210	9" x 9" Green and White (Checker Pattern) Floor Tile and associated Mastic-Removed	First Floor	127	Removed
210	9" x 9" Green and White (Checker Pattern) Floor Tile and associated Mastic-Removed	First Floor	139	Removed
210	9" x 9" White with Brown Smudges Floor Tile and associated Mastic - Removed	First Floor	132	Removed
210	9" x 9" Green Floor Tile and associated Mastic - Removed	First Floor	129	Removed
210	9" x 9" Green Floor Tile and associated Mastic - Removed	First Floor	128	Removed
210	9" x 9" Green Floor Tile and associated Mastic - Removed	First Floor	131	Removed
210	9" x 9" Green Floor Tile and associated Mastic - Removed	First Floor	130	Removed
210	9" x 9" Green Floor Tile and assocaited Mastic underneath Carpet-Removed	First Floor	Northwest Hallway	Removed

Building Number	Material Description	Material Location (Floor)	Room / Location	Sample Results
210	Mastic Associated with Beige and Blue Floor Tile with Black and White Smudges--Removed	Basement	Southwest Stairwell	Removed
210	Mastic Associated with Beige and Blue Floor Tile with Black and White Smudges--Removed	Basement	GCS1	Removed
210	12" x 12" Green and White Floor Tile and associated Mastic--Removed	Basement	Stairwells	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1B144	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1B127	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1C120	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1A103	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1A101	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1B133	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1AC1	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1B101	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1AVT	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1B102	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1B103	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1A104	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1B105	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1C103	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1B107	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1B108	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	Stairwells	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1B114	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1BS1	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1B144A	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1C128	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1C132	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1C105	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1B117	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1B111	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1C101	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1B138	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1B109	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1CS1	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1C148	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1C144	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1A100	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1C135	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1C146	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1B140	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1C145	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1C144A	Removed

Building Number	Material Description	Material Location (Floor)	Room / Location	Sample Results
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1B120	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1B142	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1B143	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1B124	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1B125	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1C143	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1C102A	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1C102	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1C139	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1C147	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1C107	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1C124	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1C114	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1C108	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1C109	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1C117	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	Hallway	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	First Floor	1B135	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	252	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	253	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	221	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	251	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	244	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	243	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	205	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	250	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	248	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	239C	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	233C	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	233B	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	233	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	239	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	226	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	238C	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	238A	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	225	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	215A	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	247	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	214B	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	207	Removed

Building Number	Material Description	Material Location (Floor)	Room / Location	Sample Results
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	210	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	202	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	232	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	221A	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	213	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	201A	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	228	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	219	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	204	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	206C	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	237	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	214C	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	213C	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	242	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	Hallway	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	216	Removed
210	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	207A	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	241	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	218	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	215B	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	201	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	240	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	227	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	236	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	230	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	206A	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	208A	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	214	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	235B	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	211	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	235A	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	229	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	209	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	217	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	234A	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	Stairwells	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	203	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	208C	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	235	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	246	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	213B	Removed

Building Number	Material Description	Material Location (Floor)	Room / Location	Sample Results
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	234	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	245	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	207C	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	234B	Removed
211	Mastic associated with 12" x 12" Dark Tan Floor Tile--Removed	Second Floor	215	Removed
211	Grey Exterior Cement Wall Panels - Removed	Building Exterior		Removed
211	12" x 12" Off-White Floor Tile and associated Black Mastic-Removed	Mezzanine	202	Removed
211	Mastic associated with 12" x 12" Grey Floor Tile with Green and Maroon Smudges--Removed	Basement	Center Hallway	Removed
211	Yellow and Black Carpet Mastic-removed	First Floor	152	Removed
211	Yellow and Black Carpet Mastic - removed	First Floor	150	Removed
211	Yellow and Black Carpet Mastic--Removed	Second Floor	East Stairwell	Removed
211	12" x 12" Beige Floor Tile with Brown Streaks and associated Mastic - Removed	First Floor	106J	Removed
211	12" x 12" Green Floor Tile and associated Mastic--Removed	First Floor	106G	Removed
211	Brown Wood Pattern Sheet Flooring--Removed	First Floor	106A	Removed
211	Mastic associated with 12" x 12" Tan and White Floor Tile Under Carpet-Removed	Basement	10D	Removed
211	12" x 12" Grey Floor Tile with Blue and Maroon Smudges and associated Mastic - Removed	Basement	Elevators	Removed
211	12" x 12" Grey Floor Tile With Blue and Maroon Smudges and associated Mastic-Removed	Basement	Center Hallway	Removed
211	Grey Thermal Pipe Insulation with Cloth Wrap--Removed	Basement	Crawl Space	Removed
211	9" x 9" Maroon and Black Floor Tile and Associated Mastic--Removed	Basement	North and South Stairwells	Removed
211	Mastic associated with 12" x 12" Beige Floor Tile with Greyish Brown and White Smudges--Removed	First Floor	105	Removed
211	Mastic Associated with 12" x 12" Beige Floor Tile with Greyish Brown and White Smudges--Removed	First Floor	106	Removed
211	Mastic associated with 12" x 12" Beige Floor Tile with Greyish Brown and White Smudges--Removed	First Floor	117	Removed
211	Mastic associated with 12" x 12" Beige Floor Tile with Greyish Brown and White Smudges--Removed	First Floor	114	Removed
211	Black Border and associated Mastic--Removed	First Floor	North Stairwell	Removed
211	Black Border and associated mastic--Removed	First Floor	South Stairwell	Removed
211	Mastic associated with Light Brown Floor Tile with Brown, White and Red Smudges - Removed	Second Floor	2-105	Removed
211	Yellow and Black Carpet Mastic--Removed	Basement	BB116	Removed

Building Number	Material Description	Material Location (Floor)	Room / Location	Sample Results
211	12" x 12" Beige Floor Tile with Brown and White Smudges and associated Mastic--Removed	Basement	BC105A	Removed
211	12" x 12" Beige Floor Tile with Brown and White Smudges and associated Mastic-Removed	Basement	BC106	Removed
211	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap-Removed	Basement	BC109 to BC113	Removed
211	Yellow and Black Carpet Mastic--Removed	First Floor	1C112	Removed
211	18" x 18" Light Grey Floor Tile with Dark Smudges and associated Mastic--Removed	First Floor	1C114	Removed
211	12" x 12" Tan and White Floor Tile and associated Mastic - Removed	Second Floor	2B113	Removed
211	12" x 12" Tan and White Floor Tile and associated Mastic--Removed	Second Floor	2B109	Removed
211	12" x 12" Tan and White Floor Tile and associated Mastic--Removed	Second Floor	2C124	Removed
211	12" x 12" Grey Floor Tile and associated Mastic--Removed	Second Floor	2A108	Removed
211	12" x 12" Green and White Floor Tile and associated Mastic--Removed	Second Floor	2C105	Removed
211	12" x 12" Green and White Floor Tile and associated Mastic--Removed	Second Floor	2C114	Removed
211	12" x 12" Green and White Floor Tile and associated Mastic--Removed	Second Floor	2C102	Removed
211	12" x 12" Green and White Floor Tile and associated Mastic-Removed	Second Floor	2C109	Removed
211	Yellow and Black Carpet Mastic--Removed	Third Floor	3B103	Removed
211	Yellow and Black Carpet Mastic--Removed	Third Floor	3B107	Removed
211	12" x 12" Beige Floor Tile with Brown and White Smudges and associated Mastic--Removed	Third Floor	3A100	Removed
211	12" x 12" Beige Floor Tile with Brown and White Smudges and associated Mastic--Removed	Third Floor	3B110	Removed
211	9" x 9" Green and White Checkered Pattern Floor Tile and associated Mastic--Removed	First Floor	111A	Removed
211	9" x 9" Green and White Checkered Pattern Floor Tile and associated Mastic--Removed	First Floor	111	Removed
211	9" x 9" Green and White Checkered Pattern Floor Tile and associated Mastic--Removed	Second Floor	202A	Removed
211	9" x 9" Black and Brown (Checker Pattern) Floor Tile and associated Mastic--Removed	First Floor	South Hallway	Removed
211	12" x 12" Grey and White Floor Tile and associated Mastic--Removed	Second Floor	217	Removed
211	12" x 12" Grey and White Floor Tile and associated Mastic--Removed	Second Floor	206	Removed
211	12" x 12" Grey and White Floor Tile and associated Mastic--Removed	Second Floor	219A	Removed
211	9" x 9" Red and Tan (Checker Pattern) Floor Tile and associated Mastic--Removed	Second Floor	231	Removed
211	9" x 9" Red and Tan (Checker Pattern) Floor Tile and associated Mastic--Removed	Second Floor	231A	Removed
211	9" x 9" Red and Tan (Checker Pattern) Floor Tile and associated Mastic--Removed	Second Floor	230	Removed
211	9" x 9" Red and Tan (Checker Pattern) Floor Tile and associated Mastic--Removed	Second Floor	231B	Removed
211	12" x 12" Tan and White Floor Tile and associated Mastic - Removed	Basement	7	Removed
211	12" x 12" Tan and White Floor Tile and associated Mastic	Basement	12	Removed

Building Number	Material Description	Material Location (Floor)	Room / Location	Sample Results
211	12" x 12" Tan and White Floor Tile and associated Mastic--Removed	Basement	9B	Removed
211	12" x 12" Tan and White Floor Tile and associated Mastic--Removed	Basement	6B	Removed
211	12" x 12" Tan and White Floor Tile and associated Mastic-Removed	First Floor	106H	Removed
212	12" x 12" Tan and White Floor Tile and associated Mastic-Removed	First Floor	106	Removed
212	12" x 12" Tan and White Floor Tile and associated Mastic-Removed	First Floor	Hallway 106	Removed
212	12" x 12" Tan and White Floor Tile and associated Mastic-Removed	First Floor	106A	Removed
212	12" x 12" Tan and White Floor Tile and associated Mastic-Removed	First Floor	106B	Removed
212	12" x 12" Tan and White Floor Tile and associated Mastic-Removed	First Floor	106C	Removed
212	12" x 12" Tan and White Floor Tile and associated Mastic-Removed	First Floor	106D	Removed
212	12" x 12" Tan and White Floor Tile and associated Mastic-Removed	First Floor	106E	Removed
212	12" x 12" Tan and White Floor Tile and associated Mastic-Removed	First Floor	106F	Removed
212	12" x 12" Tan and White Floor Tile and associated Mastic-Removed	First Floor	106G	Removed
212	12" x 12" Tan and White Floor Tile and associated Mastic-Removed	First Floor	106I	Removed
212	12" x 12" Off-White Floor Tile with Grey Streaks and associated Mastic--Removed	First Floor	107A	Removed
212	12" x 12" Off-White Floor Tile with Grey Streaks and associated Mastic--Removed	First Floor	107B	Removed
247	12" x 12" Off-White Floor Tile with Multi-Colored Smudges and associated Mastic--Removed	Basement	4A	Removed
259	12" x 12" Off-White Floor Tile with Multi-Colored Smudges and associated Mastic--Removed	Basement	4A	Removed
259	12" x 12" Off White and Blue Checkered Pattern Floor Tile and associated Black Mastic--Removed			Removed
T-38-40	Grey Thermal Pipe Insulation with Cloth Wrap--Replaced with Fiberglass	First Floor	3D	Replaced

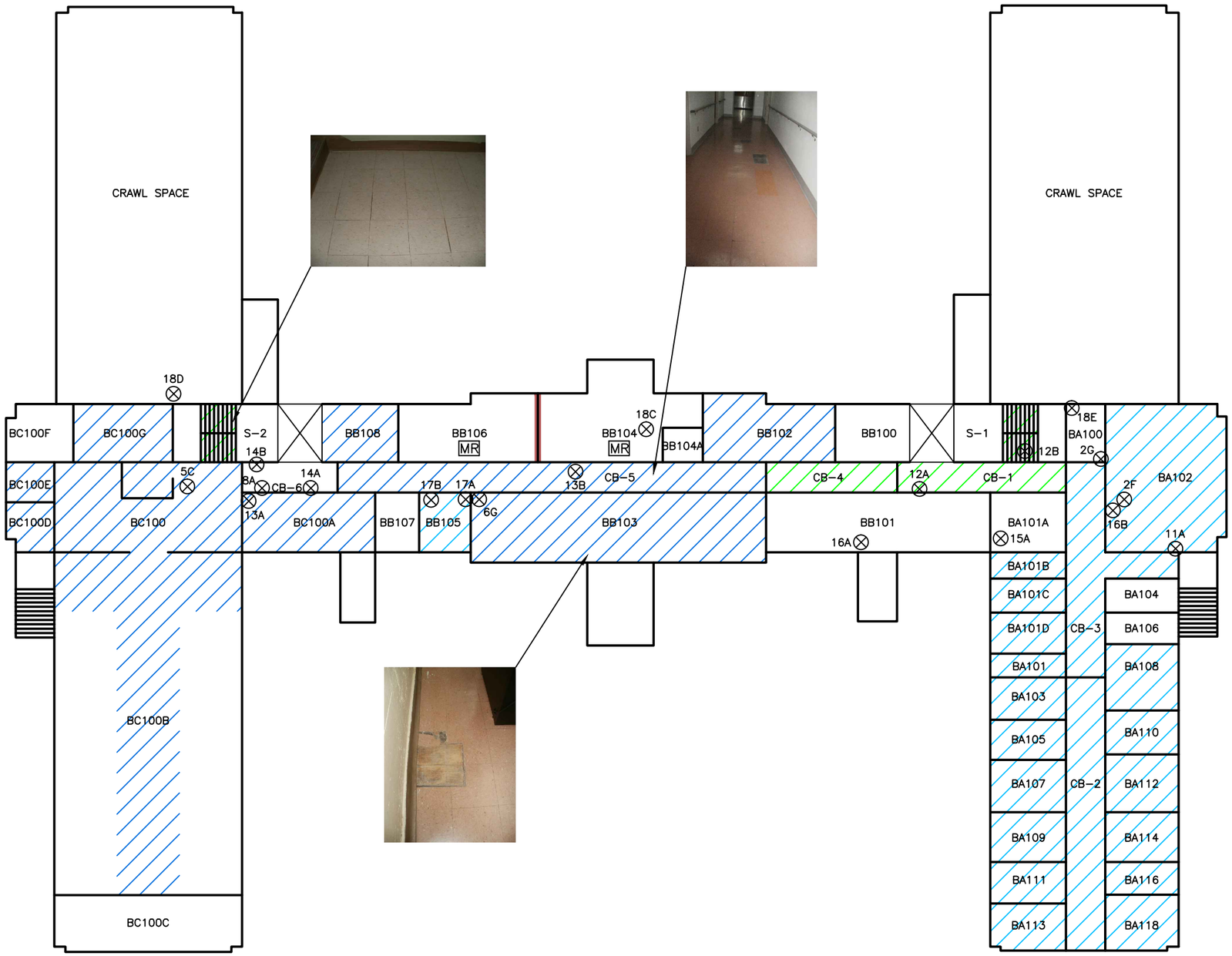
APPENDIX D

LIST OF REMODELED BUILDING SPACES

Building No.	Building Name	HSA No.	Material Description	Location	Quantity	Units	New Material
24	Patient Ward Building and SPD	12	Mastic associated with 12" x 12" Dark Tan Floor Tile	GB116	1,200	s.f.	New Floor Tile
24	Patient Ward Building and SPD	15	Mastic associated with Beige and Blue Floor Tile with Black and White Smudges	GB120	1,200	s.f.	New Floor Tile
24	Patient Ward Building and SPD	16	Mastic associated with 12" x 12" White Floor Tile with Dark Streaks	GB109B	2,100	s.f.	New Floor Tile
24	Patient Ward Building and SPD	16	Mastic associated with 12" x 12" White Floor Tile with Dark Streaks	GB113	200	s.f.	New Carpet
27	Medical/Surgical and Specialty Clinics and Patient Business Services	25	Mastic associated with 12" x 12" Brown and White Floor Tile	Rooms 23 (22A - K)	920	s.f.	New Floor Tile
27	Medical/Surgical and Specialty Clinics and Patient Business Services	03	Yellow and Black Carpet Mastic	16	375	s.f.	New Carpet
27	Medical/Surgical and Specialty Clinics and Patient Business Services	24	Mastic associated with 12" x 12" Grey Floor Tile and Blue and Maroon Smudges	Basement Hall	1,500	s.f.	New Floor Tile
27	Medical/Surgical and Specialty Clinics and Patient Business Services	03	Yellow and Black Carpet Mastic	140	325	s.f.	New Floor Tile
27	Medical/Surgical and Specialty Clinics and Patient Business Services	03	Yellow and Black Carpet Mastic	Room 239	960	s.f.	Wood Pattern Laminate over Mastic
30	Patient Ward Building and Clinics	22	Mastic associated with 12" x 12" Tan and White Floor Tile	Basement, Room 13	400	s.f.	New Wood Pattern Sheet Floor
30	Patient Ward Building and Clinics	22	Mastic associated with 12" x 12" Tan and White Floor Tile	Basement, Rooms 13A - C	460	s.f.	New Grey Sheet Floor
30	Patient Ward Building and Clinics	18	Mastic associated with 12" x 12" Beige Floor Tile with Greyish Brown and White Smudges	Room 134	72	s.f.	New Floor Tile
30	Patient Ward Building and Clinics	18	Mastic associated with 12" x 12" Beige Floor Tile with Greyish Brown and White Smudges	Room 154	170	s.f.	New Floor Tile
30	Patient Ward Building and Clinics	18	Mastic associated with 12" x 12" Beige Floor Tile with Greyish Brown and White Smudges	Room 147	300	s.f.	New Floor Tile
30	Patient Ward Building and Clinics	18	Mastic associated with 12" x 12" Beige Floor Tile with Greyish Brown and White Smudges	Room 140	170	s.f.	New Floor Tile
30	Patient Ward Building and Clinics	18	Mastic associated with 12" x 12" Beige Floor Tile with Greyish Brown and White Smudges	Room 141	170	s.f.	New Floor Tile
30	Patient Ward Building and Clinics	18	Mastic associated with 12" x 12" Beige Floor Tile with Greyish Brown and White Smudges	Room 142	90	s.f.	New Floor Tile
30	Patient Ward Building and Clinics	18	Mastic associated with 12" x 12" Beige Floor Tile with Greyish Brown and White Smudges	Room 150	125	s.f.	New Floor Tile
30	Patient Ward Building and Clinics	18	Mastic associated with 12" x 12" Beige Floor Tile with Greyish Brown and White Smudges	Room 137	170	s.f.	New Floor TIle
30	Patient Ward Building and Clinics	18	Mastic associated with 12" x 12" Beige Floor Tile with Greyish Brown and White Smudges	Room 133	250	s.f.	New Floor Tile
30	Patient Ward Building and Clinics	18	Mastic associated with 12" x 12" Beige Floor Tile with Greyish Brown and White Smudges	Room 145	100	s.f.	New Floor Tile
30	Patient Ward Building and Clinics	18	Mastic associated with 12" x 12" Beige Floor Tile with Greyish Brown and White Smudges	Room 157	170	s.f.	New Floor Tile
30	Patient Ward Building and Clinics	18	Mastic associated with 12" x 12" Beige Floor Tile with Greyish Brown and White Smudges	Room 139	170	s.f.	New Floor Tile
30	Patient Ward Building and Clinics	18	Mastic associated with 12" x 12" Beige Floor Tile with Greyish Brown and White Smudges	First Floor Hall	1,425	s.f.	New Floor Tile
30	Patient Ward Building and Clinics	22	Mastic associated with 12" x 12" Tan and White Floor Tile	Room 126	100	s.f.	New Wood Pattern Laminate
30	Patient Ward Building and Clinics	22	Mastic associated with 12" x 12" Tan and White Floor Tile	Room 128	165	s.f.	New Wood Pattern Laminate
30	Patient Ward Building and Clinics	22	Mastic associated with 12" x 12" Tan and White Floor Tile	Room 128A	130	s.f.	New Wood Pattern Laminate
30	Patient Ward Building and Clinics	22	Mastic associated with 12" x 12" Tan and White Floor Tile	Room 129	200	s.f.	New Wood Pattern Laminate
30	Patient Ward Building and Clinics	22	Mastic associated with 12" x 12" Tan and White Floor Tile	Room 8D	500	s.f.	New Wood Pattern Laminate
30	Patient Ward Building and Clinics	22	Mastic associated with 12" x 12" Tan and White Floor Tile	Room 127	150	s.f.	New Wood Pattern Wood Laminate
30	Patient Ward Building and Clinics	22	Mastic associated with 12" x 12" Tan and White Floor Tile	Room 130	200	s.f.	New Carpet
30	Patient Ward Building and Clinics	24	12" x 12" Beige, Grey, and Brown Floor Tile and Associated Mastic	Basement Hall	300	s.f.	New Floor Tile
31	Admissions and Clinics	12	Mastic associated with Light Brown Floor Tile with Brown, White and Red Smudges	Room 2-302	480	s.f.	New Floor Tile
31	Admissions and Clinics	18	Mastic associated with 12" x 12" Tan and White Floor Tile	G-326	300	s.f.	New Floor Tile
35	Patient Ward Building, Psychological Testing, SA/DDTP	16	18" x 18" Light Grey Floor Tile with Dark Smudges and associated Mastic	Room 1C101	120	s.f.	New Wood Pattern Laminate
35	Patient Ward Building, Psychological Testing, SA/DDTP	16	18" x 18" Light Grey Floor Tile with Dark Smudges and associated Mastic	Room 1C125	295	s.f.	New Wood Pattern Laminate
35	Patient Ward Building, Psychological Testing, SA/DDTP	16	18" x 18" Light Grey Floor Tile with Dark Smudges and associated Mastic	Room 1C104	120	s.f.	New Wood Pattern Laminate
35	Patient Ward Building, Psychological Testing, SA/DDTP	16	18" x 18" Light Grey Floor Tile with Dark Smudges and associated Mastic	Room 1C123	295	s.f.	New Wood Pattern Laminate
35	Patient Ward Building, Psychological Testing, SA/DDTP	16	18" x 18" Light Grey Floor Tile with Dark Smudges and associated Mastic	Room 1C119	615	s.f.	New Wood Pattern Laminate
35	Patient Ward Building, Psychological Testing, SA/DDTP	11	12" x 12" Beige Floor Tile with Brown and White Smudges and Associated Mastic	Basement Hall	3,195	s.f.	New Floor Tile
35	Patient Ward Building, Psychological Testing, SA/DDTP	06	Yellow and Black Carpet Mastic	Basement, BB112A - C	620	s.f.	New Carpet
212	Inter-Agency Child Care Center and Union Office Suite	19	9" x 9" Green and White (Checkered Pattern) Floor Tile and associated Mastic	Room 106	420	s.f.	New Floor Tile
212	Inter-Agency Child Care Center and Union Office Suite	19	9" x 9" Green and White (Checkered Pattern) Floor Tile and associated Mastic	Room 122	315	s.f.	New Floor Tile
252	Chapel	09	9" x 9" Beige Floor Tile and Associated Mastic underneath Carpet	Room 106	50	s.f.	New Floor Tile

APPENDIX E

MAPS WITH PHOTO OF DAMAGED ACM



LEGEND

ELEVATOR

MR MECHANICAL ROOM

ROOM NUMBER

2F ⊗ APPROXIMATE ASBESTOS SAMPLE LOCATION

HSA-06: FLOOR TILE AND ASSOCIATED MASTIC UNDER CARPET

HSA-12: 12"X12" BEIGE FLOOR TILE WITH MULTI-COLORED SMUDGES AND ASSOCIATED MASTIC

HSA-13: 12"X12" LIGHT BROWN FLOOR TILE WITH RED AND WHITE SMUDGES AND ASSOCIATED MASTIC

HSA-19: CEMENT WALL PANEL GREY

NOT TO SCALE

FIGURE 21.0

ASBESTOS 6-MONTH PERIODIC SURVEILLANCE - NOVEMBER 2014

BUILDING 1 BASMENT SAMPLE AND ACM LOCATION MAP
CHILLICOTHE VA MEDICAL CENTER
17273 SR 104
CHILLICOTHE, OHIO

PREPARED FOR

U.S. DEPARTMENT OF VETERAN AFFAIRS
CHILLICOTHE, OHIO

DRAWN CLW/12-04-14	CHECKED
REVISED	APPROVED
JOB NO. 12091.06	TTL associates inc
DRAWING NUMBER **1209106-1.0E**	

LEGEND

ROOM NUMBER

1A APPROXIMATE ASBESTOS SAMPLE LOCATION

HSA–03: 12"X12" GREY AND WHITE FLOOR TILE WITH ASSOCIATED MASTIC

HSA–05: 12"X12" TAN AND WHITE FLOOR TILE AND ASSOCIATED MASTIC

HSA–12: 9"X9" BLACK, WHITE AND GREEN CHECKER PATTERN FLOOR TILE AND ASSOCIATED MASTIC

HSA–15: 9"X9" BLACK AND BROWN CHECKER PATTERN FLOOR TILE AND ASSOCIATED MASTIC

NOT TO SCALE

FIGURE 29.1
ASBESTOS 6–MONTH PERIODIC SURVEILLANCE – NOVEMBER 2014
BUILDING 5 FIRST FLOOR SAMPLE AND ACM LOCATION MAP
CHILLICOTHE VA MEDICAL CENTER
17273 SR 104
CHILLICOTHE, OHIO

PREPARED FOR
U.S. DEPARTMENT OF VETERAN AFFAIRS
CHILLICOTHE, OHIO

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REVISED	APPROVED
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DRAWING NUMBER **1209106–5.1E**	

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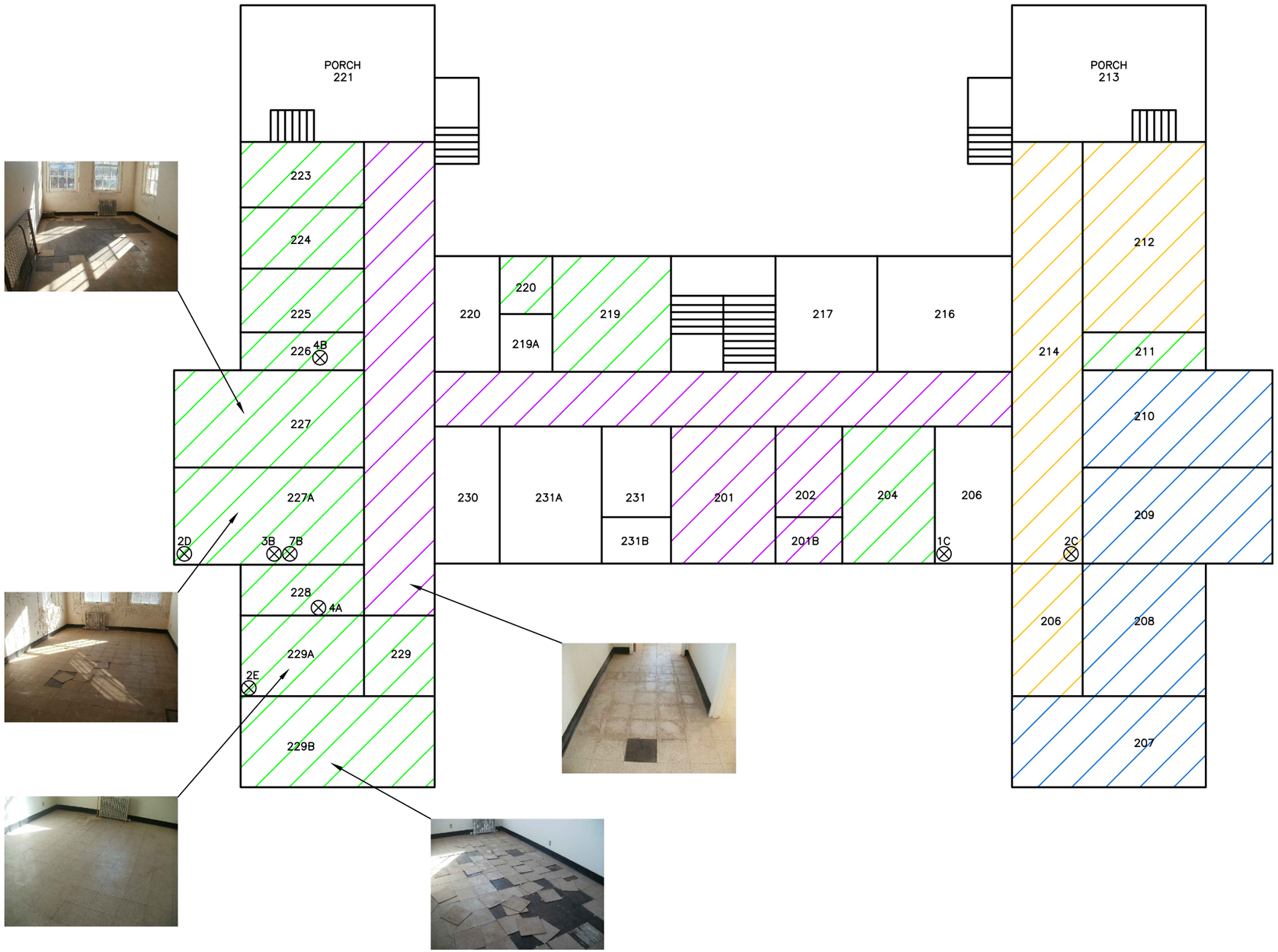

LEGEND

ROOM NUMBER

1A ⊗ APPROXIMATE ASBESTOS SAMPLE LOCATION

HSA–03: 12"X12" GREY AND WHITE FLOOR TILE WITH ASSOCIATED MASTIC

HSA–15: 9"X9" BLACK AND BROWN CHECKER PATTERN FLOOR TILE AND ASSOCIATED MASTIC

HSA–16: 9"X9" RED AND TAN CHECKER PATTERN FLOOR TILE AND ASSOCIATED MASTIC

HSA–20: 9"X9" RED, TAN AND BROWN CHECKER PATTERN FLOOR TILE AND ASSOCIATED MASTIC

NOT TO SCALE

FIGURE 29.2

ASBESTOS 6–MONTH PERIODIC SURVEILLANCE – NOVEMBER 2014

BUILDING 5 SECOND FLOOR SAMPLE AND ACM LOCATION MAP
CHILLICOTHE VA MEDICAL CENTER
17273 SR 104
CHILLICOTHE, OHIO

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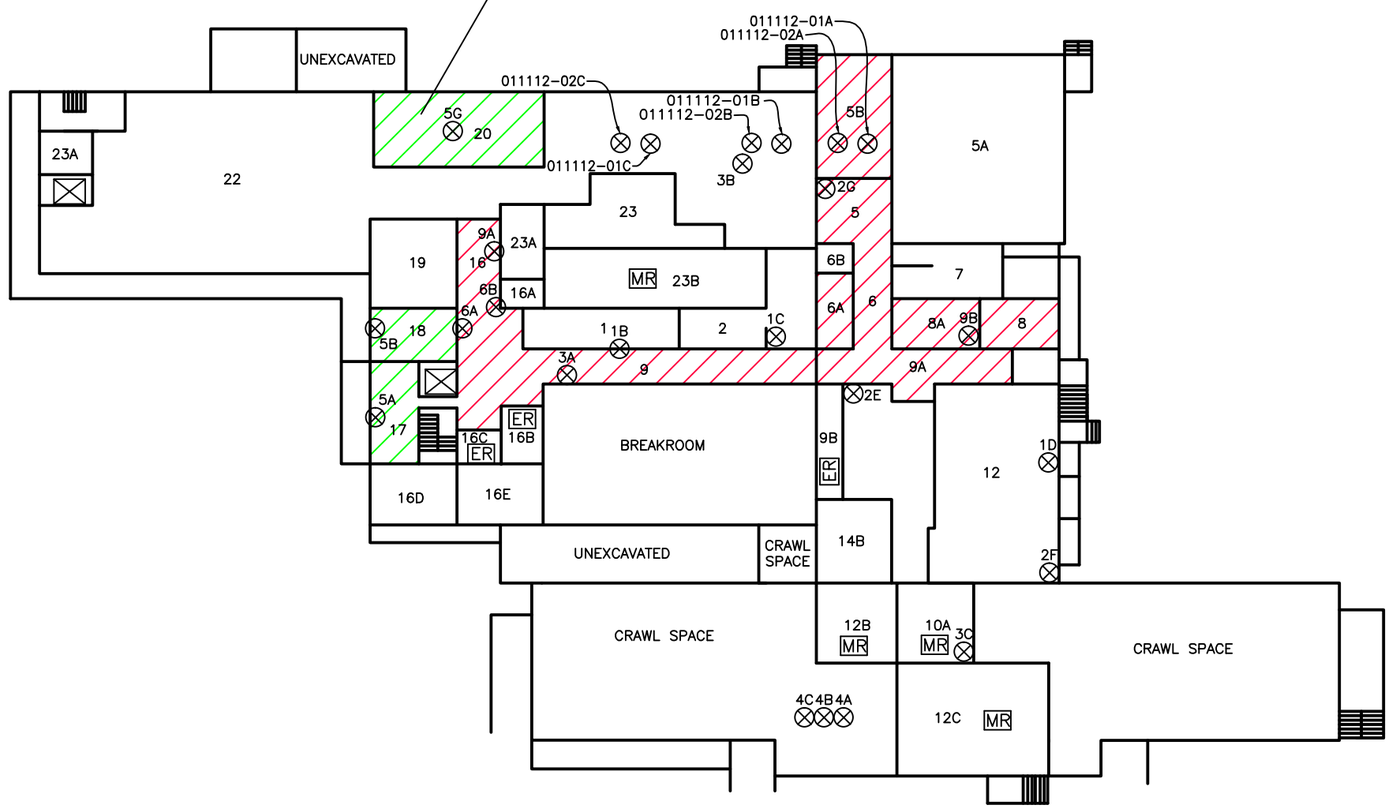
CHILLICOTHE, OHIO

DRAWN CLW/12–04–14	CHECKED
REVISED	APPROVED
JOB NO. 12091.06	TTL associates inc
DRAWING NUMBER **1029106–5.2E**	



N

LEGEND

- ELEVATOR
- MR MECHANICAL ROOM
- ER ELECTRICAL ROOM
- ### ROOM NUMBER
- 1B APPROXIMATE ASBESTOS SAMPLE LOCATION
- HSA–05: BROWN CORK INSULATION AND ASSOCIATED BLACK MASTIC
- HSA–09: 12"X12" TAN AND WHITE FLOOR TILE AND ASSOCIATED MASTIC

APPROXIMATE SCALE – FEET

0 30 60

FIGURE 3.1

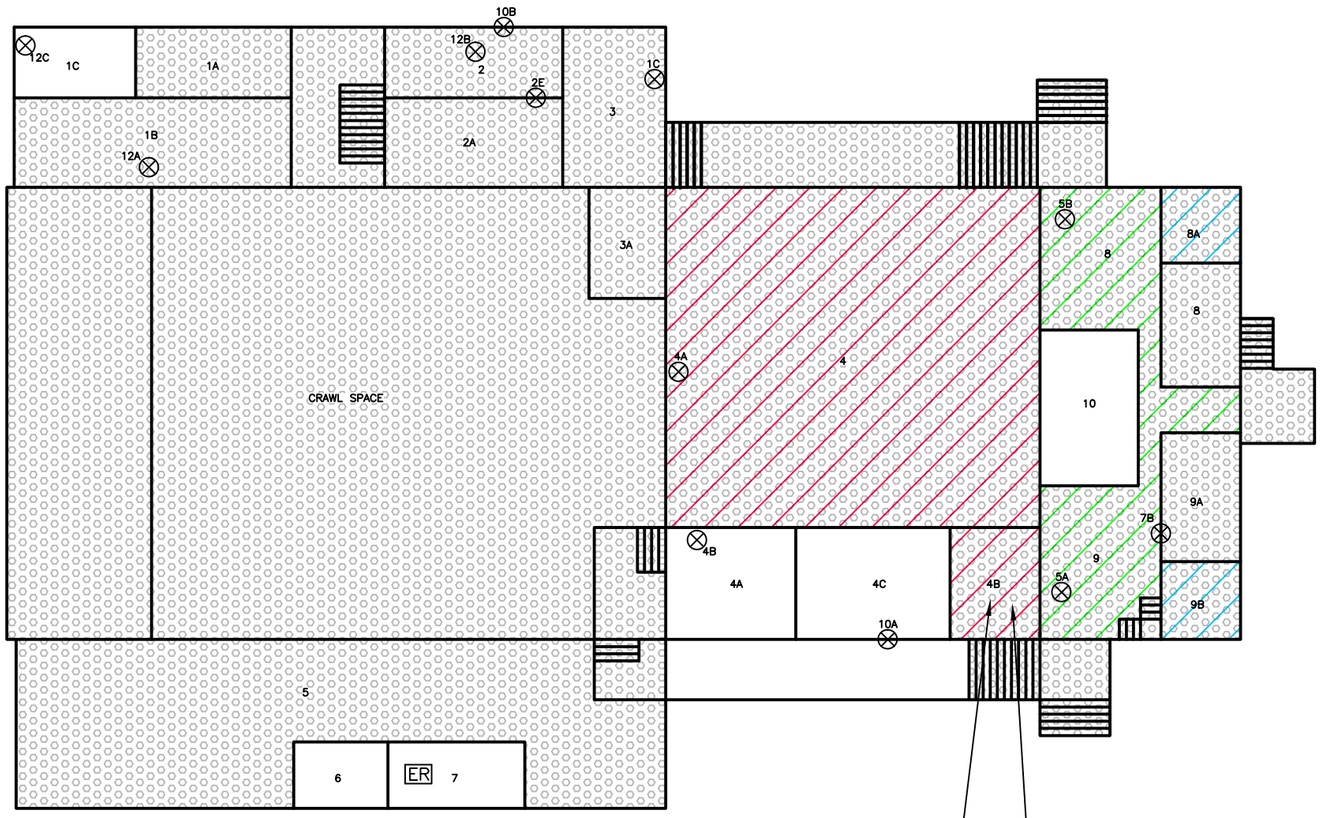
ASBESTOS 6–MONTH PERIODIC SURVEILLANCE –NOVEMBER 2014

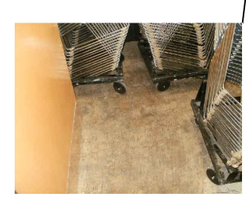
BUILDING 7 BASEMENT FLOOR SAMPLE LOCATION MAP
CHILLICOTHE VA MEDICAL CENTER
17273 SR 104
CHILLICOTHE, OHIO

PREPARED FOR

U.S. DEPARTMENT OF VETERAN AFFAIRS
CHILLICOTHE, OHIO

DRAWN CLW/12–04–14	CHECKED
REVISED	APPROVED
JOB NO. 12091.06	TTL associates inc
DRAWING NUMBER **1209106–7.0E**	





LEGEND

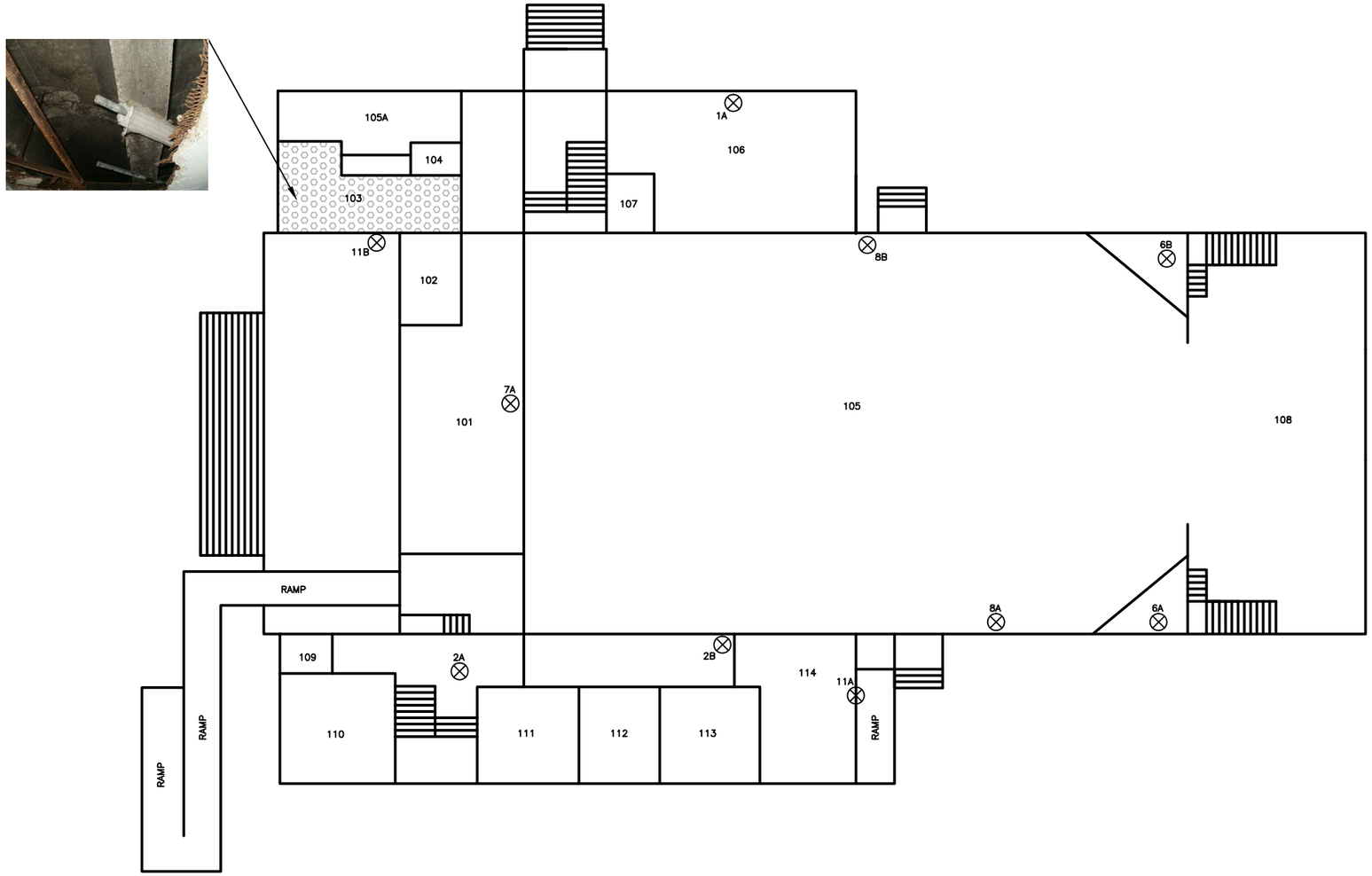
- ER — ELECTRICAL ROOM
- ### — ROOM NUMBER
- 1C ⊗ — APPROXIMATE ASBESTOS SAMPLE LOCATION
- HSA–04: MASTIC ASSOCIATED WITH 12"X12" OFF–WHITE FLOOR TILE WITH MULTI–COLORED SMUDGES
- HSA–05: 12"X12" OFF–WHITE FLOOR TILE WITH BROWN STREAKS AND ASSOCIATED MASTIC
- HSA–13: 9"X9" TAN AND BROWN FLOOR TILE AND ASSOCIATED MASTIC
- HSA–14: GREY THERMAL PIPE INSULATION AND FITTINGS WITH CLOTH WRAP

0 16 32

FIGURE 34.0
ASBESTOS 6–MONTH PERIODIC SURVEILLANCE – NOVEMBER 2014
BUILDING 9 BASEMENT SAMPLE AND ACM LOCATION MAP
CHILLICOTHE VA MEDICAL CENTER
17273 SR 104
CHILLICOTHE, OHIO

PREPARED FOR
U.S. DEPARTMENT OF VETERAN AFFAIRS
CHILLICOTHE, OHIO

DRAWN CLW/12–04–14	CHECKED
REVISED	APPROVED
JOB NO. 12091.06	TTL associates inc
DRAWING NUMBER **1209106–9.0E**	



LEGEND

ROOM NUMBER

1A ⊗ APPROXIMATE ASBESTOS SAMPLE LOCATION

HSA–14: GREY THERMAL PIPE INSULATION AND FITTINGS WITH CLOTH WRAP

0 16 32

FIGURE 34.0

ASBESTOS 6–MONTH PERIODIC SURVEILLANCE –NOVEMBER 2014

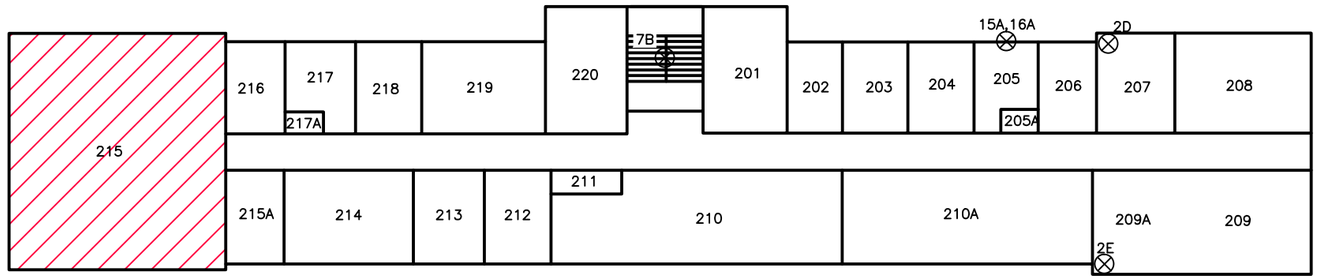
BUILDING 9 FIRST FLOOR SAMPLE AND ACM LOCATION MAP
CHILLICOTHE VA MEDICAL CENTER
17273 SR 104
CHILLICOTHE, OHIO

PREPARED FOR

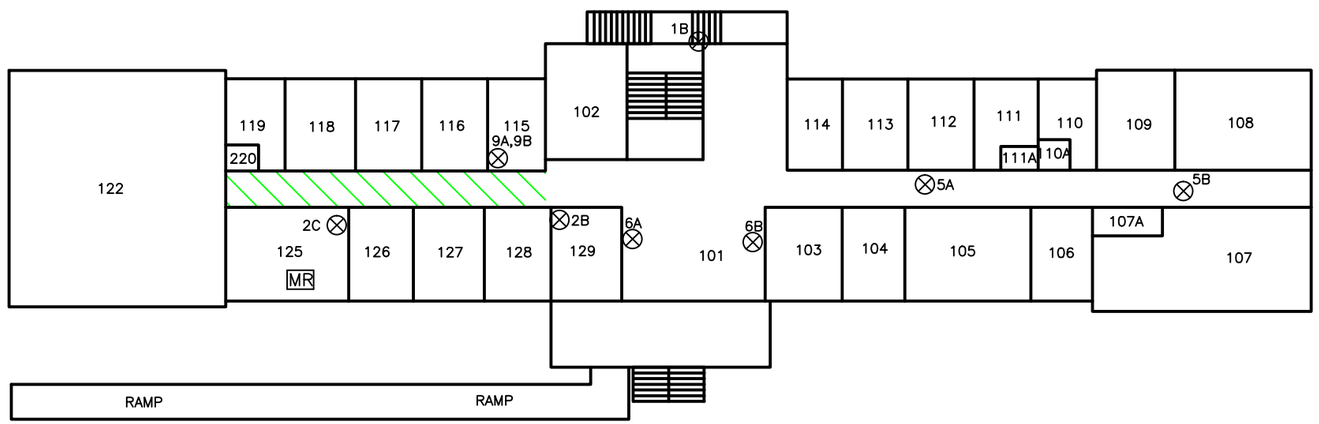
U.S. DEPARTMENT OF VETERAN AFFAIRS
CHILLICOTHE, OHIO

DRAWN CLW/12–04–14	CHECKED
REVISED	APPROVED
JOB NO. 12091.06	
DRAWING NUMBER **1209106–9.1E**	

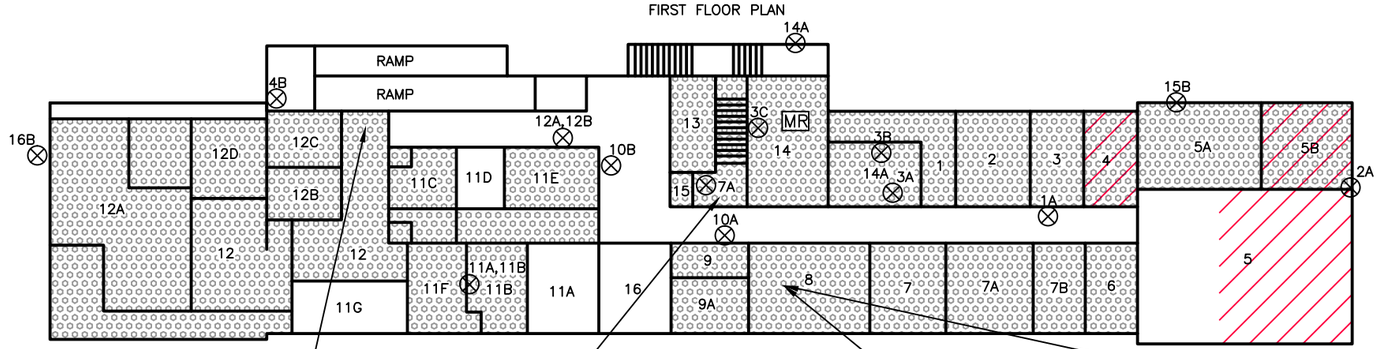
associates inc



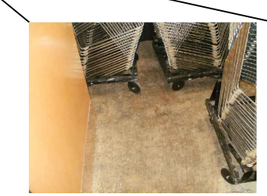
SECOND FLOOR PLAN



FIRST FLOOR PLAN



BASEMENT FLOOR PLAN



LEGEND

- MR — MECHANICAL ROOM
- ### — ROOM NUMBER
- 1A — APPROXIMATE ASBESTOS SAMPLE LOCATION
- HSA–05: 9"X9" FLOOR TILE UNDERNEATH CARPET
- HSA–17: 9"X9" BROWN FLOOR TILE AND ASSOCIATED MASTIC UNDERNEATH RAISED FLOOR
- HSA–18: GREY THERMAL PIPE INSULATION AND FITTINGS WITH CLOTH WRAP

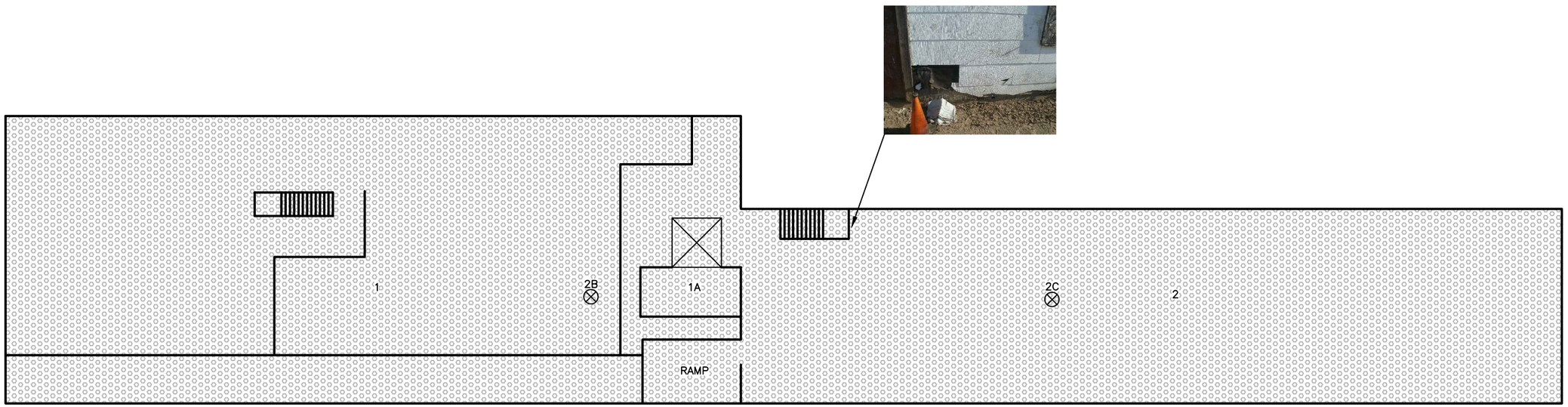
0 20 40

FIGURE 21.0
ASBESTOS 6–MONTH PERIODIC SURVEILLANCE – NOVEMBER 2014
BUILDING 18 SAMPLE AND ACM LOCATION MAP
CHILLICOTHE VA MEDICAL CENTER
17273 SR 104
CHILLICOTHE, OHIO

PREPARED FOR
U.S. DEPARTMENT OF VETERAN AFFAIRS
CHILLICOTHE, OHIO

DRAWN CLW/12–04–14	CHECKED
REVISED	APPROVED
JOB NO. 12091.06	
DRAWING NUMBER **1209106–18.0E**	

associates inc



BASEMENT FLOOR PLAN

LEGEND

ELEVATOR

ROOM NUMBER

2B APPROXIMATE ASBESTOS SAMPLE LOCATION

HSA–04: EXTERIOR WINDOW CAULK, BEIGE

HSA–06: GREY THERMAL PIPE INSULATION AND FITTING WITH CLOTH WRAP

NOT TO SCALE

FIGURE 11.0

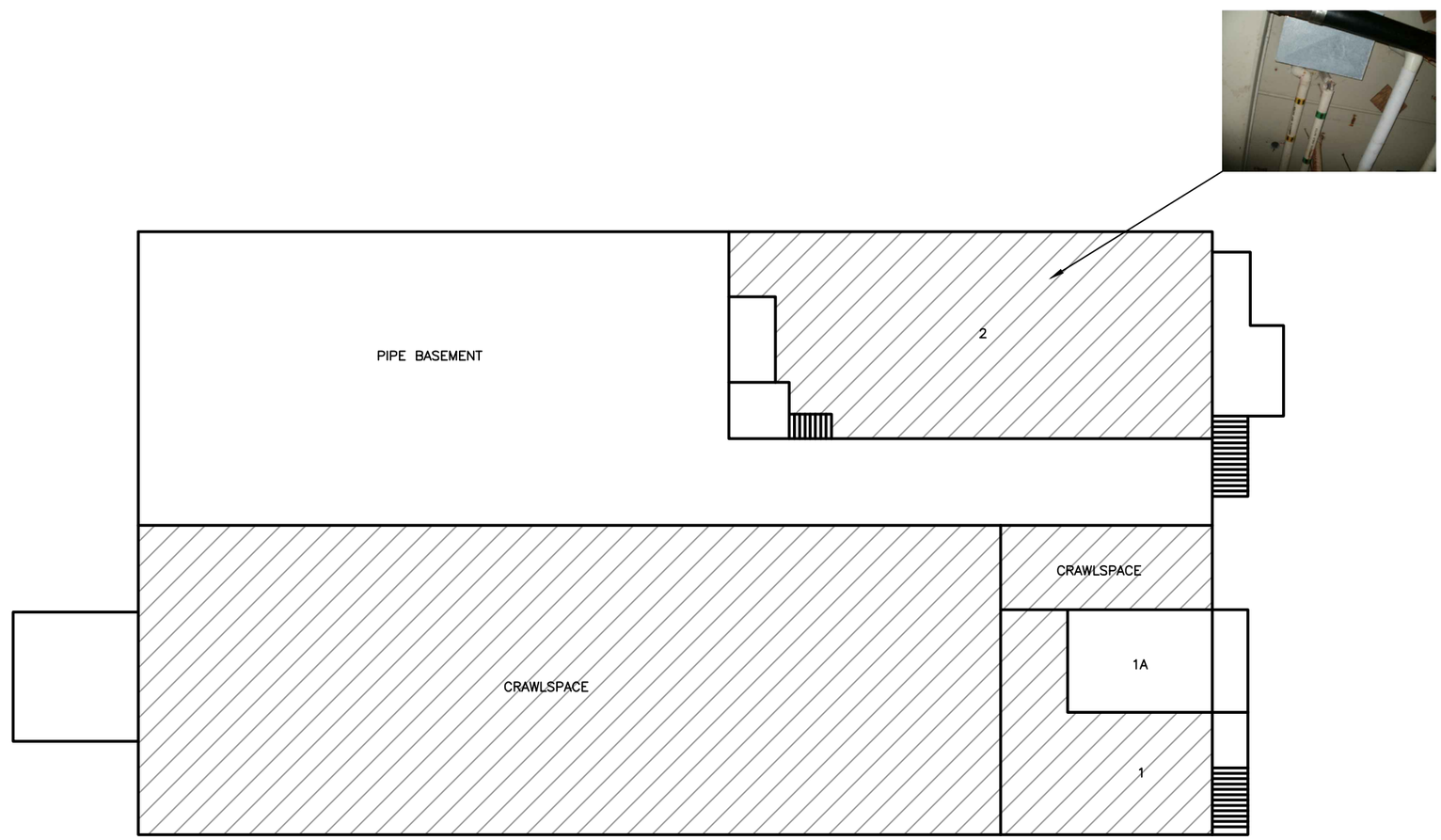
ASBESTOS 6–MONTH PERIODIC SURVEILLANCE – NOVEMBER 2014

BUILDING 23 BASEMENT SAMPLE AND ACM LOCATION MAP
CHILLICOTHE VA MEDICAL CENTER
17273 SR 104
CHILLICOTHE, OHIO

PREPARED FOR

U.S. DEPARTMENT OF VETERAN AFFAIRS
CHILLICOTHE, OHIO

DRAWN CLW/12––04–14	CHECKED
REVISED	APPROVED
JOB NO. 12091.06	TTL associates inc
DRAWING NUMBER **1209106–23E**	



LEGEND

ROOM NUMBER

HSA–08: FITTINGS

NOT TO SCALE

FIGURE 15.0
ASBESTOS 6–MONTH PERIODIC SURVEILLANCE – NOVEMBER 2014
BUILDING 25 PIPE BASEMENT SAMPLE AND ACM LOCATION MAP
CHILLICOTHE VA MEDICAL CENTER
17273 SR 104
CHILLICOTHE, OHIO

PREPARED FOR
U.S. DEPARTMENT OF VETERAN AFFAIRS
CHILLICOTHE, OHIO

DRAWN CLW/12–04–14	CHECKED
REVISED	APPROVED
JOB NO. 12091.06	
DRAWING NUMBER **1209106–25.0E**	

associates inc

LEGEND

ROOM NUMBER

1A APPROXIMATE ASBESTOS SAMPLE LOCATION

HSA–03: MASTIC ASSOCIATED WITH 12"X12" WHITE FLOOR TILE WITH DARK STREAKS

HSA–08: FITTINGS

NOT TO SCALE

FIGURE 15.1

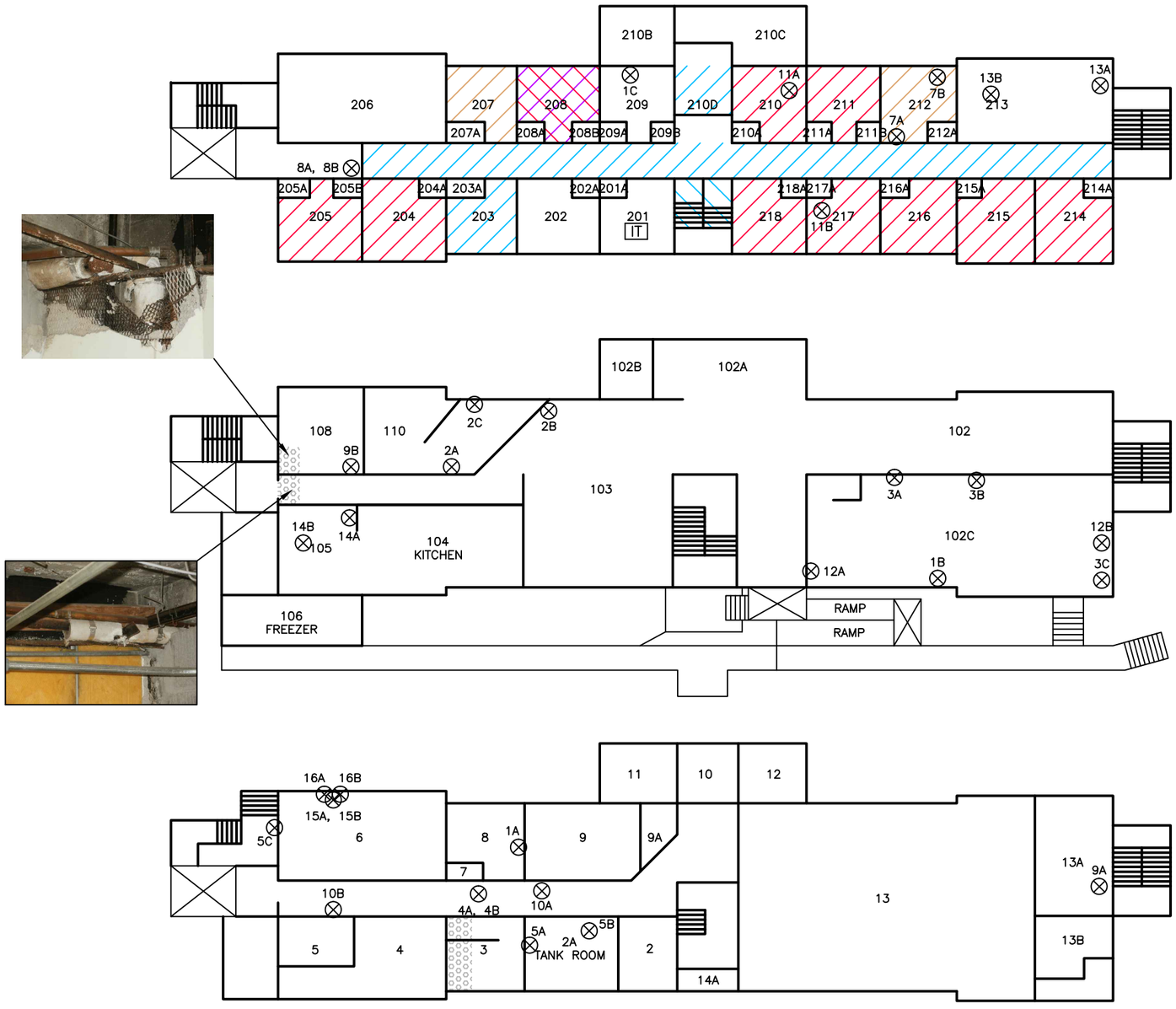
ASBESTOS 6–MONTH PERIODIC SURVEILLANCE – NOVEMBER 2014

BUILDING 25 FIRST FLOOR SAMPLE LOCATION MAP
CHILLICOTHE VA MEDICAL CENTER
17273 SR 104
CHILLICOTHE, OHIO

PREPARED FOR

U.S. DEPARTMENT OF VETERAN AFFAIRS
CHILLICOTHE, OHIO

DRAWN CLW/12–04–14	CHECKED
REVISED	APPROVED
JOB NO. 12091.06	TTL associates inc
DRAWING NUMBER **1209106–25.1E**	



LEGEND

- ELEVATOR
- IT INFORMATION/ TECHNOLOGY ROOM
- ### ROOM NUMBER
- 1A ⊗ APPROXIMATE ASBESTOS SAMPLE LOCATION
- HSA–07: 12"X12" OFF–WHITE FLOOR TILE WITH BROWN SMUDGES AND ASSOCIATED MASTIC
- HSA–08: 12"X12" OFF–WHITE FLOOR TILE WITH BROWN STREAKS AND ASSOCIATED MASTIC
- HSA–11: 12"X12" OFF–WHITE FLOOR TILE WITH BROWN STREAKS UNDERNEATH CARPET
- HSA–17: GREY THERMAL PIPE INSULATION AND FITTINGS WITH CLOTH WRAP
- HSA–18: 9"X9" BROWN AND TAN CHECKER PATTERN FLOOR TILE AND ASSOCIATED MASTIC UNDERNEATH CARPET
- HSA–18: 9"X9" BROWN AND TAN CHECKER PATTERN FLOOR TILE AND ASSOCIATED MASTIC

NOT TO SCALE

FIGURE 26.0
ASBESTOS 6–MONTH PERIODIC SURVEILLANCE – NOVEMBER 2014
BUILDING 28 SAMPLE LOCATION MAP
CHILLICOTHE VA MEDICAL CENTER
17273 SR 104
CHILLICOTHE, OHIO

PREPARED FOR
U.S. DEPARTMENT OF VETERAN AFFAIRS
CHILLICOTHE, OHIO

DRAWN CLW/12–04–14	CHECKED
REVISED	APPROVED
JOB NO. 12091.06	TTL associates inc
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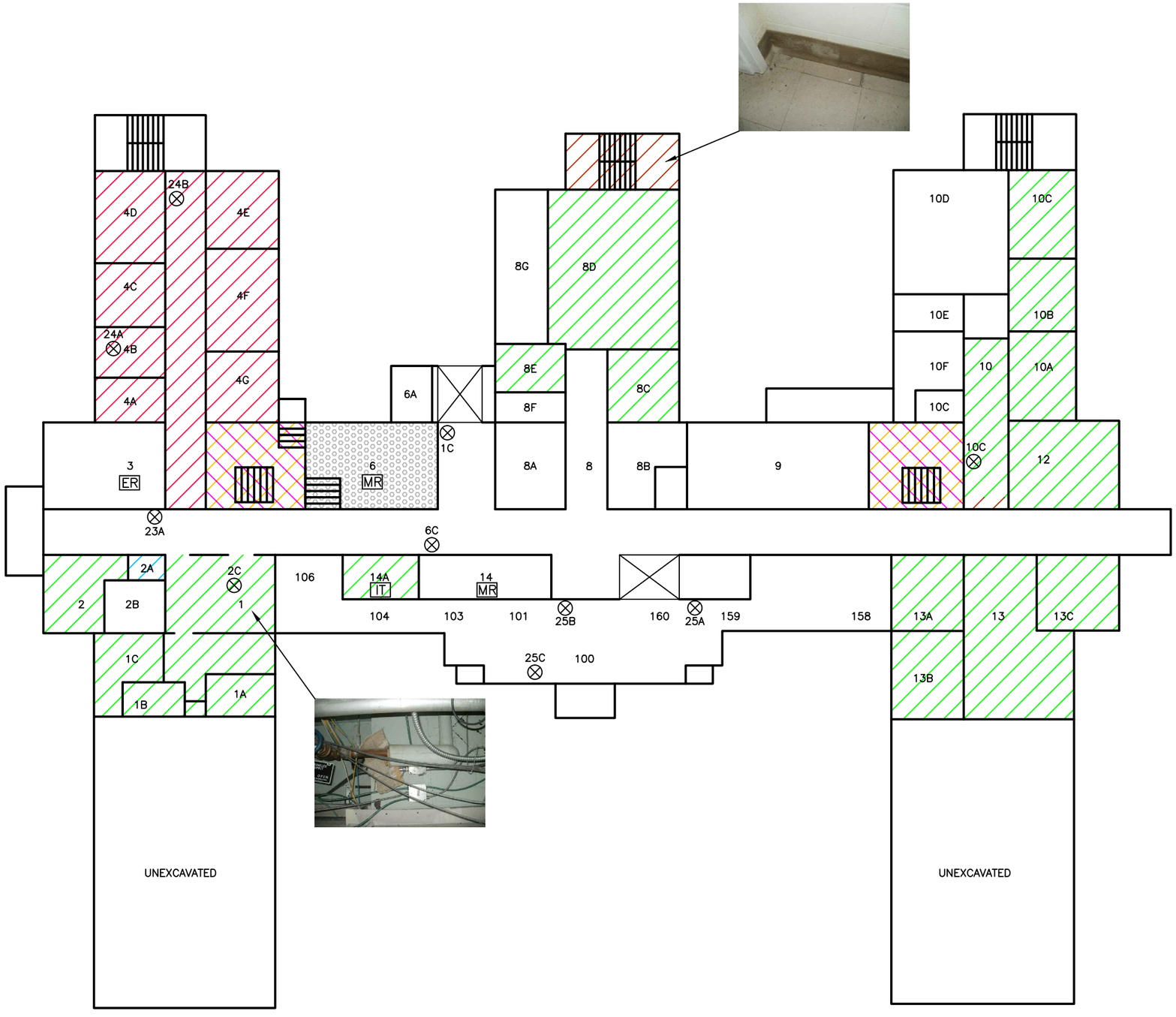


LEGEND

- ELEVATOR
- ER ELECTRICAL ROOM
- MR MECHANICAL ROOM
- IT INFORMATION/ TECHNOLOGY ROOM
- ### ROOM NUMBER
- 1C APPROXIMATE ASBESTOS SAMPLE LOCATION
- HSA–22: MASTIC ASSOCIATED WITH 12"X12" TAN AND WHITE FLOOR TILE
- HSA–23: 12"X12" GREY FLOOR TILE WITH BLUE AND MAROON SMUDGES AND ASSOCIATED MASTIC
- HSA–24: 12"X12" BEIGE, GREY AND BROWN FLOOR TILE AND ASSOCIATED MASTIC
- HSA–27: ALL EXTERIOR WINDOWS HAVE ACM CAULK
- HSA–29: 9"X9" BLACK FLOOR TILE AND ASSOCIATED MASTIC
- HSA–30: GREY THERMAL PIPE INSULATION AND FITTINGS WITH CLOTH WRAP
- HSA–33: 9"X9" DARK RED AND MAROON CHECKER PATTERN FLOOR TILE AND ASSOCIATED MASTIC
- HSA–34: BLACK BORDER AND ASSOCIATED MASTIC

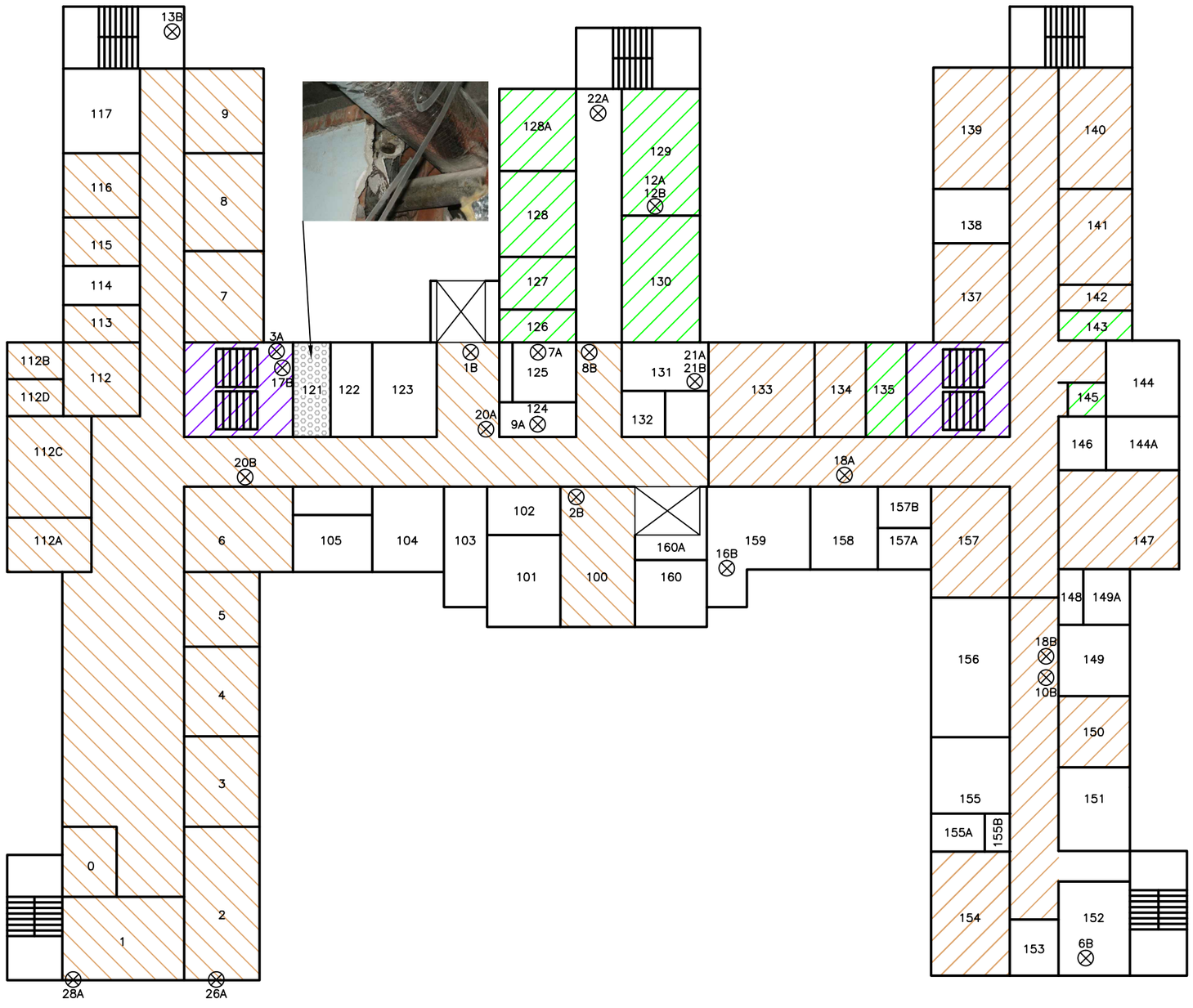
NOT TO SCALE

FIGURE 5.0
ASBESTOS 6–MONTH PERIODIC SURVEILLANCE – NOVEMBER 2014
BUILDING 30 BASMENT SAMPLE AND ACM LOCATION MAP
CHILLICOTHE VA MEDICAL CENTER
17273 SR 104
CHILLICOTHE, OHIO

PREPARED FOR
U.S. DEPARTMENT OF VETERAN AFFAIRS
CHILLICOTHE, OHIO

DRAWN CLW/12–04–14	CHECKED
REVISED	APPROVED
JOB NO. 12091.06	
DRAWING NUMBER 1209106–30.0E	

TTL associates inc



LEGEND

- ELEVATOR
- ### ROOM NUMBER
- 1B ⊗ APPROXIMATE ASBESTOS SAMPLE LOCATION
- HSA–17: 12"X12" OLIVE GREEN AND GREY (CHECKERED PATTERN) FLOOR TILE AND ASSOCIATED BLACK MASTIC
- HSA–18: MASTIC ASSOCIATED WITH 12"X12" BEIGE FLOOR TILE WITH GREYISH BROWN AND WHITE SMUDGES
- HSA–18: MASTIC UNDER NEW FLOOR TILE (BEIGE, OLIVE, ORANGE AND RED)
- HSA–22: MASTIC ASSOCIATED WITH 12"X12" TAN AND WHITE FLOOR TILE
- HSA–27: ALL EXTERIOR WINDOWS HAVE ACM CAULK
- HSA–30: GREY THERMAL PIPE INSULATION AND FITTINGS WITH CLOTH WRAP

NOT TO SCALE

FIGURE 5.1

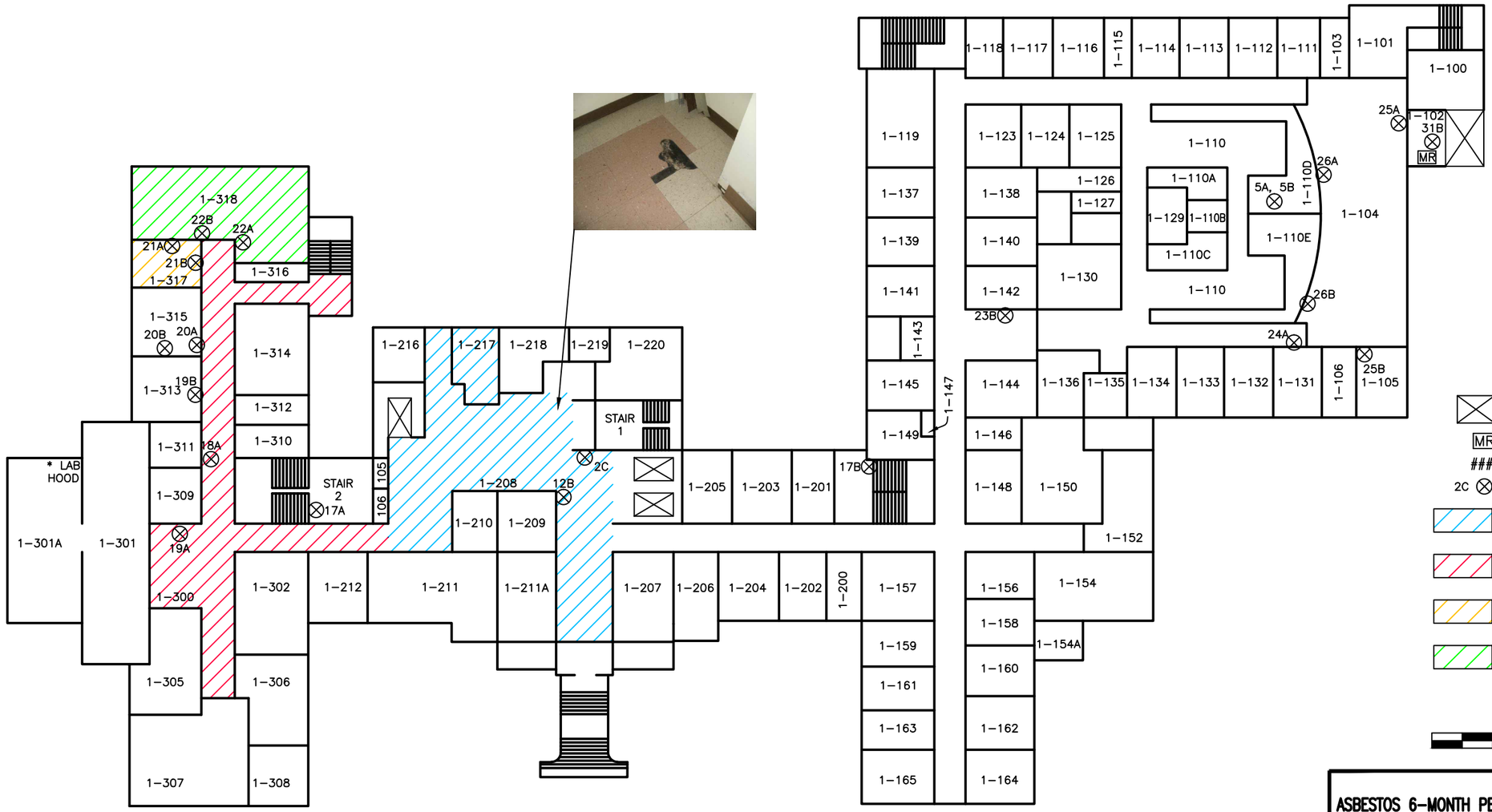
ASBESTOS 6–MONTH PERIODIC SURVEILLANCE – NOVEMBER 2014

BUILDING 30 FIRST FLOOR SAMPLE AND ACM LOCATION MAP
CHILLICOTHE VA MEDICAL CENTER
17273 SR 104
CHILLICOTHE, OHIO

PREPARED FOR

U.S. DEPARTMENT OF VETERAN AFFAIRS
CHILLICOTHE, OHIO

DRAWN CLW/12–04–14	CHECKED
REVISED	APPROVED
JOB NO. 12091.06	TTL associates inc
DRAWING NUMBER **1209106–30.1E**	



LEGEND

- ELEVATOR
- MR MECHANICAL ROOM
- ### ROOM NUMBER
- 2C ⊗ APPROXIMATE ASBESTOS SAMPLE LOCATION
- HSA-12: MASTIC ASSOCIATED WITH LIGHT BROWN FLOOR TILE WITH BROWN, WHITE AND RED SMUDGES
- HSA-18: MASTIC ASSOCIATED WITH 12"X12" TAN AND WHITE FLOOR TILE
- HSA-21: MASTIC ASSOCIATED WITH 12"X12" ORANGE FLOOR TILE
- HSA-22: MASTIC ASSOCIATED WITH 12"X12" GREEN FLOOR TILE

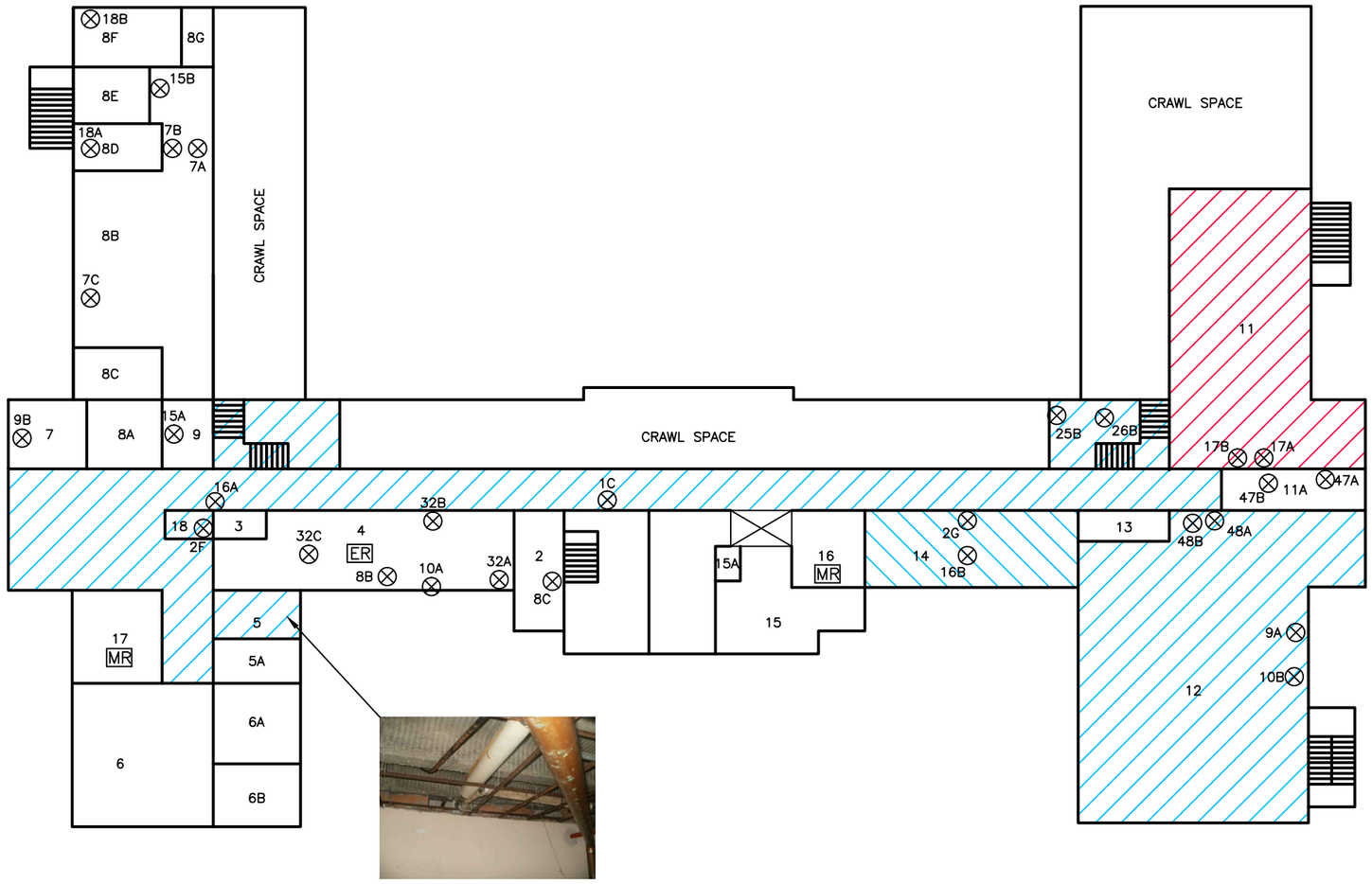
ROOM 1-301: TRANSITE LAB HOOD

NOT TO SCALE

FIGURE 14.2
ASBESTOS 6-MONTH PERIODIC SURVEILLANCE - NOVEMBER 2014
BUILDING 31 FIRST FLOOR SAMPLE AND ACM LOCATION MAP
CHILLICOTHE VA MEDICAL CENTER
17273 SR 104
CHILLICOTHE, OHIO

PREPARED FOR
U.S. DEPARTMENT OF VETERAN AFFAIRS
CHILLICOTHE, OHIO

DRAWN CLW/12-04-14	CHECKED
REVISED	APPROVED
JOB NO. 12091.06	
DRAWING NUMBER **1209106-31.2E**	TTL associates inc



LEGEND

- ELEVATOR
- ER — ELECTRICAL ROOM
- MR — MECHANICAL ROOM
- ### — ROOM NUMBER
- 2F — APPROXIMATE ASBESTOS SAMPLE LOCATION
- HSA–16: 12"X12" OFF–WHITE FLOOR TILE WITH BROWN STREAKS AND ASSOCIATED MASTIC
- HSA–16: 12"X12" OFF–WHITE FLOOR TILE WITH BROWN STREAKS AND ASSOCIATED MASTIC UNDER CARPET
- HSA–17: 12"X12" WHITE FLOOR TILE WITH DARK STREAKS AND ASSOCIATED MASTIC

NOT TO SCALE

FIGURE 18.0

ASBESTOS 6–MONTH PERIODIC SURVEILLANCE – NOVEMBER 2014

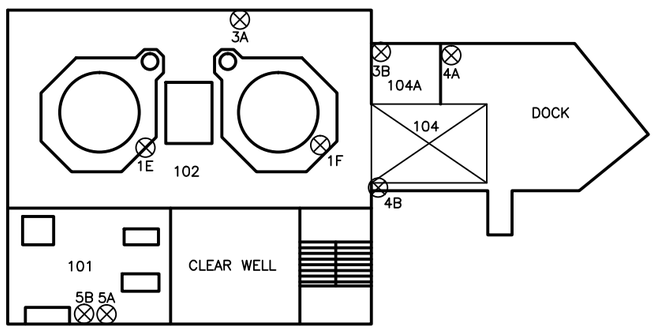
BUILDING 212 BASEMENT SAMPLE AND ACM LOCATION MAP
CHILLICOTHE VA MEDICAL CENTER
17273 SR 104
CHILLICOTHE, OHIO

PREPARED FOR

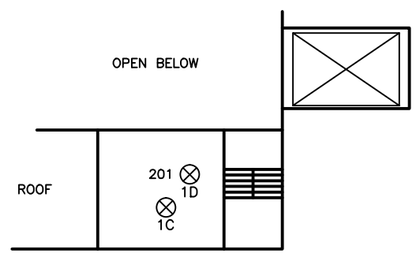
U.S. DEPARTMENT OF VETERAN AFFAIRS
CHILLICOTHE, OHIO

DRAWN CLW/12–04–14	CHECKED
REVISED	APPROVED
JOB NO. 12091.06	
DRAWING NUMBER **1209106–212.0E**	

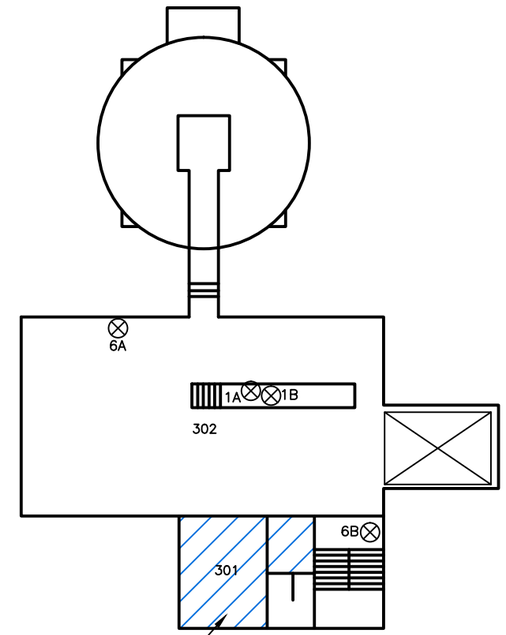
ATL associates inc



FIRST FLOOR PLAN



PARTIAL SECOND FLOOR PLAN



THIRD FLOOR PLAN

LEGEND

ELEVATOR

ROOM NUMBER

1A APPROXIMATE ASBESTOS SAMPLE LOCATION

HSA-06: 9"X9" GREY FLOOR TILE AND ASSOCIATED MASTIC

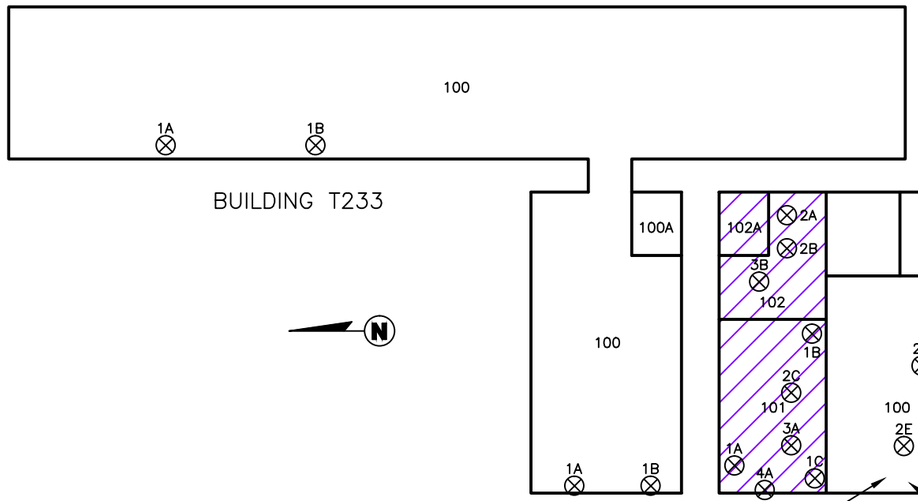
NOT TO SCALE

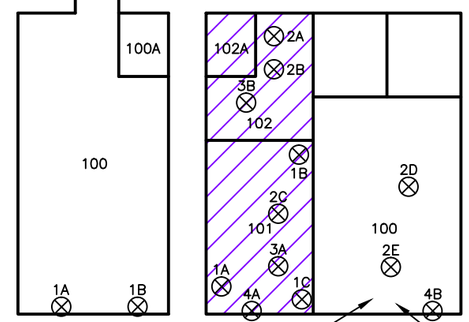
FIGURE 10.0
ASBESTOS 6-MONTH PERIODIC SURVEILLANCE - NOVEMBER 2014
BUILDING 256 SAMPLE AND ACM LOCATION MAP
CHILLICOTHE VA MEDICAL CENTER
17273 SR 104
CHILLICOTHE, OHIO

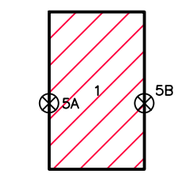
PREPARED FOR
U.S. DEPARTMENT OF VETERAN AFFAIRS
CHILLICOTHE, OHIO

DRAWN CLW/12-04-14	CHECKED
REVISED	APPROVED
JOB NO. 12091.06	
DRAWING NUMBER **1209106-256.0E**	

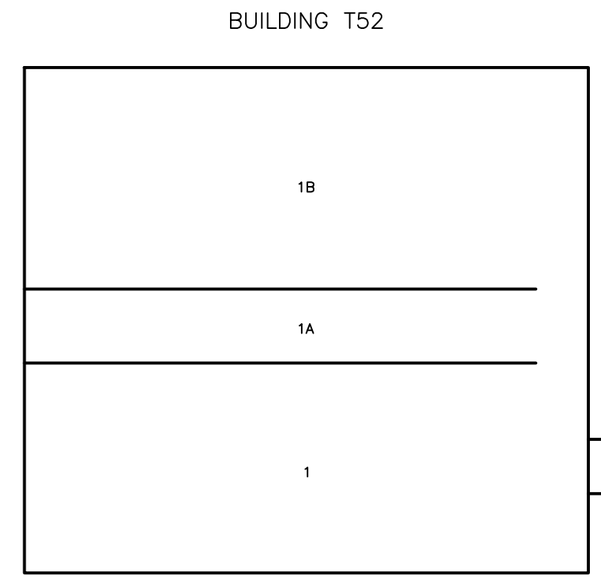
associates inc





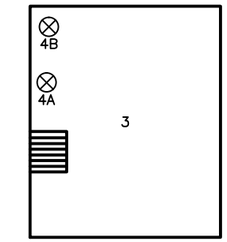


BUILDING T236

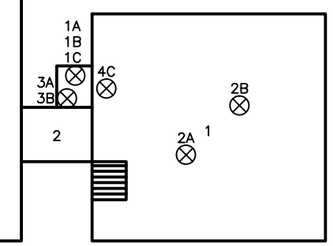


BUILDING T54

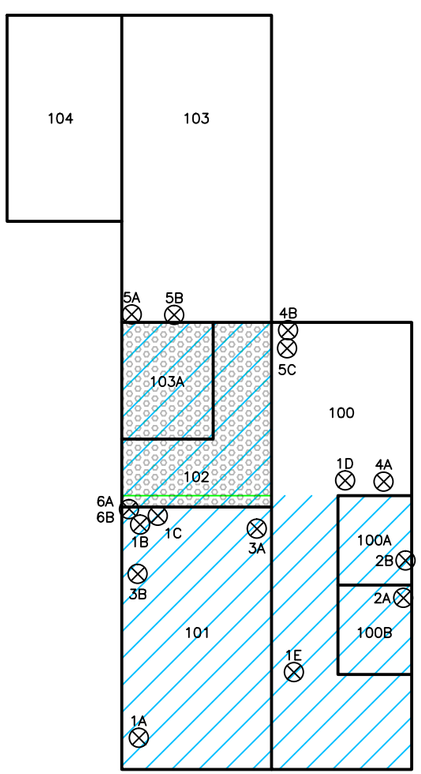
BUILDING T55



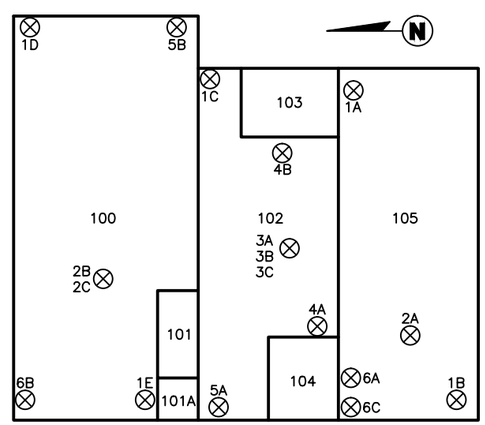
BUILDING T51
BASEMENT FLOOR PLAN



BUILDING T51
FIRST FLOOR PLAN



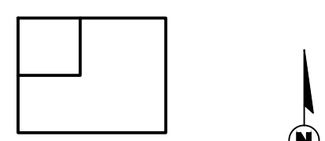
BUILDING T228



BUILDING T40

BUILDING T39

BUILDING T38



BUILDING T57

BUILDING T197

LEGEND

ROOM NUMBER

1A APPROXIMATE ASBESTOS SAMPLE LOCATION

BUILDINGS T41 & T51 – WHITE PAINTED GREY EXTERIOR CEMENT WALL SHINGLES

HSA-01: 9"X9" FLOOR TILE AND ASSOCIATED MASTIC

HSA-03: 12"X12" WHITE FLOOR TILE WITH BROWN STREAKS AND ASSOCIATED MASTIC

HSA-06: PAINTED LIGHT GREEN GREY CEMENT WALL PANEL

HSA-07: GREY THERMAL PIPE INSULATION AND FITTINGS WITH CLOTH WRAP

HSA-41-03: 12"X12" GREEN AND WHITE CHECKERED PATTERN FLOOR TILE AND ASSOCIATED MASTIC

NOT TO SCALE

FIGURE 20.0

ASBESTOS 6-MONTH PERIODIC SURVEILLANCE – NOVEMBER 2014

TEMPORARY BUILDINGS SAMPLE AND ACM LOCATION MAPS
CHILLICOTHE VA MEDICAL CENTER
17273 SR 104
CHILLICOTHE, OHIO

PREPARED FOR

U.S. DEPARTMENT OF VETERAN AFFAIRS
CHILLICOTHE, OHIO

DRAWN CLW/12-04-14	CHECKED
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JOB NO. 12091.06	TTL associates inc
DRAWING NUMBER 1209106-TEMP.0E	

APPENDIX F

ASBESTOS SURVEILLANCE FINDINGS FORMS

SURVEILLANCE FINDINGS FOR ACBM - Building 1							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Basement Hallway CB-5	12” x 12” Light Brown Floor Tile with Red and White Smudges and associated Mastic	M	NF	None	10 s.f.		Remove loose material and reinstall	5
BB 108	12” x 12” Light Brown Floor Tile with Red and White Smudges and associated Mastic	M	NF	None	2 s.f.		Remove and Replace	5
BB 103	12” x 12” Light Brown Floor Tile with Red and White Smudges and associated Mastic	M	NF	None	4 s.f.		Remove loose material and reinstall	5
West Stairwell Basement	12”X12” Beige Floor Tile with Multi-Colored Smudges and Associated Mastic	M	NF	None	10 s.f.		Remove loose material and reinstall	5

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM – Building 2							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Basement Tank Room and Crawl Space	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	1,380 l.f.		Patch and repair	2
Crawlspace	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	5,400 s.f.		Debris clean-up	2
1st Floor Pipe Chase between 103 and 104A	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	3 l.f.		Patch and repair, debris clean-up	2
1st Floor Pipe Chase North Wall of 103	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	12 l.f.		Patch and repair, debris clean-up	2
1st Floor Pipe Chase Northwest Corner of 113	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	16 l.f.		Patch and repair, debris clean-up	2
1st Floor Pipe Chase Southwest Corner of 109	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	24 l.f.		Patch and repair, debris clean-up	2
1st Floor Pipe Chase in 111/112	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	3 l.f.		Patch and repair, debris clean-up	2
1st Floor Stairwells	12” x 12” Off-White Floor Tile with Dark Streaks and associated Mastic	M	NF	None	20 s.f.		Remove loose material and reinstall	5
Room 207	12” x 12” Off-White Floor Tile with Dark Streaks and associated Mastic	M	NF	None	100 s.f.		Remove loose material and reinstall	5
Room 118	12” x 12” Cream with Olive Streaks Floor Tile and Black Mastic	M	NF	None	100 s.f.		Remove and Replace	5
Room 118	12” x 12” Olive Floor Tile and Black Mastic	M	NF	None	100 s.f.		Remove and Replace	5
Stairwells	Fire Door and Frame	M	NF	None	3 doors		Repair	5

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM – Building 3							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Crawlspace	Grey Thermal Pipe Insulation Fittings with Cloth Wrap	T	F	1	167 l.f.		Patch and repair	2
Crawlspace	Grey Thermal Pipe Insulation Fittings with Cloth Wrap	T	F	1	70 s.f.		Debris clean-up	2

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM-Building 4							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Room 209A	9” x 9” Green and White Checkered Pattern Floor Tile and Associated Mastic under Carpet	M	NF	None	4 s.f.		Remove and Replace Floor Tile	5
Room 209	9” x 9” Green and White Checkered Pattern Floor Tile and Associated Mastic under Carpet	M	NF	None	4 s.f.		Remove and Replace Floor Tile	5
Room 207A	9” x 9” Green and White Checkered Pattern Floor Tile and Associated Mastic under Carpet	M	NF	None	1 s.f.		Remove and Replace Floor Tile	5
Room 116	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	10 l.f.		Patch and Repair	2
Crawlspace	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	560 l.f.		Patch and Repair	2
Tank Room	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	105 l.f.		Patch and Repair	2
Room 115	9” x 9” Green and White Checkered Pattern Floor Tile and Associated Mastic	M	NF	None	5 s.f.		Remove Loose Material and Reinstall	5

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM-Building 5							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Room 129B	9” x 9” Black and Brown Checkered Pattern Floor Tile and Associated Mastic	M	NF	None	1 s.f.		Remove and Replace Floor Tile	5
Room 126	9” x 9” Black and Brown Checkered Pattern Floor Tile and associated Mastic	M	NF	None	4 s.f.		Remove and Replace	5
1st Floor South Hall	9” x 9” Black, White, Green Checkered Pattern Floor Tile and Associated Mastic	M	NF	None	2 s.f.		Remove and Replace Floor Tile	5
1st Floor Center Hall	9” x 9” Black, White, Green Checkered Pattern Floor Tile and Associated Mastic	M	NF	None	4 s.f.		Remove and Replace Floor Tile	5
Crawlspace	Grey Thermal Pipe Insulation Fittings with Cloth Wrap	T	F	1	640 l.f.		Patch and Repair, Debris clean up	2
Room 224	12” x 12” Grey and White Floor Tile and associated Mastic	M	NF	None	115 s.f.		Remove Loose Material and Reinstall	5
Room 225	12” x 12” Grey and White Floor Tile and associated Mastic	M	NF	None	100 s.f.		Remove Loose Material and Reinstall	5
Room 227	12” x 12” Grey and White Floor Tile and associated Mastic	M	NF	None	65 s.f.		Remove Loose Material and Reinstall	5
Room 227A	12” x 12” Grey and White Floor Tile and associated Mastic	M	NF	None	255 s.f.		Remove Loose Material and Reinstall	5
Room 229A	12” x 12” Grey and White Floor Tile and associated Mastic	M	NF	None	170 s.f.		Remove Loose Material and Reinstall	5
Room 229	12” x 12” Grey and White Floor Tile and associated Mastic	M	NF	None	75 s.f.		Remove Loose Material and Reinstall	5
Room 219	12” x 12” Grey and White Floor Tile and associated Mastic	M	NF	None	170 s.f.		Remove Loose Material and Reinstall	5
Room 228	12” x 12” Grey and White Floor Tile and associated Mastic	M	NF	None	65 s.f.		Remove Loose Material and Reinstall	5

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM-Building 5							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Room 223	12” x 12” Grey and White Floor Tile and associated Mastic	M	NF	None	360 s.f.		Remove Loose Material and Reinstall	5
1st Floor North Hallway	12” x 12” Grey and White Floor Tile and associated Mastic	M	NF	None	2 s.f.		Remove and Replace	5
Room 229B	12” x 12” Grey and White Floor Tile and associated Mastic	M	NF	None	260 s.f.		Remove Loose Material and Reinstall	5
Room 226	12” x 12” Grey and White Floor Tile and associated Mastic	M	NF	None	115 s.f.		Remove Loose Material and Reinstall	5
Tank Room	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	40 l.f.		Patch and Repair	2
2nd Floor Center Hallway	9” x 9” Red and Tan (Checkered Pattern) Floor Tile and associated Mastic	M	NF	None	100 s.f.		Remove Loose Material and Reinstall	5
Room 129A	9” x 9” Black and Brown (Checker Pattern) Floor Tile and associated Mastic	M	NF	None	10 s.f.		Remove and Replace Floor Tile	5

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM – Building 6							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Basement Tank Room	Grey Thermal Pipe Insulation with Cloth Wrap	T	F	1	1380 l.f.		Patch and Repair, Debris Clean-up	2
Crawlspace	Grey Thermal Pipe Insulation with Cloth Wrap	T	F	1	5400 s.f.		Patch and Repair, Debris Clean-up	2
1st Floor Pipe Chase between 104B and 105	Grey Thermal Pipe Insulation with Cloth Wrap	T	F	1	4 l.f.		Patch and Repair, Debris Clean-up	2
1st Floor Pipe Chase between 102 and 103	Grey Thermal Pipe Insulation with Cloth Wrap	T	F	1	20 l.f.		Patch and Repair, Debris Clean-up	2
1st Floor Pipe Chase East Wall of 108	Grey Thermal Pipe Insulation with Cloth Wrap	T	F	1	72 l.f.		Patch and Repair, Debris Clean-up	2
Above Ceilings in 108 and 108A	Grey Thermal Pipe Insulation with Cloth Wrap	T	F	1	72 l.f.		Patch and Repair, Debris Clean-up	2
Room 114	12” x 12” Off-White Floor Tile with Dark Streaks and associated Mastic	M	NF	None	795 s.f.		Remove and Replace	5
Crawlspace	Pipe Insulation Debris	T	F	1	None		Debris Clean-up	2

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM – Building 7							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Room 20	Brown Cork Insulation and Associated Black Mastic	S	NF	X	530 s.f.		Encapsulate, Debris Clean-up	5
Room 17	Brown Cork Insulation and Associated Black Mastic	S	NF	X	240 s.f.		Encapsulate, Debris Clean-up	5
Room 18	Brown Cork Insulation and Associated Black Mastic	S	NF	X	195 s.f.		Encapsulate, Debris Clean-up	5

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM – Building 8							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Room 5A	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	2 l.f.		Patch and Repair, Encapsulate End of Pipe	2
Room 6-6A	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	20 l.f.		Encapsulate End of Pipe	2

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM-Building 9							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Crawlspace	Grey Thermal Pipe Insulation Fittings with Cloth Wrap	T	F	1	485 l.f.		Debris Clean-up	2
Room 103	Grey Thermal Pipe Insulation Fittings with Cloth Wrap	T	F	1	7 l.f.		Patch and Repair, Encapsulate End of Pipe	2

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM BUILDING 10							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Room 105	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	None	2 l.f.		Patch and Repair	2
Tank Room	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	None	2 l.f.		Patch and Repair	2
Crawl Space	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	None	35 l.f.		Patch and Repair	2

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM – Building 11							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Basement-Office Spaces, Hallway and Restroom	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	36 l.f.		Patch and Repair, Debris Clean-up	2
Tank Room	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	250 l.f.		Patch and Repair, Debris Clean-up	2
Crawlspace	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	2,475 s.f.		Debris Clean-up	2
Room 106 (1st floor pipe chase between 105 and 105A)	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	2 l.f.	Quantity of damaged material changed	Patch and Repair, Debris Clean-up	2

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM - 17							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Basement Serving Kitchen	6” Black Cove Base and associated Black Mastic	M	NF	None	25 l.f.		Remove Loose Material and Reinstall	5
Basement Storage	9” x 9” Green and Black Floor Tile (Checkered Pattern) and associated Mastic	M	NF	None	4 s.f.		Remove and Reinstall	5

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM – Building 18							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Room 8	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	14 l.f.		Patch and Repair	2
Room 8	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	20 s.f.		Debris Clean-up	2
Room 12C – Unisex Restroom	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	2 l.f.		Patch and Repair, Encapsulate End of Pipe	2
Basement Center Stairwell	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	None	6 l.f.		Patch and Repair	2
Room 12	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	None	3 l.f.		Patch and Repair	2

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM – Building 20							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Third Floor	Debris on Floor	T	F	1	150 s.f.		Patch and Repair, Debris Clean-up	1
Third Floor	Tank Insulation	T	F	None	200 s.f.		Patch and Repair, Debris Clean-up	1

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM – Building 21							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Room 28A	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	2 l.f.		Encapsulate End of Pipe	2

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM – Building 23							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Basement	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	3 l.f.		Patch and Repair	2

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM – Building 25							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Crawlspace	Fittings	T	F	1	1 s.f.		Debris Clean-up	2
Pipe Basement, Room 2	Fittings	T	F	1	1 each		Patch and Repair	2
Crawlspace at Door to South Crawlspace	Fittings	T	F	1	1 s.f.		Debris Clean-up	2
Room 109	Mastic associated with 12” x 12” White Floor Tile with Dark Streaks	M	NF	None	20 s.f.		Repair and Replace	5
Pipe Basement, Room 2	Fire Door and Frame	M	NF	None	1 door		Remove, Debris Clean-up	5

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM – Building 28							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Basement, Room 3	Grey Thermal Pipe Insulation Fitting with Cloth Wrap	T	F	1	8 l.f.		Encapsulate End of Pipe	2
First Floor	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	2 l.f.		Encapsulate End of Pipe	2
First Floor, Room 108	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	2 l.f.		Remove and Replace	2

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM – Building 29							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Crawlspace	Grey Thermal Pipe Insulation Fittings with Cloth Wrap	T	F	1	300 l.f.		Patch and Repair, Debris Clean-up	2

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM-Building 30							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Room 121	Grey Thermal Pipe Insulation and Fittings	T	F	1	21 l.f.		Patch and Repair	2
Basement, Room 1	Grey Thermal Pipe Insulation and Fittings with Cloth Wrap	T	F	1	1 l.f.		Patch and Repair	2
Basement, Center East	12”X12” Grey Floor Tile with Blue and Maroon Smudges and Associated Mastic	M	NF	1	2 s.f.		Remove and Replace	5
Basement Hallway, Outside of Room 10	Mastic Associated with 12”X12” Tan and White Floor Tile	M	NF	1	1 s.f.		Remove and Replace	5

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM-Building 31							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
First Floor, Room 1-208	Mastic Associated with Light Brown Floor Tile with Brown, White, and Red Smudges	M	NF	1	2 s.f.		Remove and Replace	5

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM – Building 35							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Crawlspace	Grey Thermal Pipe Insulation Fittings with Cloth Wrap	T	F	1	65 l.f.		Patch and Repair	2
Crawlspace	Grey Thermal Pipe Insulation Fittings with Cloth Wrap	T	F	1	200 s.f.		Debris Clean-up	2

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM – Building 60							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Crawlspace	Grey Thermal Pipe Insulation Fitting with Cloth Wrap	T	F	1	400 l.f.		Patch and Repair, Debris Clean-up	2

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM – Building 179							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Exterior	Painted White Grey Exterior Cement Wall Shingles	M	NF	5	200 s.f.		Encapsulate Broken Shingles, Clean up Debris on Ground	5

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM-Building 212							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Room 5	12” x 12” Off-White Floor Tile with Brown Streaks and Associated Mastic	M	NF	None	18 s.f.		Remove and Replace Floor Tile	5
Room 12	12” x 12” Off-White Floor Tile with Brown Streaks and Associated Mastic	M	NF	None	4 s.f.		Remove and Replace Floor Tile	5
Room 122	9” x 9” Green and White (checkered pattern) Floor Tile and associated Mastic	M	NF	None	4 s.f.		Remove and Replace Floor Tile	5

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM – Building 256							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Room 301	9” x 9” Grey Floor Tile and Associated Mastic	M	NF	5	300 s.f.		Remove Loose Material and Reinstall	5

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM – Building T-41							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Exterior	Painted White Grey Exterior Cement Wall Shingles	M	NF	5	400 s.f.		Encapsulate Broken Shingles, Clean up Debris on Ground	5

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM – Building T-51							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Walkway between Buildings T-51 and T-52	Grey Thermal Pipe Insulation Fitting with Metal Jacket	T	F	1	2 l.f.		Patch and Repair	2
Inside T-51	Grey Thermal Pipe Insulation Fitting with Metal Jacket	T	F	1	1 l.f.		Encapsulate end of Pipe	2

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM-Building T-228							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Room 102	12” x 12” White Floor Tile with Brown Streaks and Associated Mastic	M	NF	None	10 s.f.		Remove and Replace Floor Tile	5

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

SURVEILLANCE FINDINGS FOR ACBM-Building T-236							MANAGEMENT PLANNER RECOMMENDATIONS	
Location(s) of ACBM	Material Description	Type T/M/S	Friability F/NF	Assessment Category	Quantity LF/SF	Change in Assessment	Preventative Measures, Response Action & Initial/Additional Cleaning	Response Action Priority
Greenhouse Garage	9” x 9” Floor Tile and associated Mastic	M	NF	None	150 s.f.		Remove and Replace Floor Tile	5

Types: T=Thermal; M=Miscellaneous; S=Surfacing
Friability: N=Non Friable; F=Friable
Quantity: LF=Linear Feet; SF=Square Feet

Asbestos Survey

VA Project: Improve Water System
VA Project Number: 538-18-101
Chillicothe VA Medical Center
17273 State Route 104

Chillicothe, Ohio 45601

September 27, 2019

Terracon Project No. N1197373

Prepared for:
FFE, Inc.
Cincinnati, Ohio 45215

Prepared by:
Terracon Consultants, Inc.
Cincinnati, Ohio 45226

September 27, 2019

FFE, Inc.
438 Springfield Pike, Suite C
Cincinnati, Ohio 45215

Attn: Mr. Clint Weekley
President
T: (513) 519-5999
E: clint.weekley@ffe-serv.com

Re: Asbestos Survey
VA Project: Improve Water System
VA Project No. 538-18-101
Chillicothe VA Medical Center
17273 State Route 104
Chillicothe, Ohio 45601
Terracon Project No. N1197373

Dear Mr. Weekley,

Terracon Consultants, Inc. (Terracon) is pleased to submit the attached report for the above-referenced renovation project to FFE, Inc. (Client). The purpose of this report is to present the results of an asbestos survey which was performed at the site on September 16, 17, and 18, 2019, and in general accordance with our proposal number PN1197373, dated September 11, 2019. We understand that this survey was requested for the purpose of a planned renovation pertaining to the improvement of the water systems in Buildings 24, 27, 30, 35, 210, 211, and 256 at the Chillicothe VA Medical Center (CVAMC).

Asbestos-containing materials (ACM) were identified as a result of the survey. Please refer to the attached report for detail.

Terracon appreciates the opportunity to provide this service to FFE, Inc. If you have any questions regarding this report, please contact the undersigned at 513-321-5816.

Sincerely,
Terracon Consultants, Inc.

Joshua Vogel
Project Manager
OH AHES #35291

Joseph A. Tussey, CHMM
Sr. Associate / Group Manager
OH AHES #32388

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APPENDIX A IDENTIFIED ASBESTOS-CONTAINING MATERIALS BY HOMOGENEOUS AREA (HA)

APPENDIX B ASBESTOS SURVEY SAMPLE & RESULTS SUMMARY

APPENDIX C ASBESTOS ANALYTICAL LABORATORY DATA

APPENDIX D LICENSES AND CERTIFICATIONS

APPENDIX E SAMPLE LOCATION DRAWINGS

APPENDIX F PHOTOS

EXECUTIVE SUMMARY

Terracon Consultants, Inc. (Terracon) conducted an asbestos survey which was specifically limited to within the boundaries and intent of the planned renovation project entitled "Improve Water System" in Buildings 24, 27, 30, 35, 210, 211, and 256 at the Chillicothe VA Medical Center (CVAMC). We understand that this survey was requested prior to renovation for the purpose of compliance with the EPA National Emission Standards for Hazardous Air Pollutants (NESHAP) regulation (40 CFR Part 61, Subpart M). The survey included identifying and sampling suspect asbestos-containing materials (ACM) for laboratory analysis, and providing information regarding the identity, location, condition, and approximate quantities of ACM (if any) pertaining to specific building components which may be impacted by the planned renovation as indicated on Client-provided drawings (see Appendix E). The survey was performed on September 16, 17, and 18, 2019 by a United States Environmental Protection Agency (USEPA)-accredited asbestos inspector and Ohio Environmental Protection Agency (OEPA)-licensed Asbestos Hazard Evaluation Specialist (AHES). The survey was conducted in general accordance with our proposal number PN1197373, dated September 11, 2019, and the sampling protocols established in USEPA 40 Code of Federal Regulations (CFR) Part 763, Subpart E, known as the Asbestos Hazard Emergency Response Act (AHERA).

Specific to the subject renovation project areas and building systems indicated on Client-provided drawings (see Appendix E) and based on the analytical results of the collected samples, the materials listed below were identified to contain asbestos.

ACM Description	Material Location	% and Type Asbestos	Estimated Quantity*
Building 27			
White Mastic on Non-Asbestos-Containing Fiberglass Pipe Insulation	Various Locations Throughout Building 27	1.0% Chrysotile by Point Count (PC)	~550 Linear Feet (LF)
Air-Cell Pipe Insulation and Associated Fitting Insulation	Pipe Chase in Room 252	Assumed (out of reach to sample)	~20 LF
Building 30			
White Mastic on Non-Asbestos-Containing Fiberglass Pipe Insulation	Various Locations Throughout Building 30	1.3% Chrysotile PC	~900 LF
Building 256			
White Interior Window Caulk	Pump Room, Chemical Feed Room	1.5% Chrysotile PC	~15 Square Feet (SF) or 5 Windows
White Exterior Window Glazing		1.0% Chrysotile PC	~20 SF or 5 Windows
White Interior Expansion Caulking	Throughout Building	1.3% Chrysotile PC	~50 SF
White Interior Door Caulking	Throughout Building	1.5% Chrysotile PC	~36 SF or 12 Doors
White Interior Window Glazing	3rd Floor Stairwell Landing	0.75% Chrysotile PC	~3 SF or 1 Window

ACM Description	Material Location	% and Type Asbestos	Estimated Quantity*
9"x9" Grey Floor Tile with Black Mastic	Lab Entry, Toilet Room, Lab	Floor Tile: 1.3% Chrysotile PC, Mastic: 2.1% Chrysotile PC	~350 SF
White Interior Window Caulking	Lab Windows	Trace Chrysotile PC	~8 SF or 2 Windows
Lab Drying Rack	East Wall of Lab	25% Chrysotile	~4 SF
Joint Compound within Drywall Ceiling System	Elevator Equipment Room	0.75% Chrysotile by Point Count (PC) in Joint Compound; Trace Chrysotile by PC in Composite Samples of Gypsum and Joint Compound Analyzed Together	~75 SF (of drywall system)

***Estimated quantities** listed above are based on a cursory field evaluation, and actual quantities may vary significantly, especially if ACMs are present outside of the renovation areas, and in hidden and/or inaccessible areas not evaluated as part of this survey. This is not a bidding document and contractors would be responsible for drawing their own conclusions on quantities present.

In regard to Buildings 24, 35, 210, and 211 asbestos was not detected in the samples collected from these buildings. It should also be noted that inaccessible/concealed suspect materials, other than those identified during this survey, may exist. Should additional suspect materials be uncovered prior to or during renovation activities, those materials must be assumed asbestos-containing until sampled by an Ohio AHES and analysis can confirm or deny their asbestos content.

A sample summary is included in Appendix B and the laboratory analytical reports are included in Appendix C. Sample locations/renovation project drawings are included in Appendix E and example photos of the identified ACM are included in Appendix F.

If the identified ACM will be impacted by the renovation project, the materials will need to be removed prior to renovation by a state-licensed asbestos abatement contractor in accordance with applicable federal, state, and local asbestos regulations, as well as per the VA's abatement specification requirements.

Please note that areas which could not be accessed (e.g. locked rooms, patient-occupied, etc.) are indicated on the drawings included in Appendix E. Assumptions were made in some instances for inaccessible areas relative to positive materials based upon the analytical data interpretation. Additional suspect ACM (not sampled as part of this survey) may be present in inaccessible areas.

ASBESTOS SURVEY

VA Project: Improve Water System
VA Project No. 538-18-101
Chillicothe VA Medical Center
17273 State Route 104
Chillicothe, Ohio 45601Terracon Project No. N1197373
September 27, 2019

1.0 INTRODUCTION

Terracon Consultants, Inc. (Terracon) conducted an asbestos survey specifically limited to within the boundaries and intent of the planned renovation project entitled “Improve Water System” in Buildings 24, 27, 30, 35, 210, 211, and 256 at the Chillicothe VA Medical Center (CVAMC). The survey was performed at the site on September 16, 17, and 18, 2019 by a United States Environmental Protection Agency (USEPA)-accredited asbestos inspector and Ohio Environmental Protection Agency (OEPA)-licensed Asbestos Hazard Evaluation Specialist (AHES). Accessible building components and areas intended to be renovated were surveyed based upon Client-provided renovation plans. Homogeneous areas of suspect asbestos-containing materials (ACM) were visually identified and documented. Although reasonable effort was made to survey accessible suspect materials, additional suspect but un-sampled materials could be located in walls, in voids, or in other concealed areas. Suspect ACM samples were collected in general accordance with the sampling protocols outlined in USEPA 40 Code of Federal Regulations (CFR) Part 763, Subpart E, known as the Asbestos Hazard Emergency Response Act (AHERA). Samples were delivered to an accredited laboratory for analysis by Polarized Light Microscopy (PLM).

1.1 Project Objective

We understand that this survey was requested for the purposes of a future planned renovation project pertaining to improve the water systems in Buildings 24, 27, 30, 35, 210, 211, and 256. Please note that asbestos surveys are required prior to renovation or demolition to satisfy requirements of the USEPA 40 CFR Part 61, Subpart M, the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulation (as well as the state NESHAP equivalent).

1.2 Reliance

This report is for the exclusive use of FFE Inc. (Client) for the project being discussed. Reliance by any other party on this report is prohibited without written authorization of Terracon and FFE Inc. Reliance on this report by FFE Inc. and all authorized parties will be subject to the terms, conditions, and limitations stated in the proposal and the agreement between Terracon and FFE Inc.

2.0 PROJECT DESCRIPTION

The renovation project includes impacts to various plumbing components (primarily removal of abandon pipe and valve replacement) at various locations throughout Buildings 24, 27, 30, 35, 210, 211, and 256. Building 256 also included what appears to be a full interior renovation based on Client-provided drawings. Client-provided drawings which indicate the areas and systems being impacted are shown on the sample location drawings included in Appendix E.

3.0 FIELD ACTIVITIES

The survey was conducted by Mr. Joshua Vogel, USEPA-accredited asbestos inspector and OEPA-licensed AHES. A copy of Mr. Vogel's Ohio AHES credential is attached as Appendix D. The survey was conducted in general accordance with the sample collection protocols established in USEPA 40 CFR Part 763, Subpart E, Section 763.86, AHERA. A summary of survey activities is provided below.

3.1 Visual Assessment

Survey activities were initiated with visual observation of accessible areas and accessible building components pertaining to the renovation project to identify homogeneous areas of suspect ACM. A homogeneous area (HA) consists of building materials that appear similar throughout in terms of color and texture with consideration given to the date of application.

Areas which could not be accessed (e.g. locked rooms, patient-occupied, etc.) are indicated on the drawings included in Appendix E. Assumptions were made in some instances for inaccessible areas relative to positive materials based upon the analytical data interpretation. Additional suspect ACM (not sampled as part of this survey) may be present in inaccessible areas.

3.2 Physical Assessment

A physical assessment of each HA of suspect ACM was conducted to assess the friability and condition of the materials. A friable material is defined by the USEPA as a material which can be crumbled, pulverized, or reduced to powder by hand pressure when dry. Friability was assessed by physically touching suspect materials.

3.3 Sample Collection

Based on results of the visual observation, bulk samples of suspect ACM were collected in general accordance with USEPA AHERA sampling protocols. Samples of suspect materials were collected from randomly selected locations in each homogeneous area. Bulk samples were collected using wet methods as applicable to reduce the potential for fiber release. Samples were placed in sealable containers and labeled with unique sample numbers using an indelible marker.

The selection of sample locations and frequency of sampling were based on Terracon's observations and the assumption that like materials in the same area are homogeneous in content.

Terracon collected a total of 258 bulk samples from 79 homogeneous areas of suspect ACM. A summary of suspect ACM samples collected during the survey is included as Appendix B.

3.4 Sample Analysis

Bulk samples were submitted under chain of custody to International Asbestos Testing Laboratories (IATL) of Mount Laurel, New Jersey for analysis PLM with dispersion staining techniques per USEPA methodology 600/R-93/116. The percentage of asbestos, where applicable, was determined by microscopic visual estimation. When applicable for samples determined by PLM to have a low asbestos content (<10%), the additional point count (PC) method was utilized. IATL is accredited under the National Voluntary Laboratory Accreditation Program (NVLAP), accreditation number 101165-0.

4.0 REGULATORY OVERVIEW

The asbestos NESHAP (40 CFR Part 61, Subpart M) regulates asbestos fiber emissions and asbestos waste disposal practices. The asbestos NESHAP regulation also requires the identification and classification of existing ACM according to friability prior to demolition or renovation activity. Friable ACM is a material containing more than 1% asbestos that, when dry, can be crumbled, pulverized, or reduced to powder by hand pressure. All friable ACM is considered regulated asbestos containing material (RACM).

The asbestos NESHAP regulation classifies material subject to demolition or renovation as either RACM, Category I non-friable ACM, or Category II non-friable ACM. RACM includes all friable ACM (pre-disturbance), along with Category I non-friable ACM that becomes friable (during disturbance), and Category I non-friable ACM subject to sanding, grinding, cutting, or abrading, or Category II non-friable ACM with a high probability of becoming crumbled, pulverized, or reduced to powder by forces expected to act on the material during disturbance. Category I non-friable ACM are exclusively asbestos-containing packings, gaskets, resilient floor coverings, and asphalt roofing products that contain more than 1% asbestos. Category II non-friable ACM are all other non-friable materials (other than Category I non-friable ACM) that contain more than 1% asbestos. Category II non-friable ACM generally includes (but is not limited to) cementitious material such as: cement pipes, cement siding (Transite™), cement panels, glazing, mortar, and grouts.

The OEPA adopted Chapter 3745-20 of the Ohio Administrative Code (OAC) and implements the Asbestos NESHAP. The owner or operator must provide the OEPA district office or local air agency with written notification at least 10 business days prior to the commencement demolition projects and prior to removal of RACM in quantities greater than 50 linear or 50 square feet. The

OEPA also regulates friable asbestos abatement activities, asbestos personnel training, and issuance of asbestos professional certifications under OAC 3745-22. OEPA audits asbestos abatement projects and responds to public health emergencies where friable ACMs has been released. Please note that per OEPA regulations, non-friable floor tile if broken into pieces four (4) square inches or smaller are considered friable, and thus as a RACM.

The United States Occupational Safety and Health Administration (USOSHA) asbestos standard for construction (29 CFR 1926.1101) regulates workplace exposure to asbestos. The USOSHA standard requires that employee exposure to airborne asbestos must not exceed 0.1 fibers per cubic centimeter of air (0.1 f/cc) as an eight-hour time weighted average (TWA) and not exceed 1.0 fibers per cubic centimeter of air (1.0 f/cc) over a 30-minute time period known as an excursion limit (EL). The TWA and EL are known as USOSHA's asbestos permissible exposure limits (PELs). The USOSHA standard classifies construction and maintenance activities which could disturb ACM and specifies work practices and precautions which employers must follow when engaging in each class of regulated work.

5.0 FINDINGS AND RECOMMENDATIONS

Specific to the subject renovation project areas and building systems indicated on Client-provided drawings (see Appendix E) and based on the analytical results of the collected samples, the materials listed below were identified to contain asbestos.

ACM Description	Material Location	% and Type Asbestos	Estimated Quantity*
Building 27			
White Mastic on Non-Asbestos-Containing Fiberglass Pipe Insulation	Various Locations Throughout Building 27	1.0% Chrysotile by Point Count (PC)	~550 Linear Feet (LF)
Air-Cell Pipe Insulation and Associated Fitting Insulation	Pipe Chase in Room 252	Assumed (out of reach to sample)	~20 LF
Building 30			
White Mastic on Non-Asbestos-Containing Fiberglass Pipe Insulation	Various Locations Throughout Building 30	1.3% Chrysotile PC	~900 LF
Building 256			
White Interior Window Caulk	Pump Room, Chemical Feed Room	1.5% Chrysotile PC	~15 Square Feet (SF) or 5 Windows
White Exterior Window Glazing		1.0% Chrysotile PC	~20 SF or 5 Windows
White Interior Expansion Caulking	Throughout Building	1.3% Chrysotile PC	~50 SF
White Interior Door Caulking	Throughout Building	1.5% Chrysotile PC	~36 SF or 12 Doors
White Interior Window Glazing	3rd Floor Stairwell Landing	0.75% Chrysotile PC	~3 SF or 1 Window
9"x9" Grey Floor Tile with Black Mastic	Lab Entry, Toilet Room, Lab	Floor Tile: 1.3% Chrysotile PC, Mastic: 2.1% Chrysotile PC	~350 SF

ACM Description	Material Location	% and Type Asbestos	Estimated Quantity*
White Interior Window Caulking	Lab Windows	Trace Chrysotile PC	~8 SF or 2 Windows
Lab Drying Rack	East Wall of Lab	25% Chrysotile	~4 SF
Joint Compound within Drywall Ceiling System	Elevator Equipment Room	0.75% Chrysotile by Point Count (PC) in Joint Compound; Trace Chrysotile by PC in Composite Samples of Gypsum and Joint Compound Analyzed Together	~75 SF (of drywall system)

***Estimated quantities** listed above are based on a cursory field evaluation, and actual quantities may vary significantly, especially if ACMs are present outside of the renovation areas, and in hidden and/or inaccessible areas not evaluated as part of this survey. This is not a bidding document and contractors would be responsible for drawing their own conclusions on quantities present.

In regard to Buildings 24, 35, 210, and 211 asbestos was not detected in the samples collected from these buildings. It should also be noted that inaccessible/concealed suspect materials, other than those identified during this survey, may exist. Should additional suspect materials be uncovered prior to or during renovation activities, those materials must be assumed asbestos-containing until sampled by an Ohio AHES and analysis can confirm or deny their asbestos content.

A sample summary is included in Appendix B and the laboratory analytical reports are included in Appendix C. Sample locations/renovation project drawings are included in Appendix E and example photos of the identified ACM are included in Appendix F.

If the identified ACM will be impacted by the renovation project, the materials will need to be removed prior to renovation by a state-licensed asbestos abatement contractor in accordance with applicable federal, state, and local asbestos regulations, as well as per the VA's abatement specification requirements.

Please note that areas which could not be accessed (e.g. locked rooms, patient-occupied, etc.) are indicated on the drawings included in Appendix E. Assumptions were made in some instances for inaccessible areas relative to positive materials based upon the analytical data interpretation. Additional suspect ACM (not sampled as part of this survey) may be present in inaccessible areas.

6.0 LIMITATIONS/GENERAL COMMENTS

In some instances, project areas/rooms were inaccessible (e.g. locked, patient-occupied, etc.) during our site visit. Such areas are noted on the project drawings included in Appendix E (in some instances assumptions had to be made based on data interpretation).

The survey was project specific and limited to our understanding of the Client's intended renovation project scope; this survey is not meant to be a comprehensive survey of each building/facility. In addition, Terracon did not perform sampling which required demolition or destructive activities such as knocking large holes in walls, dismantling of equipment or removal

of protective coverings. Reasonable efforts to access suspect materials within known areas of restricted access (e.g., crawl spaces) were made; however, confined spaces or areas which may pose a health or safety risk to Terracon personnel were not sampled. Sampling did not include suspect materials which could not be safely reached with available ladders/man-lifts.

This asbestos survey was conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the profession currently practicing under similar conditions in the same locale. The results, findings, conclusions, and recommendations expressed in this report are based on conditions observed during our survey of the building. The information contained in this report is relevant to the date on which this survey was performed and should not be relied upon to represent conditions at a later date. This report has been prepared on behalf of and exclusively for use by FFE Inc. for specific application to their project as discussed. **This report is not a bidding document. Contractors or consultants reviewing this report must draw their own conclusions regarding quantities, further investigation or remediation deemed necessary.** Terracon does not warrant the work of regulatory agencies, laboratories, or other third-parties supplying information which may have been used in the preparation of this report. No warranty, express or implied is made.

APPENDIX A

VA Project: Improve Water System
VA Project No. 538-18-101
Chillicothe VA Medical Center
17273 State Route 104
Chillicothe, Ohio 45601

IDENTIFIED ASBESTOS-CONTAINING MATERIALS BY HOMOGENEOUS AREA (HA)

HA No's.	ACM Description	Material Location	% and Type Asbestos	EPA NESHAP Classification	Condition	Estimated Quantity*
Building 27						
27-1	White Mastic on Non-Asbestos-Containing Fiberglass Pipe Insulation	Various Locations Throughout Building 27	1.0% Chrysotile by Point Count (PC)	Not Regulated by EPA NESHAP (not >1%) – Regulated by OSHA	Good	~550 Linear Feet (LF)
27-7	Air-Cell Pipe Insulation and Associated Fittings	Pipe Chase in Room 252	Assumed	Regulated Asbestos Containing Material (RACM)	Good	~20 LF
Building 30						
30-2	White Mastic on Non-Asbestos-Containing Fiberglass Pipe Insulation	Various Locations Throughout Building 30	1.3% Chrysotile PC	Category II Non-Friable	Good	~900 LF
Building 256						
256-1	White Interior Window Caulk	Pump Room, Chemical Feed Room (Same Windows as HA 256-18)	1.5% Chrysotile PC	Category II Non-Friable	Good	~15 Square Feet (SF) or 5 Windows
256-3	White Expansion Caulking Interior	Throughout Building	1.3% Chrysotile PC	Category II Non-Friable	Good	~50 SF
256-4	White Interior Door Caulking	Throughout Building	1.5% Chrysotile PC	Category II Non-Friable	Good	~36 SF or 12 Doors
256-6	White Interior Window Glazing	3rd Floor Stairwell Landing	0.75% Chrysotile PC	Not Regulated by EPA NESHAP (<1%) – Regulated by OSHA	Poor	~3 SF or 1 Window
256-7	9"x9" Grey Floor Tile with Black Mastic	Lab Entry, Toilet Room, Lab	Floor Tile: 1.3% Chrysotile PC, Mastic: 2.1% Chrysotile PC	Category I Non-Friable	Good	~350 SF

HA No's.	ACM Description	Material Location	% and Type Asbestos	EPA NESHAP Classification	Condition	Estimated Quantity*
256-10	White Interior Window Caulking	Lab Windows	Trace Chrysotile PC	Not Regulated by EPA NESHAP (<1%) – Regulated by OSHA	Good	~8 SF or 2 Windows
256-12	Lab Drying Rack	East Wall of Lab	25% Chrysotile	Category II Non-Friable	Good	~4 SF
256-16	Joint Compound within Drywall Ceiling System	Elevator Equipment Room	0.75% Chrysotile by Point Count (PC) in Joint Compound; Trace Chrysotile by PC in Composite Samples of Gypsum and Joint Compound Analyzed Together	Not regulated by NESHAP (<1% asbestos by composite with PC); however, removal is considered Class II Work under OSHA 1926.1101	Good	~75 SF (of drywall system)
256-18	White Exterior Window Glazing	Chemical Feed Room, Pump Room (Same Windows as HA 256-1)	1.0% Chrysotile PC	Not Regulated by EPA NESHAP (not >1%) – Regulated by OSHA	Poor	20 SF or 5 Windows

See Appendix B for a summary of samples collected, Appendix C for detailed analytical results, Appendix E for a sample location drawings/renovation plans, and Appendix F for example photos of the identified ACM.

***Estimated quantities** listed above are based on a cursory field evaluation, and actual quantities may vary significantly, especially if ACMs are present outside of the planned renovation areas, and in hidden and/or inaccessible areas not evaluated as part of this survey. This is not a bidding document and contractors would be responsible for drawing their own conclusions regarding quantities present.

In regard to Buildings 24, 35, 210, and 211, asbestos was not detected in the samples collected from these buildings. It should also be noted that inaccessible/concealed suspect materials, other than those identified during this survey, may exist. Should additional suspect materials be uncovered prior to or during renovation activities, those materials must be assumed asbestos-containing until sampled by an Ohio AHES and analysis can confirm or deny their asbestos content.

Please note that areas which could not be accessed (e.g. locked rooms, patient-occupied, etc.) are indicated on the drawings included in Appendix E. Assumptions were made in some instances for inaccessible areas relative to positive materials based upon the analytical data interpretation. Additional suspect ACM (not sampled as part of this survey) may be present in inaccessible areas.

It should be noted that inaccessible/concealed suspect materials, other than those identified during this survey, may exist (especially in inaccessible areas noted on drawings). Should additional suspect materials be uncovered prior to or during renovation activities, those materials must be assumed asbestos-containing until sampled by an Ohio-licensed asbestos inspector and analysis can confirm or deny their asbestos-content.

If the identified ACM will be impacted by the renovation, such materials would need to be properly removed, handled, and disposed in accordance with applicable federal and state EPA regulations, OSHA regulations, and per VA project specifications.

APPENDIX B

VA Project: Improve Water System
VA Project No. 538-18-101
Chillicothe VA Medical Center
17273 State Route 104
Chillicothe, Ohio 45601

ASBESTOS SURVEY SAMPLE & RESULTS SUMMARY

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
Building 24					
24-1	001	White Mastic on Fiberglass Pipe Insulation	Southwest Corner of Room GA102	Various Locations Throughout	Mastic: None Detected (ND), Insulation: ND
	002		Hallway Outside Room GC108		Mastic: ND
	003		Middle of Room CB103A		Mastic: ND, Insulation: ND
24-2	004	2'x2' Ceiling Tile with Bumpy Pattern	Outside Room GB106	Corridors: GBC1, GC108 Rooms: GB111, GB109A,	ND
	005		Center of Room GB111		ND
	006		Outside Room GB103A		ND
24-3	007	2'x4' Ceiling Tile with Small Fissure Pattern	Center of Room GB116	Rooms: GB116, GB107, GB103A	ND
	008		Above Door in Room GB107		ND
	009		Center of Room GB103A		ND
24-4	010	Red Fire Stop Caulking	Center of East Wall Room GB116	Various Locations Throughout	ND
	011		Hallway Outside Room GC108		ND

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
	012		Hallway Outside Room 138		ND
24-5	013	2'x4' Ceiling Tile with Bird Track Pattern	Outside Room 103	Corridor: 1C2, 1C3, 1C8 Rooms: 219A, 204	ND
	014		Outside Room 106		ND
	015		Outside Room 138		ND
24-6	016	Drywall System: Drywall and Joint Compound	Above Door in Room 219A	Room 219A and Room 205	Drywall: ND, Joint Compound: ND
	017		Above Door in Room 219A		Drywall: ND, Joint Compound: ND
	018		Middle of North Wall in Room 205		Drywall: ND, Joint Compound: ND
24-7	019	Spray on Fire Proofing	Room 219A	Various Locations Throughout	ND
	020		Room 219A		ND
	021		Room 219A		ND
Building 27					
27-1	001	White Mastic on Fiberglass Pipe Insulation	Northeast Corner of Room 20	Various Locations Throughout	Mastic: ND
	002		Hallway Outside Room 34		**Mastic: 1.0% Chrysotile by Point Count (PC),** Insulation: ND
	003		Middle of Room 135		Mastic: ND, Insulation: ND
27-2	004	2'x2' Ceiling Tile with Bumpy Pattern	Hallway Outside Room 1	Corridor 1C, Outside Room 11B, Suite 5, Outside Room 16 and 17	ND
	005		Hallway Outside Room 11B		ND

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
	006		Outside Room 30A		ND
27-3	007	2'x4' Drywall Ceiling Tile	Just Inside Door of Room 13	Room: 13, 5D, 3, 32	ND
	008		Just Inside Door of Room 5D		ND
	009		Center of Room 3		ND
27-4	010	Red Fire Stop Caulking	Just Inside Door of Room 13	Various Locations Throughout	ND
	011		Just Inside Door of Room 256		ND
	012		Just Inside Room 256		ND
27-5	013	2'x4' Ceiling Tile with Bird Track Pattern	Room 22A Near Ceiling Vent	Rooms: 22A, 22I, 22K, 27, 129, 135, 102, 120, 150, 234A, 252	ND
	014		Center of Room 27		ND
	015		Room 135 Next to Sprinkler Head		ND
27-6	016	Spray-On Fire Proofing	Middle of Room 120	Various Locations Throughout	ND
	017		Middle of Room 129		ND
	018		Middle of Room 135		ND
	019		Near Window of Room 234A		ND
	020		Center of Room 252		ND
	021		Middle of Room 256		ND

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
	022		Near Window of Room 102		ND
27-7	-	Air-Cell Pipe Insulation and Associated Fittings	-	Pipe Chase in Room 252 (could not reach to sample)	**Assumed**
27-8	023	Drywall System over Plaster Walls	North Wall in Room 252	North Wall in Room 252	Drywall: ND, Plaster: ND
	024		North Wall in Room 252		Drywall: ND, Plaster: ND
	025		North Wall in Room 252		Drywall: ND, Plaster: ND
Building 30					
30-1	001	2'x2' Ceiling Tile with Bumpy Pattern	Hallway Outside Room 1	Corridor 0B, 205, 210	ND
	002		Hallway Outside Room 205		ND
	003		Hallway Outside Room 210		ND
30-2	004	White Mastic on Fiberglass Pipe Insulation	Hallway Outside Room 1	Various Locations Throughout	**1.2% Chrysotile PC**
	005		Hallway Outside Room 8A		**1.3% Chrysotile PC**
	006		Above Door in Room 129		**1.1% Chrysotile PC**
30-3	007	2'x4' Ceiling Tile with Large Fissure Pattern	Southwest Corner of Corridor 0C	Corridor: 10C, 0C Rooms: 100E, 131, 129, 138, 144, 152, 242	ND
	008		Corridor 100E near Ice Machine		ND
	009		Middle of West Wall in Room 131		ND

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
30-4	010	2'x2' Ceiling Tile with Large Fissure Pattern	Room 10D on South Wall	Morgue Suite	ND
	011		Northeast Corner of Corridor 10E		ND
	012		Southwest Corner of Corridor 10E		ND
30-5	013	Red Fire Stop Caulking	Southeast Corner of Room 14	Various Locations Throughout	ND
	014		Above Door in Room 129		ND
	015		Pipe Chase Near Room 212		ND
30-6	016	2'x4' Drywall Ceiling Tile	North Wall of Room 135	Room: 135, 220, 232A	ND
	017		Next to Vent in Room 220		ND
	018		Just Inside Room of Room 232A		ND
30-7	019	Spray on Fire Proofing	Above Sink in Room 135	Various Locations Throughout	ND
	020		Southeast Corner of Room 138		ND
	021		Pipe Chase Next to Room 212		ND
	022		Next to Vent in Room 220		ND
	023		Hallway Outside in Room 205		ND
	024		Hallway Across from Room 249		ND
	025		Room 232A Just Inside Door		ND

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
Building 31					
31-1	001	2'x4' Bird Track Ceiling Tile	Building 303 – Center of Room	Rooms: B303, G-319, 1-310, 1-112, 1-1104, 1-150, 1-311, 1-201, 1-302, 1-307, 2-308, 2-203, 2-119, 2-300C, Corridor 1C5	ND
	002		Hallway Outside Room 1-112		ND
	003		In Corridor 1C5 on East Side		ND
31-2	004	Spray on Fire Proofing	Building 303 – Center of Room	Various Locations Throughout	ND
	005		Outside Room G349		ND
	006		Middle of Room G347E		ND
	007		Hallway Outside Room 1-112		ND
	008		At Entry to G347A		ND
	009		Outside Room G344		ND
	010		Outside Room G322A		ND
31-3	011	2'x2' Textured Ceiling Tile	Outside Room G349	Hallway outside G349, C343E, G311, 327, G217B	ND
	012		Outside G343E		ND
	013		At Entry to Room G347A		ND
31-4	014	White Mastic on Fiberglass Pipe Insulation	Outside Room G349	Throughout Building	ND
	015		Hallway Outside Room 1-112		ND

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
	016		Middle of Room 1-310		ND
31-5	017	2'x2' Drywall Ceiling Tile	Center of Room G345E	Room G345E	ND
	018		Southeast Corner of Room G345E		ND
	019		Southwest Corner of Room G345E		ND
31-6	020	Drywall System: Drywall and Joint Compound	Outside Room G311	Outside Room G311	Drywall: ND, Joint Compound: ND
	021		Outside Room G311		Drywall: ND, Joint Compound: ND
	022		Outside Room G311		Drywall: ND, Joint Compound: ND
31-7	023	2'x4' Large Fissure Ceiling Tile	Center of Room G301	Rooms: G301, G128, G126, B108, 1-140, 1-150, 1-149, 1-161, 3-201C, CL132, G217B	ND
	024		Center of Room G128		ND
	025		Center of Room B108		ND
31-8	026	Drywall System: Drywall and Joint Compound	Hallway Across Froom Room G217B	Hallway Across Froom Room G217B	Drywall: ND, Joint Compound: ND
	027		Hallway Across Froom Room G217B		Drywall: ND, Joint Compound: ND
	028		Hallway Across Froom Room G217B		Drywall: ND, Joint Compound: ND
31-9	029	Drywall System: Drywall and Joint Compound	Southeast Corner	Room G126	Drywall: ND, Joint Compound: ND
	030		Southeast Corner		Drywall: ND, Joint Compound: ND

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
	031		Southeast Corner		Drywall: ND, Joint Compound: ND
31-10	032	Plaster: Base Coat and Finished Coat	Southeast Corner of Corridor 1C5	Corridor 1C5	Base Coat: ND Finished Coat: ND
	033		Southeast Corner of Corridor 1C5		Base Coat: ND Finished Coat: ND
	034		Southeast Corner of Corridor 1C5		Base Coat: ND Finished Coat: ND
31-11	035	Drywall System: Drywall and Joint Compound	Northeast Corner of Room 2-108	Rooms 2-108 and 2-102	Drywall: ND, Joint Compound: ND
	036		Northeast Corner of Room 2-108		Drywall: ND, Joint Compound: ND
	037		Northeast Corner of Room 2-102		Drywall: ND, Joint Compound: ND
31-12	038	2'x4' Drywall Ceiling Tile	Middle of Room 2-112	Rooms: 2-112, 2-121, 2-120, 2-116, 2-117	ND
	039		Middle of Room 2-116		ND
	040		Middle of Room 2-117		ND
31-13	041	Drywall System: Drywall and Joint Compound	Northeast Corner	Room 2-120	Drywall: ND, Joint Compound: ND
	042		Northeast Corner		Drywall: ND, Joint Compound: ND
	043		Northeast Corner		Drywall: ND, Joint Compound: ND
Building 35					
35-1	001	White Mastic on Fiberglass Pipe Insulation	Center of Tank Room	Throughout Building	ND
	002		Pipe Chase BC-109		ND

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
	003		Pipe Chase A1-105		ND
35-2	004	Drywall System: Drywall and Joint Compound	North Wall of room BB-113	Room BB-113	Drywall: ND, Joint Compound: ND
	005		North Wall of room BB-113		Drywall: ND, Joint Compound: ND
	006		North Wall of room BB-113		Drywall: ND, Joint Compound: ND
35-3	007	2'x4' Bird Track Ceiling Tile	At Entry to Room BC-107	Corridor BB113 Rooms BC108F, BC101, 1B-116, 1C-116, 1C-104, 2B-100, 3B-132	ND
	008		Above the Door in Room 1B-116		ND
	009		At Entry to Room 2B-100		ND
35-4	010	2'x4' Large Fissure Ceiling Tile	Center of Room BB112	Rooms BB112, 1B140, 1B121, 2C-111	ND
	011		Above the Door in Room 1B-121		ND
	012		Above the Door in Room 2C111		ND
35-5	013	Drywall System: Drywall and Joint Compound	Center of the North Wall in Room 1B141	Rooms 1B-141, 1B-132, 1B-128, 1B121, 1A-102, 1C-116,1C104	Drywall: ND, Joint Compound: ND
	014		NE Corner of Room 1D-132		Drywall: ND, Joint Compound: ND
	015		NE Corner of Room 1B-128		Drywall: ND, Joint Compound: ND
	016		Above the door in Room 1B-121		Drywall: ND, Joint Compound: ND
	017		SE Corner of Room 1A-102		Drywall: ND, Joint Compound: ND
	018		Middle of the North Wall in Room 1C104		Drywall: ND, Joint Compound: ND

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
	019		Center of the South Wall in Room 1C116		Drywall: ND, Joint Compound: ND
35-6	020	Plaster: Base Coat and Finished Coat	SE Corner of Room 1B-136	Room 1B-136	Base Coat: ND, Finished Coat: ND
	021		NE Corner of Room 1B-136		Base Coat: ND, Finished Coat: ND
	022		SW Corner of Room 1B-136		Base Coat: ND, Finished Coat: ND
35-7	023	2'x2' Textured Ceiling Tile	SW Corner in Room 1C-132	Room 1C-132	ND
	024		Middle of the East Wall in Room 1C-132		ND
	025		NW Corner in Room 1C-132		ND
35-8	026	Drywall System: Drywall and Joint Compound	NW Corner of Room 2C-116	Rooms 2C-116, 2B-117C, 2B-118, 2B-122, 2B-123	Drywall: ND, Joint Compound: ND
	027		Middle of the West Wall in Room 2C-116		Drywall: ND, Joint Compound: ND
	028		SW Corner in Room 2C-116		Drywall: ND, Joint Compound: ND
	029		NW Corner of Room 2B-117C		Drywall: ND, Joint Compound: ND
	030		Middle of the South Wall in Room 2B-118		Drywall: ND, Joint Compound: ND
	031		Outside the Entrance of Room 2B-122		Drywall: ND, Joint Compound: ND
	032		Outside the Entrance of Room 2B-123		Drywall: ND, Joint Compound: ND
35-9	033		SW Corner of Room 3B-124	Rooms 3B-124, 3B-120, 3B-102	Drywall: ND, Joint Compound: ND

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
	034	Drywall System: Drywall and Joint Compound	SW Corner of Room 3B-120		Drywall: ND, Joint Compound: ND
	035		SW Corner of Room 3B-102		Drywall: ND, Joint Compound: ND
35-10	036	Plaster: Base Coat and Finished Coat	North Shower in Room 3C-132	Room 3C-132	Base Coat: ND, Finished Coat: ND
	037		Center Shower in Room 3C-132		Base Coat: ND, Finished Coat: ND
	038		South Shower in Room 3C-132		Base Coat: ND, Finished Coat: ND
Building 210					
210-1	001	White Mastic on Fiberglass Pipe Insulation	Northwest Corner of Room G015B	Various Locations Throughout	ND
	002		Corridor 101 Outside Elevator		ND
	003		Outside Room 265		ND
210-2	004	2'x4' Ceiling Tile with Large Fissure Pattern	Near Door of Room G030	Rooms G030, 141B, 241B and Corridor 101	ND
	005		Center Corridor 101		ND
	006		Center of Room 141B		ND
210-3	007	2x'2' Ceiling Tile with Small Fissure Pattern	Hallway Outside Room G025A	Rooms G025A, G025T, Hallway Outside G025a and G025T	ND
	008		Hallway Outside G025T		ND
	009		Middle of Room G025A		ND
210-4	010	Spray on Fire Proofing	Hallway Outside Room G025A	Rooms 141B, 241B, G025A,	ND

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
	011		Above Door in Room 141B		ND
	012		Above Door in Room 241B		ND
210-5	013	2'x4' Ceiling Tile with Textured Pattern	Above Door in Room 194	Room 194	ND
	014		Southwest Corner of 194		ND
	015		Northwest Corner of Room 194		ND
210-6	016	Red Fire Stop Caulking	Above Door in Room 194	Rooms G030, 194 and 241B	ND
	017		Above Door in Room 241B		ND
	018		Above Door in Room G030		ND
210-7	019	Drywall System: Drywall and Joint Compound	Southwest Corner	South Wall in Room 241B	Drywall: ND, Joint Compound: ND
	020		Southwest Corner		Drywall: ND, Joint Compound: ND
	021		Southwest Corner		Drywall: ND, Joint Compound: ND
Building 211					
211-1	001	White Mastic on Fiberglass Pipe Insulation	Middle of Room F12	Various Locations Throughout	ND
	002		Middle of East Wall in Room G022		ND
	003		Middle of Corridor 267		ND
211-2	004	2'x4' Ceiling Tile with Small Fissure Pattern	Hallway Outside Room G018	Hallway Outside G018, Rooms:	ND

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
	005		Northeast Corner of Room 164	164, 209A, 109A, Corridor 267	ND
	006		Center of Room 109A		ND
211-3	007	2'x4' Ceiling Tile with Bird Track Pattern	Center of Room G027	Rooms G027 and G027B	ND
	008		Center of Room G027B		ND
	009		Center of Room G027B		ND
211-4	010	Drywall System: Drywall and Joint Compound	Northwest Corner	Room G027B	Drywall: ND, Joint Compound: ND
	011		Northwest Corner		Drywall: ND, Joint Compound: ND
	012		Northwest Corner		Drywall: ND, Joint Compound: ND
211-5	013	2'x2' Ceiling Tile with Textured Pattern	Center of West Wall in Room 22	Rooms G022 and G024G	ND
	014		Above Door in Room G024G		ND
	015		Above Door in Room G022		ND
211-6	016	2'x2' Ceiling Tile with Small Fissure Pattern	Outside Room G037	Outside Room G037 and G080	ND
	017		Outside Room G0080		ND
	018		Outside Room G026		ND
211-7	019	Spray On Fireproofing	Outside Room G037	Various Locations Throughout	ND
	020		Outside Room G037		ND

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
	021		Outside Room G037		ND
	022		Outside Room G0080		ND
	023		Outside Room G002		ND
	024		Outside Room 242		ND
	025		Outside Room 243		ND
211-8	026	White Fire Stop Caulking	Outside Room G0084	Various Locations Throughout	ND
	027		Above Door on Room 209		ND
	028		Above Door of Room 234		ND
211-9	029	Drywall System: Drywall and Joint Compound	Above Door of Room 209	Rooms 209, 205, 234	Drywall: ND, Joint Compound: ND
	030		Above Door of Room 205		Drywall: ND, Joint Compound: ND
	031		Southwest Corner of Room 234		Drywall: ND, Joint Compound: ND
Building 256					
256-1	001	White Interior Window Caulk	Bottom of Window in Pump Room	Pump Room, Chemical Feed Room	**1.5% Chrysotile PC**
	002		NW Window in Chem. Feed Room		**1.3% Chrysotile PC**
	003		SW Window in Chem. Feed Room		**1.1% Chrysotile PC**
256-2	004		East Side of Restroom	Throughout Building	ND

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
	005	White Mastic on Fiberglass Pipe Insulation	Pipe off of South Tank on Northeast Corner of Tank		ND
	006		Middle of East Wall In Pump Room		ND
256-3	007	White Expansion Caulking Interior	Bottom of the Steps 1st Floor Stairs	Throughout Building	ND
	008		NW Corner of Pump Room		**1.2% Chrysotile PC**
	009		Middle of West Wall in the Chlorination Room		**1.3% Chrysotile PC**
256-4	010	White Interior Door Caulking	Door to Pump Room	Throughout Building	**1.5% Chrysotile PC**
	011		1St Floor Door to Stairwell		ND
	012		3Rd Floor Door To Stairwell		**1.3% Chrysotile PC**
256-5	013	Black Rubber tank Insulation	North Tank North East Corner	On Water Tanks	ND
	014		North Tank North West Corner		ND
	015		South Tank North West Corner		ND
256-6	016	White Interior Window Glazing	3Rd Floor Window	3RD Floor Stairwell Landing	**0.5% Chrysotile PC**
	017		3Rd Floor Window		**0.75% Chrysotile PC**
	018		3Rd Floor Window		**0.25% Chrysotile PC**
256-7	019	9”x9” Grey Floor Tile with Black Mastic	At Entry To the Lab	Lab Entry, Toilet Room, Lab	**Floor Tile: 1.3% Chrysotile PC, Mastic: 1.5% Chrysotile PC**

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
	020		Northeast Corner of Restroom		**Floor Tile: 1.2% Chrysotile PC, Mastic: 1.8% Chrysotile PC**
	021		Northwest Corner of the Lab		**Floor Tile: 1.3% Chrysotile PC, Mastic: 2.1% Chrysotile PC**
256-8	022	4" Black Cove Base with Yellow Mastic	Southwest Corner of Lab Entry	Lab Entry, Toilet Room, Lab	Cove Base: ND, Mastic: ND
	023		Northeast Corner of Restroom		Cove Base: ND, Mastic: ND
	024		Northwest Corner of the Lab		Cove Base: ND, Mastic: ND
256-9	025	2'x4' Ceiling Tile with Bird Track Pattern	Southwest Corner of the Lab	Lab Entry, Toilet Room, Lab	ND
	026		Northeast Corner of Restroom		ND
	027		Northeast Corner of the Lab		ND
256-10	028	White Window Caulking Interior	South Window	Lab Windows	**Trace Chrysotile PC**
	029		South Window		**Trace Chrysotile PC**
	030		East Window		**Trace Chrysotile PC**
256-11	031	Lab Sink	On Sink	Lab	ND
	032		On Sink		ND
	033		On Sink		ND
256-12	034	Lab Drying Rack	On Drying Rack	East Wall of Lab	**25% Chrysotile**
	035		On Drying Rack		**20% Chrysotile**

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
	036		On Drying Rack		**20% Chrysotile**
256-13	037	White Exterior Door Caulking	South Door	Exterior Doors	ND
	038		Northeast Door		ND
	039		Northwest Door		ND
256-14	040	White Expansion Caulk	Near Elevator Equipment Room	Exterior Walls	ND
	041		Near Northeast Entry		ND
	042		South side of Building		ND
256-15	043	White Caulking	Around Vent	Around Vent on Northwest side of Building	ND
	044		Around Vent		ND
	045		Around Vent		ND
256-16	046	Drywall Ceiling System: Drywall and Joint Compound	South Side	Elevator Equipment Room	Drywall: ND, **Joint Compound 0.75% Chrysotile PC**, Tape: ND, **Composite: Trace Chrysotile PC**
	047		Northwest Corner		Drywall: ND, **Joint Compound 0.5% Chrysotile PC**, Tape: ND, **Composite: Trace Chrysotile PC**
	048		North Side		Drywall: ND, **Joint Compound 0.25% Chrysotile PC**, Tape: ND, **Composite: Trace Chrysotile PC**
256-17	049	Grey Exterior Caulking	East Side		ND

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
	050		East Side	Around Louvers on South Side of Building	ND
	051		West Side		ND
256-18	052	White Exterior Window Glazing	Southwest window in Chemical Feed Room	Chemical Feed Room, Pump Room	**1.0% Chrysotile PC**
	053		Pump Room		**0.75% Chrysotile PC**
	054		Pump Room		**0.75% Chrysotile PC**

APPENDIX C

ASBESTOS ANALYTICAL LABORATORY DATA

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599952 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B24
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880127
Client No.: 24-1-001
Analyst Observation: White Mastic
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Southwest Corner Of Room GA102
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880127(L2)
Client No.: 24-1-001
Analyst Observation: Yellow Insulation
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Southwest Corner Of Room GA102
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
100 Mineral Wool

Percent Non-Fibrous Material:
None Detected

Lab No.: 6880128
Client No.: 24-1-002
Analyst Observation: White/Silver Wrap / Mastic
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Hallway Outside Room GC108
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
30 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
65

Lab No.: 6880129
Client No.: 24-1-003
Analyst Observation: White/Silver Wrap / Mastic
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Middle Of Room CB103A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
20 Cellulose
10 Fibrous Glass

Percent Non-Fibrous Material:
70

Lab No.: 6880129(L2)
Client No.: 24-1-003
Analyst Observation: Yellow Insulation
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Middle Of Room CB103A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
100 Mineral Wool

Percent Non-Fibrous Material:
None Detected

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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Mt. Laurel, New Jersey 08054
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	611 Lunken Park Drive	Report No.:	599952 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B24
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880130
Client No.: 24-2-004
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2'x2' Ceiling Tile With Bumpy Pattern
Location: Outside Room GB106
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
40 Mineral Wool

Percent Non-Fibrous Material:
20

Lab No.: 6880131
Client No.: 24-2-005
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2'x2' Ceiling Tile With Bumpy Pattern
Location: Center Of Room GB111
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
40 Mineral Wool

Percent Non-Fibrous Material:
20

Lab No.: 6880132
Client No.: 24-2-006
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2'x2' Ceiling Tile With Bumpy Pattern
Location: Outside Room GB103A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
40 Mineral Wool

Percent Non-Fibrous Material:
20

Lab No.: 6880133
Client No.: 24-3-007
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2'x4' Ceiling Tile With Small Fissure Pattern
Location: Center Of Room GB116
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
30 Mineral Wool

Percent Non-Fibrous Material:
30

Lab No.: 6880134
Client No.: 24-3-008
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2'x4' Ceiling Tile With Small Fissure Pattern
Location: Above Door In Room GB107
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
30 Mineral Wool

Percent Non-Fibrous Material:
30

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599952 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B24
Client:	TER940	Project No.:	N1197373

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880135
Client No.: 24-3-009
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2'x4' Ceiling Tile With Small Fissure Pattern
Location: Center Of Room GB103A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
50 Cellulose
30 Mineral Wool

Percent Non-Fibrous Material:
20

Lab No.: 6880136
Client No.: 24-4-010
Analyst Observation: Red Firestop
Client Description: Red Fire Stop Caulking
Location: Center Of East Wall Room GB116
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
10 Fibrous Glass

Percent Non-Fibrous Material:
90

Lab No.: 6880137
Client No.: 24-4-011
Analyst Observation: Red Firestop
Client Description: Red Fire Stop Caulking
Location: Hallway Outside Room GC108
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
8 Cellulose

Percent Non-Fibrous Material:
92

Lab No.: 6880138
Client No.: 24-4-012
Analyst Observation: Red Firestop
Client Description: Red Fire Stop Caulking
Location: Hallway Outside Room 138
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
10 Fibrous Glass

Percent Non-Fibrous Material:
90

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599952 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B24
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880139
Client No.: 24-5-013
Analyst Observation: White Ceiling Tile
Client Description: 2'x4' Ceiling Tile With Bird Track Pattern
Location: Outside Room 103
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
60 Cellulose
20 Fibrous Glass

Percent Non-Fibrous Material:
20

Lab No.: 6880140
Client No.: 24-5-014
Analyst Observation: White Ceiling Tile
Client Description: 2'x4' Ceiling Tile With Bird Track Pattern
Location: Outside Room 106
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
60 Cellulose
20 Fibrous Glass

Percent Non-Fibrous Material:
20

Lab No.: 6880141
Client No.: 24-5-015
Analyst Observation: White Ceiling Tile
Client Description: 2'x4' Ceiling Tile With Bird Track Pattern
Location: Outside Room 138
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
60 Cellulose
20 Fibrous Glass

Percent Non-Fibrous Material:
20

Lab No.: 6880142
Client No.: 24-6-016
Analyst Observation: White Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: Above Door In Room 219A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose

Percent Non-Fibrous Material:
95

Lab No.: 6880142(L2)
Client No.: 24-6-016
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: Above Door In Room 219A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature: Tiffany Lowe
Analyst: Tiffany Lowe

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599952 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B24
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880142(L3)
Client No.: 24-6-016
Analyst Observation: Tan Spray-On Fireproofing
Client Description: Drywall System: Drywall And Joint Compound
Location: Above Door In Room 219A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
90

Lab No.: 6880142(L4)
Client No.: 24-6-016
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: Above Door In Room 219A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
2 Cellulose

Percent Non-Fibrous Material:
98

Lab No.: 6880143
Client No.: 24-6-017
Analyst Observation: White Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: Above Door In Room 219A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
90

Lab No.: 6880143(L2)
Client No.: 24-6-017
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: Above Door In Room 219A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880143(L3)
Client No.: 24-6-017
Analyst Observation: Tan Spray-On Fireproofing
Client Description: Drywall System: Drywall And Joint Compound
Location: Above Door In Room 219A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
90

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature: Tiffany Lowe
Analyst: Tiffany Lowe

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599952 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B24
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880143(L4)
Client No.: 24-6-017
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: Above Door In Room 219A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
3 Cellulose
3 Fibrous Glass

Percent Non-Fibrous Material:
94

Lab No.: 6880144
Client No.: 24-6-018
Analyst Observation: White Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: Middle Of North Wall In Room 205
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
90

Lab No.: 6880144(L2)
Client No.: 24-6-018
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: Middle Of North Wall In Room 205
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880144(L3)
Client No.: 24-6-018
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: Middle Of North Wall In Room 205
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
2 Cellulose
2 Fibrous Glass

Percent Non-Fibrous Material:
96

Lab No.: 6880145
Client No.: 24-7-019
Analyst Observation: Tan Spray-On Fireproofing
Client Description: Spray-on Fireproofing
Location: Room 219A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
10 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
85

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature: Tiffany Lowe
Analyst: Tiffany Lowe

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599952 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B24
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880146
Client No.: 24-7-020
Analyst Observation: Tan Spray-On Fireproofing
Client Description: Spray-on Fireproofing
Location: Room 219A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
10 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
85

Lab No.: 6880147
Client No.: 24-7-021
Analyst Observation: Tan Spray-On Fireproofing
Client Description: Spray-on Fireproofing
Location: Room 219A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
10 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
85

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature: Tiffany Lowe
Analyst: Tiffany Lowe

Approved By:
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	611 Lunken Park Drive	Report No.:	599952 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B24
		Project No.:	N1197373
Client:	TER940		

Appendix to Analytical Report

Customer Contact:
Method:40 CFR Appendix E to Subpart E of Part 763, interim method for the Determination of Asbestos in Bulk Insulation Samples, and USEPA 600, R93-116 as needed.

This appendix seeks to promote greater understanding of any observations, exceptions, special instructions, or circumstances that the laboratory needs to communicate to the client concerning the above samples. The information below is used to help promote your ability to make the most informed decisions for you and your customers. Please note the following points of contact for any questions you may have.

iATL Customer Service: customerservice@iatl.com
iATL Office Manager:wchampion@iatl.com
iATL Account Representative: Cassie Doherty
Sample Login Notes: See Batch Sheet Attached
Sample Matrix: Bulk Building Materials
Exceptions Noted: See Following Pages

General Terms, Warrants, Limits, Qualifiers:

General information about iATL capabilities and client/laboratory relationships and responsibilities are spelled out in iATL policies that are listed at www.iATL.com and ir our Quality Assurance Manual per ISO 17025 standard requirements. The information therein is a representation of iATL definitions and policies for turnaround times, sample submittal, collection media, blank definitions, quantification issues and limit of detection, analytical methods and procedures, sub-contracting policies, results reporting options, fees, terms, and discounts, confidentiality, sample archival and disposal, and data interpretation.

iATL warrants the test results to be of a precision normal for the type and methodology employed for each sample submitted. iATL disclaims any other warrants, expressed or implied, including warranty of fitness for a particular purpose and warranty of merchantability. iATL accepts no legal responsibility for the purpose for which the client uses test results. Any analytical work performed must be governed by our Standard Terms and Conditions. Prices, methods and detection limits may be changed without notification. Please contact your Customer Service Representative for the most current information.

This confidential report relates only to those item(s) tested and does not represent an endorsement by NIST-NVLAP, AIHA LAP LLC, or any agency of local, state or province governments nor of any agency of the U.S. government.

This report shall not be reproduced except in full, without written approval of the laboratory.

Information Pertinent to this Report:

Analysis by US EPA 600 93-116: Determination of Asbestos in Bulk Building Materials by Polarized Light Microscopy (PLM).

Certifications:

- NIST-NVLAP No. 101165-0
- NYSDOH-ELAP No. 11021
- AIHA-LAP, LLC No. 100188

Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. PC Trace represents a <0.25% amount. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

Analytical Methodology Alternatives: Your initial request for analysis may not have accounted for recent advances in regulatory requirements or advances in technology that are routinely used in similar situations for other qualified projects. You may have the option to explore additional analysis for further information. Below are a few options, listed as the matrix followed by the appropriate methodology. Also included are links to more information on our website.

Bulk Building Materials that are Non-Friable Organically Bound (NOB) by Gravimetric Reduction techniques employing PLM and TEM: ELAP 198.6 (PLM-NOB), ELAP 198.4 (TEM-NOB)

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599952 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B24
		Project No.:	N1197373
Client:	TER940		

Loose Fill Vermiculite Insulation, Attic Insulation, Zonolite (copyright), etc.: US EPA 600 R-4/004 (multi-tiered analytical process)
Sprayed On Insulation/Fireproofing with Vermiculite (SOF-V): ELAP 198.8 (PLM-SOF-V)

Soil, sludge, sediment, aggregate, and like materials analyzed for asbestos or other elongated mineral particles (ex. erionite, etc.): ASTM D7521, CARB 435, and other options available

Asbestos in Surface Dust according to one of ASTM's Methods (very dependent on sampling collection technique – by TEM): ASTM D 5755, D5756, or D6480

Various other asbestos matrices (air, water, etc.) and analytical methods are available.

Disclaimers / Qualifiers:

There may be some samples in this project that have a "NOTE:" associated with a sample result. We use added disclaimers or qualifiers to inform the client about something that requires further explanation. Here is a list with highlighted disclaimers that may be pertinent to this project. For a full explanation of these and other disclaimers, please inquire at **customerservice@iatl.com**.

1) Note: No mastic provided for analysis.
2) Note: Insufficient mastic provided for analysis.
3) Note: Insufficient material provided for analysis.
4) Note: Insufficient sample provided for QC reanalysis.
5) Note: Different material than indicated on Sample Log / Description.
6) Note: Sample not submitted.
7) Note: Attached to asbestos containing material.
8) Note: Received wet.
9) Note: Possible surface contamination.
10) Note: Not building material. 1% threshold may not apply.
11) Note: Recommend TEM-NOB analysis as per EPA recommendations.
12) Note: Asbestos detected but not quantifiable.
13) Note: Multiple identical samples submitted, only one analyzed.
14) Note: Analyzed by EPA 600/R-93/116. Point Counting detection limit at 0.080%.
15) Note: Analyzed by EPA 600/R-93/116. Point Counting detection limit at 0.125%.
16) Note: This sample contains >10% vermiculite mineral. See Appendix for Recommendations for Vermiculite Analysis.

Recommendations for Vermiculite Analysis:

Several analytical protocols exist for the analysis of asbestos in vermiculite. These analytical approaches vary depending upon the nature of the vermiculite mineral being tested (e.g. un-processed gange, homogeneous exfoliated books of mica, or mixed mineral composites).Please contact your client representative for pricing and turnaround time options available.

iATL recommends initial testing using the EPA 600/R-93/116 method. This method is specifically designed for the analysis of asbestos in bulk building materials. It provides an acceptable starting point for primary screening of vermiculite for possible asbestos.

Results from this testing may be inconclusive. EPA suggests proceeding to a multi-tiered analysis involving wet separation techniques in conjunction with PLM and TEM gravimetric analysis (EPA 600/R-04/004).

For New York State customers, NYSDOH requires disclaimers and qualifiers for various vermiculite containing samples that direct analysis via ELAP198.6 and ELAP198.8 for samples that contain >10% vermiculite mineral where ELAP198.6 may be used to evaluate the asbestos content of the material. However, any test result using ELAP198.6 will be reported with the following disclaimer: “ELAP198.6 method does not remove vermiculite and may underestimate the level of asbestos present in a sample containing >10% vermiculite.”

Further information on this method and other vermiculite and asbestos issues can be found at the following: Agency for Toxic Substances and Disease Registry (ATSDR) www.atsdr.cdc.gov, United States Geological Survey (USGS) www.minerals.usgs.gov/minerals/, US EPA www.epa.gov/asbestos. The USEPA also has an informative brochure "Current Best Practices for Vermiculite Attic Insulation" EPA 747F03001 May 2003, that may assist the health and remediation professional.

The following is a summary of the analytical process outlines in the EPA 600/R-04/004 Method:

1)**Analytical Step/Method:** Initial Screening by PLM, EPA 600R-93/116
Requirements/Comments: Minimum of 0.1 g of sample. ~0.25% LOQ for most samples.

2)**Analytical Step/Method:** Wet Separation by PLM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Sinks" only.

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599952 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B24
		Project No.:	N1197373
Client:	TER940		

3)**Analytical Step/Method:** Wet Separation by PLM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Floats" only.

4)**Analytical Step/Method:** Wet Separation by TEM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Sinks" only.

5)**Analytical Step/Method:** Wet Separation by TEM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Suspension" only.

LOQ, Limit of Quantitation estimates for mass and volume analyses.
*With advance notice and confirmation by the laboratory.
**Approximately 1 Liter of sample in double-bagged container (~9x6 inch bag of sample).

iATL INTERNATIONAL
ASBESTOS TESTING LABORATORIES

9000 Commerce Parkway, Suite B • Mount Laurel, NJ 08054
Phone: 877-428-4285/856-231-9449 • Fax: 856-231-9818

Chain of Custody

–Bulk Asbestos –

Contact Information

Client Company:	Terracon Consultants, Inc.	**Project Number:**	N1197373
Office Address:	611 Lunken Park Drive	**Project Name:**	Chillicothe VAMC B24
City, State, Zip:	Cincinnati, OH 45226	**Primary Contact:**	Joshua Vogel
Fax Number:	513-321-0294	**Office Phone:**	513-612-9085
Email Address:	joshua.vogel@terracon.com	**Cell Phone:**	513-332-5034

PLM Instructions:

- ☒ PLM: Bulk Asbestos Building Materials EPA 600 R-93/116, 1993
- ☐ PLM: Bulk Asbestos Building Materials EPA 600 M-4/82-020, 1982
- ☐ PLM: Bulk Asbestos Building Materials NIOSH 9002, 1985
- ☐ PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.1, 2002
- ☐ PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.6, 2010
- ☐ TEM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.4, 2009

☒ PLM: Point Counting
- ☐ PC: via ELAP 198.1
- ☒ PC: 400 Points
- ☐ PC: 800 Points *
- ☐ PC: 1600 Points *

☒ PLM: Instructions for Multi-Layered Samples
- ☒ Analyze and Report All Separable Layers per EPA 600
- ☒ Report Composite for Drywall Systems per NESHAP
- ☐ Report All Layers and Composite Where Applicable
- ☐ Only Analyze and Report Specifically Noted Layer

☐ PLM: Analyze Until Positive (Positive Stop)
- ☐ AUP: by Homogenous Area as Noted
- ☐ AUP: by Material Type as Noted

☐ PLM: NOB via 198.6
- ☐ PLM: Friable via EPA 600 2.3
- ☐ If <1% by PLM, to TEM via 198.4 *
- ☐ If <1% by PLM, Hold for Instructions

☐ PLM: Non-Building Material*,** (Dust, Wipe, Tape)
- ☐ Soil or Vermiculite Analysis*
- ☐ CARB 435

Special Instructions: _____

** Additional charge and turnaround may be required* *** Alternative Method (ex: EPA 600/R-04/004) may be recommended by Laboratory*

Turnaround Time

Preliminary Results Requested Date: _____ (Specific date / time) ☐ Verbal ☒ Email ☐ Fax

☐ 10 Day ☒ 5 Day ☐ 3 Day ☐ 2 Day ☐ 1 Day* ☐ 12 Hour** ☐ 6 Hour** ☐ RUSH**

* End of next business day unless otherwise specified. ** Matrix Dependent. ***Please notify the lab before shipping***

Chain of Custody

Relinquished (Name/Organization):	[signature]	Date: 09/18/19	Time:
Received (Name / iATL):		Date:	Time:
Sample Login (Name / iATL):		Date:	Time: SEP 1 0 2019
Analysis(Name(s) / iATL):	CSC 9-25-19	Date:	Time:
QA/QC Review (Name / iATL):	[signature]	Date: 9/26/19	Time:
Archived / Released: _____ QA/QC InterLAB Use: _____		Date:	Time:

SUSPECT ACM - BULK MATERIAL SAMPLE LOG

Page ____ of ____

Date: September 18, 2019
Inspector: Joshua Vogel
Project: Chillicothe VAMC Building 24
Project # N1197373

Terracon
611 Lunken Park Drive
Cincinnati, Ohio 45226
(513) 321.5816

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
24-1	001	White Mastic on Fiberglass Pipe Insulation	Southwest Corner of Room GA102	Various Locations Throughout	6880127
	002		Hallway Outside Room GC108		6880128
	003		Middle of Room CB103A		6880129
24-2	004	2'x2' Ceiling Tile with Bumpy Pattern	Outside Room GB106	Corridors: GBC1, GC108 Rooms: GB111, GB109A,	6880130
	005		Center of Room GB111		6880131
	006		Outside Room GB103A		6880132
24-3	007	2'x4' Ceiling Tile with Small Fissure Pattern	Center of Room GB116	Rooms: GB116, GB107, GB103A	6880133
	008		Above Door in Room GB107		6880134
	009		Center of Room GB103A		6880135
24-4	010	Red Fire Stop Caulking	Center of East Wall Room GB116	Various Locations Throughout	6880136
	011		Hallway Outside Room GC108		6880137
	012		Hallway Outside Room 138		6880138
24-5	013	2'x4' Ceiling Tile with Bird Track Pattern	Outside Room 103	Corridor: 1C2, 1C3, 1C8 Rooms: 219A, 204	6880139
	014		Outside Room 106		6880140
	015		Outside Room 138		6880141

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
24-6	016	Drywall System: Drywall and Joint Compound	Above Door in Room 219A	Room 219A and Room 205	6880142
	017		Above Door in Room 219A		6880143
	018		Middle of North Wall in Room 205		6880144
24-7	019	Spray on Fire Proofing	Room 219A	Various Locations Throughout	6880145
	020		Room 219A		6880146
	021		Room 219A		6880147

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Phone: 877-428-4285/856-231-9449 • Fax: 856-231-9818

Chain of Custody

–Bulk Asbestos –

Contact Information

Client Company: Terracon Consultants, Inc.
Office Address: 611 Lunken Park Drive
City, State, Zip: Cincinnati, OH 45226
Fax Number: 513-321-0294
Email Address: joshua.vogel@terracon.com

Project Number: N\197373
Project Name: Chillicothe VAMC # B24
Primary Contact: Joshua Vogel
Office Phone: 513-612-9085
Cell Phone: 513-332-5034

PLM Instructions:

- [x] PLM: Bulk Asbestos Building Materials EPA 600 R-93/116, 1993
- [ ] PLM: Bulk Asbestos Building Materials EPA 600 M-4/82-020, 1982
- [ ] PLM: Bulk Asbestos Building Materials NIOSH 9002, 1985
- [ ] PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.1, 2002
- [ ] PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.6, 2010
- [ ] TEM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.4, 2009

- [x] PLM: Point Counting
  - [ ] PC: via ELAP 198.1
  - [x] PC: 400 Points
  - [ ] PC: 800 Points *
  - [ ] PC: 1600 Points *

- [x] PLM: Instructions for Multi-Layered Samples
  - [x] Analyze and Report All Separable Layers per EPA 600
  - [x] Report Composite for Drywall Systems per NESHAP
  - [ ] Report All Layers and Composite Where Applicable
  - [ ] Only Analyze and Report Specifically Noted Layer

- [ ] PLM: Analyze Until Positive (Positive Stop)
  - [ ] AUP: by Homogenous Area as Noted
  - [ ] AUP: by Material Type as Noted
- [ ] PLM: NOB via 198.6
  - [ ] PLM: Friable via EPA 600 2.3
  - [ ] If <1% by PLM, to TEM via 198.4 *
  - [ ] If <1% by PLM, Hold for Instructions

- [ ] PLM: Non-Building Material*,** (Dust, Wipe, Tape)
  - [ ] Soil or Vermiculite Analysis*
  - [ ] CARB 435

Special Instructions: _____

** Additional charge and turnaround may be required* *** Alternative Method (ex: EPA 600/R-04/004) may be recommended by Laboratory*

Turnaround Time

Preliminary Results Requested Date: _____ (Specific date / time) ☐ Verbal ☒ Email ☐ Fax

☐ 10 Day ☒ 5 Day ☐ 3 Day ☐ 2 Day ☐ 1 Day* ☐ 12 Hour** ☐ 6 Hour** ☐ RUSH**

* End of next business day unless otherwise specified. ** Matrix Dependent. ***Please notify the lab before shipping***

Chain of Custody

Relinquished (Name/Organization):	[signature]	Date: 09/18/19	Time:
Received (Name / iATL):		Date:	Time:
Sample Login (Name / iATL):		Date:	Time: SEP 1 0 201
Analysis(Name(s) / iATL):	[signature]	Date: 9.25.19	Time:
QA/QC Review (Name / iATL):	[signature]	Date: 9/26/19	Time:
Archived / Released: _____ QA/QC InterLAB Use:		Date:	Time:

SUSPECT ACM - BULK MATERIAL SAMPLE LOG

Page ____ of ____

Date: September 18, 2019
Inspector: Joshua Vogel
Project: Chillicothe VAMC Building 24
Project # N1197373

Terracon
611 Lunken Park Drive
Cincinnati, Ohio 45226
(513) 321.5816

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
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	002		Hallway Outside Room GC108		6880128
	003		Middle of Room CB103A		6880129
24-2	004	2'x2' Ceiling Tile with Bumpy Pattern	Outside Room GB106	Corridors: GBC1, GC108 Rooms: GB111, GB109A,	6880130
	005		Center of Room GB111		6880131
	006		Outside Room GB103A		6880132
24-3	007	2'x4' Ceiling Tile with Small Fissure Pattern	Center of Room GB116	Rooms: GB116, GB107, GB103A	6880133
	008		Above Door in Room GB107		6880134
	009		Center of Room GB103A		6880135
24-4	010	Red Fire Stop Caulking	Center of East Wall Room GB116	Various Locations Throughout	6880136
	011		Hallway Outside Room GC108		6880137
	012		Hallway Outside Room 138		6880138
24-5	013	2'x4' Ceiling Tile with Bird Track Pattern	Outside Room 103	Corridor: 1C2, 1C3, 1C8 Rooms: 219A, 204	6880139
	014		Outside Room 106		6880140
	015		Outside Room 138		6880141

Start

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
24-6	016	Drywall System: Drywall and Joint Compound	Above Door in Room 219A	Room 219A and Room 205	6880142
	017		Above Door in Room 219A		6880143
	018		Middle of North Wall in Room 205		6880144
24-7	019	Spray on Fire Proofing	Room 219A	Various Locations Throughout	6880145
	020		Room 219A		6880146
	021		Room 219A		6880147

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Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/26/2019
	611 Lunken Park Drive	Report No.:	599947 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B27
Client:	TER940	Project No.:	N1197373

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6879969
Client No.: 27-1-001
Analyst Observation: White Wrap
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Northeast Corner Of Room 20
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
30 Cellulose
10 Fibrous Glass

Percent Non-Fibrous Material:
60

Lab No.: 6879970
Client No.: 27-1-002
Analyst Observation: White Sealant
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Hallway Outside Room 34
Facility:

Percent Asbestos:
PC 1.0 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
99

Lab No.: 6879970(L2)
Client No.: 27-1-002
Analyst Observation: Yellow Insulation
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Hallway Outside Room 34
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
99 Fibrous Glass

Percent Non-Fibrous Material:
1

Lab No.: 6879971
Client No.: 27-1-003
Analyst Observation: White Sealant
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Middle Of Room 135
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6879971(L2)
Client No.: 27-1-003
Analyst Observation: Yellow Insulation
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Middle Of Room 135
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
99 Fibrous Glass

Percent Non-Fibrous Material:
1

Lab No.: 6879972
Client No.: 27-2-004
Analyst Observation: Tan Ceiling Tile
Client Description: 2'x2' Ceiling Tile With Bumpy Pattern
Location: Hallway Outside Room 1
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
80 Cellulose
10 Fibrous Glass

Percent Non-Fibrous Material:
10

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature:
Analyst: Zach Schwartz

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/26/2019
	611 Lunken Park Drive	Report No.:	599947 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B27
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6879972(L2)
Client No.: 27-2-004
Analyst Observation: Tan Insulation
Client Description: 2'x2' Ceiling Tile With Bumpy Pattern
Location: Hallway Outside Room 1
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
80 Fibrous Glass

Percent Non-Fibrous Material:
20

Lab No.: 6879973
Client No.: 27-2-005
Analyst Observation: Tan Ceiling Tile
Client Description: 2'x2' Ceiling Tile With Bumpy Pattern
Location: Hallway Outside Room 11B
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
80 Cellulose
10 Fibrous Glass

Percent Non-Fibrous Material:
10

Lab No.: 6879973(L2)
Client No.: 27-2-005
Analyst Observation: Tan Insulation
Client Description: 2'x2' Ceiling Tile With Bumpy Pattern
Location: Hallway Outside Room 11B
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
90 Fibrous Glass

Percent Non-Fibrous Material:
10

Lab No.: 6879974
Client No.: 27-2-006
Analyst Observation: Tan Ceiling Tile
Client Description: 2'x2' Ceiling Tile With Bumpy Pattern
Location: Outside Room 30A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
80 Cellulose
10 Fibrous Glass

Percent Non-Fibrous Material:
10

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature:
Analyst: Zach Schwartz

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client: Terracon
611 Lunken Park Drive
Cincinnati OH 45226

Client: TER940

Report Date: 9/26/2019
Report No.: 599947 - PLM
Project: Chillicothe VAMC B27
Project No.: N1197373

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6879975
Client No.: 27-3-007
Analyst Observation: Tan Ceiling Tile
Client Description: 2'x4' Drywall Ceiling Tile
Location: Just Inside Door Of Room 13
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
70 Cellulose
20 Fibrous Glass

Percent Non-Fibrous Material:
10

Lab No.: 6879976
Client No.: 27-3-008
Analyst Observation: Tan Ceiling Tile
Client Description: 2'x4' Drywall Ceiling Tile
Location: Just Inside Door Of Room 5D
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
70 Cellulose
20 Fibrous Glass

Percent Non-Fibrous Material:
10

Lab No.: 6879977
Client No.: 27-3-009
Analyst Observation: Tan Ceiling Tile
Client Description: 2'x4' Drywall Ceiling Tile
Location: Center Of Room 3
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
70 Cellulose
20 Fibrous Glass

Percent Non-Fibrous Material:
10

Lab No.: 6879978
Client No.: 27-4-010
Analyst Observation: Red Firestop
Client Description: Red Fire Stop Caulking
Location: Just Inside Door Of Room 13
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
2 Fibrous Glass

Percent Non-Fibrous Material:
98

Lab No.: 6879979
Client No.: 27-4-011
Analyst Observation: Red Firestop
Client Description: Red Fire Stop Caulking
Location: Just Inside Door Of Room 256
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
2 Fibrous Glass

Percent Non-Fibrous Material:
98

Lab No.: 6879980
Client No.: 27-4-012
Analyst Observation: Red Firestop
Client Description: Red Fire Stop Caulking
Location: Just Inside Room 256
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
2 Fibrous Glass

Percent Non-Fibrous Material:
98

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/26/2019
Signature:
Analyst: Zach Schwartz

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/26/2019
	611 Lunken Park Drive	Report No.:	599947 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B27
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6879981
Client No.: 27-5-013
Analyst Observation: Tan Ceiling Tile
Client Description: 2'x4' Ceiling Tile With Bird Track Pattern
Location: Room 22A Near Ceiling Vent
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
80 Cellulose
10 Fibrous Glass

Percent Non-Fibrous Material:
10

Lab No.: 6879982
Client No.: 27-5-014
Analyst Observation: Tan Ceiling Tile
Client Description: 2'x4' Ceiling Tile With Bird Track Pattern
Location: Center Of Room 27
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
80 Cellulose
10 Fibrous Glass

Percent Non-Fibrous Material:
10

Lab No.: 6879983
Client No.: 27-5-015
Analyst Observation: Tan Ceiling Tile
Client Description: 2'x4' Ceiling Tile With Bird Track Pattern
Location: Room 135 Next to Sprinkler Head
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
80 Cellulose
20 Fibrous Glass

Percent Non-Fibrous Material:
None Detected

Lab No.: 6879984
Client No.: 27-6-016
Analyst Observation: Grey Insulation
Client Description: Spray-On Fire Proofing
Location: Middle Of Room 120
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
80 Fibrous Glass

Percent Non-Fibrous Material:
20

Lab No.: 6879985
Client No.: 27-6-017
Analyst Observation: Grey Insulation
Client Description: Spray-On Fire Proofing
Location: Middle Of Room 129
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
80 Fibrous Glass

Percent Non-Fibrous Material:
20

Lab No.: 6879986
Client No.: 27-6-018
Analyst Observation: Grey Insulation
Client Description: Spray-On Fire Proofing
Location: Middle Of Room 135
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
80 Fibrous Glass

Percent Non-Fibrous Material:
20

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/26/2019
Signature:
Analyst: Zach Schwartz

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/26/2019
	611 Lunken Park Drive	Report No.:	599947 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B27
Client:	TER940	Project No.:	N1197373

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6879987
Client No.: 27-6-019
Analyst Observation: Grey Insulation
Client Description: Spray-On Fire Proofing
Location: Near Window Of Room 234A
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 80 Fibrous Glass
Percent Non-Fibrous Material: 20

Lab No.: 6879988
Client No.: 27-6-020
Analyst Observation: Grey Insulation
Client Description: Spray-On Fire Proofing
Location: Center Of Room 252
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 80 Fibrous Glass
Percent Non-Fibrous Material: 20

Lab No.: 6879989
Client No.: 27-6-021
Analyst Observation: Grey Insulation
Client Description: Spray-On Fire Proofing
Location: Middle Of Room 256
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 80 Fibrous Glass
Percent Non-Fibrous Material: 20

Lab No.: 6879990
Client No.: 27-6-022
Analyst Observation: Grey Insulation
Client Description: Spray-On Fire Proofing
Location: Near Window Of Room 102
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 80 Fibrous Glass
Percent Non-Fibrous Material: 20

Lab No.: 6879991
Client No.: 27-8-023
Analyst Observation: White Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: North Wall In Room 252
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 5 Cellulose
Percent Non-Fibrous Material: 95

Lab No.: 6879991(L2)
Client No.: 27-8-023
Analyst Observation: Grey Plaster
Client Description: Drywall System: Drywall And Joint Compound
Location: North Wall In Room 252
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/26/2019
Signature:
Analyst: Zach Schwartz

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/26/2019
	611 Lunken Park Drive	Report No.:	599947 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B27
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6879991(L3) **Analyst Observation:** White Plaster **Location:** North Wall In Room 252
Client No.: 27-8-023 **Client Description:** Drywall System: Drywall And Joint Compound **Facility:**

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6879992 **Analyst Observation:** White Drywall **Location:** North Wall In Room 252
Client No.: 27-8-024 **Client Description:** Drywall System: Drywall And Joint Compound **Facility:**

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 5 Cellulose
Percent Non-Fibrous Material: 95

Lab No.: 6879992(L2) **Analyst Observation:** Grey Plaster **Location:** North Wall In Room 252
Client No.: 27-8-024 **Client Description:** Drywall System: Drywall And Joint Compound **Facility:**

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6879992(L3) **Analyst Observation:** White Plaster **Location:** North Wall In Room 252
Client No.: 27-8-024 **Client Description:** Drywall System: Drywall And Joint Compound **Facility:**

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6879993 **Analyst Observation:** White Drywall **Location:** North Wall In Room 252
Client No.: 27-8-025 **Client Description:** Drywall System: Drywall And Joint Compound **Facility:**

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 5 Cellulose
Percent Non-Fibrous Material: 95

Lab No.: 6879993(L2) **Analyst Observation:** Grey Plaster **Location:** North Wall In Room 252
Client No.: 27-8-025 **Client Description:** Drywall System: Drywall And Joint Compound **Facility:**

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/26/2019
Signature:
Analyst: Zach Schwartz

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/26/2019
	611 Lunken Park Drive	Report No.:	599947 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B27
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6879993(L3)
Client No.: 27-8-025

Analyst Observation: White Plaster
Client Description: Drywall System: Drywall And Joint Compound

Location: North Wall In Room 252
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/26/2019
Signature:
Analyst: Zach Schwartz

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/26/2019
	611 Lunken Park Drive	Report No.:	599947 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B27
		Project No.:	N1197373
Client:	TER940		

Appendix to Analytical Report

Customer Contact:
Method:40 CFR Appendix E to Subpart E of Part 763, interim method for the Determination of Asbestos in Bulk Insulation Samples, and USEPA 600, R93-116 as needed.

This appendix seeks to promote greater understanding of any observations, exceptions, special instructions, or circumstances that the laboratory needs to communicate to the client concerning the above samples. The information below is used to help promote your ability to make the most informed decisions for you and your customers. Please note the following points of contact for any questions you may have.

iATL Customer Service: customerservice@iatl.com
iATL Office Manager:wchampion@iatl.com
iATL Account Representative: Cassie Doherty
Sample Login Notes: See Batch Sheet Attached
Sample Matrix: Bulk Building Materials
Exceptions Noted: See Following Pages

General Terms, Warrants, Limits, Qualifiers:

General information about iATL capabilities and client/laboratory relationships and responsibilities are spelled out in iATL policies that are listed at www.iATL.com and ir our Quality Assurance Manual per ISO 17025 standard requirements. The information therein is a representation of iATL definitions and policies for turnaround times, sample submittal, collection media, blank definitions, quantification issues and limit of detection, analytical methods and procedures, sub-contracting policies, results reporting options, fees, terms, and discounts, confidentiality, sample archival and disposal, and data interpretation.

iATL warrants the test results to be of a precision normal for the type and methodology employed for each sample submitted. iATL disclaims any other warrants, expressed or implied, including warranty of fitness for a particular purpose and warranty of merchantability. iATL accepts no legal responsibility for the purpose for which the client uses test results. Any analytical work performed must be governed by our Standard Terms and Conditions. Prices, methods and detection limits may be changed without notification. Please contact your Customer Service Representative for the most current information.

This confidential report relates only to those item(s) tested and does not represent an endorsement by NIST-NVLAP, AIHA LAP LLC, or any agency of local, state or province governments nor of any agency of the U.S. government.

This report shall not be reproduced except in full, without written approval of the laboratory.

Information Pertinent to this Report:

Analysis by US EPA 600 93-116: Determination of Asbestos in Bulk Building Materials by Polarized Light Microscopy (PLM).

Certifications:

- NIST-NVLAP No. 101165-0
- NYSDOH-ELAP No. 11021
- AIHA-LAP, LLC No. 100188

Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. PC Trace represents a <0.25% amount. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

Analytical Methodology Alternatives: Your initial request for analysis may not have accounted for recent advances in regulatory requirements or advances in technology that are routinely used in similar situations for other qualified projects. You may have the option to explore additional analysis for further information. Below are a few options, listed as the matrix followed by the appropriate methodology. Also included are links to more information on our website.

Bulk Building Materials that are Non-Friable Organically Bound (NOB) by Gravimetric Reduction techniques employing PLM and TEM: ELAP 198.6 (PLM-NOB), ELAP 198.4 (TEM-NOB)

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/26/2019
	611 Lunken Park Drive	Report No.:	599947 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B27
		Project No.:	N1197373
Client:	TER940		

Loose Fill Vermiculite Insulation, Attic Insulation, Zonolite (copyright), etc.: US EPA 600 R-4/004 (multi-tiered analytical process)
Sprayed On Insulation/Fireproofing with Vermiculite (SOF-V): ELAP 198.8 (PLM-SOF-V)

Soil, sludge, sediment, aggregate, and like materials analyzed for asbestos or other elongated mineral particles (ex. erionite, etc.): ASTM D7521, CARB 435, and other options available

Asbestos in Surface Dust according to one of ASTM's Methods (very dependent on sampling collection technique – by TEM): ASTM D 5755, D5756, or D6480

Various other asbestos matrices (air, water, etc.) and analytical methods are available.

Disclaimers / Qualifiers:

There may be some samples in this project that have a "NOTE:" associated with a sample result. We use added disclaimers or qualifiers to inform the client about something that requires further explanation. Here is a list with highlighted disclaimers that may be pertinent to this project. For a full explanation of these and other disclaimers, please inquire at **customerservice@iatl.com**.

1) Note: No mastic provided for analysis.
2) Note: Insufficient mastic provided for analysis.
3) Note: Insufficient material provided for analysis.
4) Note: Insufficient sample provided for QC reanalysis.
5) Note: Different material than indicated on Sample Log / Description.
6) Note: Sample not submitted.
7) Note: Attached to asbestos containing material.
8) Note: Received wet.
9) Note: Possible surface contamination.
10) Note: Not building material. 1% threshold may not apply.
11) Note: Recommend TEM-NOB analysis as per EPA recommendations.
12) Note: Asbestos detected but not quantifiable.
13) Note: Multiple identical samples submitted, only one analyzed.
14) Note: Analyzed by EPA 600/R-93/116. Point Counting detection limit at 0.080%.
15) Note: Analyzed by EPA 600/R-93/116. Point Counting detection limit at 0.125%.
16) Note: This sample contains >10% vermiculite mineral. See Appendix for Recommendations for Vermiculite Analysis.

Recommendations for Vermiculite Analysis:

Several analytical protocols exist for the analysis of asbestos in vermiculite. These analytical approaches vary depending upon the nature of the vermiculite mineral being tested (e.g. un-processed gange, homogeneous exfoliated books of mica, or mixed mineral composites).Please contact your client representative for pricing and turnaround time options available.

iATL recommends initial testing using the EPA 600/R-93/116 method. This method is specifically designed for the analysis of asbestos in bulk building materials. It provides an acceptable starting point for primary screening of vermiculite for possible asbestos.

Results from this testing may be inconclusive. EPA suggests proceeding to a multi-tiered analysis involving wet separation techniques in conjunction with PLM and TEM gravimetric analysis (EPA 600/R-04/004).

For New York State customers, NYSDOH requires disclaimers and qualifiers for various vermiculite containing samples that direct analysis via ELAP198.6 and ELAP198.8 for samples that contain >10% vermiculite mineral where ELAP198.6 may be used to evaluate the asbestos content of the material. However, any test result using ELAP198.6 will be reported with the following disclaimer: “ELAP198.6 method does not remove vermiculite and may underestimate the level of asbestos present in a sample containing >10% vermiculite.”

Further information on this method and other vermiculite and asbestos issues can be found at the following: Agency for Toxic Substances and Disease Registry (ATSDR) www.atsdr.cdc.gov, United States Geological Survey (USGS) www.minerals.usgs.gov/minerals/, US EPA www.epa.gov/asbestos. The USEPA also has an informative brochure "Current Best Practices for Vermiculite Attic Insulation" EPA 747F03001 May 2003, that may assist the health and remediation professional.

The following is a summary of the analytical process outlines in the EPA 600/R-04/004 Method:

1)**Analytical Step/Method:** Initial Screening by PLM, EPA 600R-93/116
Requirements/Comments: Minimum of 0.1 g of sample. ~0.25% LOQ for most samples.

2)**Analytical Step/Method:** Wet Separation by PLM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Sinks" only.

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/26/2019
	611 Lunken Park Drive	Report No.:	599947 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B27
		Project No.:	N1197373
Client:	TER940		

3)**Analytical Step/Method:** Wet Separation by PLM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Floats" only.

4)**Analytical Step/Method:** Wet Separation by TEM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Sinks" only.

5)**Analytical Step/Method:** Wet Separation by TEM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Suspension" only.

LOQ, Limit of Quantitation estimates for mass and volume analyses.
*With advance notice and confirmation by the laboratory.
**Approximately 1 Liter of sample in double-bagged container (~9x6 inch bag of sample).

iATL INTERNATIONAL
ASBESTOS TESTING LABORATORIES

9000 Commerce Parkway, Suite B • Mount Laurel, NJ 08054
Phone: 877-428-4285/856-231-9449 • Fax: 856-231-9818

Chain of Custody

–Bulk Asbestos –

Contact Information

Client Company: Terracon Consultants, Inc.
Office Address: 611 Lunken Park Drive
City, State, Zip: Cincinnati, OH 45226
Fax Number: 513-321-0294
Email Address: joshua.vogel@terracon.com

Project Number: N1197373
Project Name: Chillicothe VAMC B27
Primary Contact: Joshua Vogel
Office Phone: 513-612-9085
Cell Phone: 513-332-5034

PLM Instructions:

- [x] PLM: Bulk Asbestos Building Materials EPA 600 R-93/116, 1993
- [ ] PLM: Bulk Asbestos Building Materials EPA 600 M-4/82-020, 1982
- [ ] PLM: Bulk Asbestos Building Materials NIOSH 9002, 1985
- [ ] PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.1, 2002
- [ ] PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.6, 2010
- [ ] TEM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.4, 2009

- [x] PLM: Point Counting
  - [ ] PC: via ELAP 198.1
  - [x] PC: 400 Points
  - [ ] PC: 800 Points *
  - [ ] PC: 1600 Points *

- [x] PLM: Instructions for Multi-Layered Samples
  - [x] Analyze and Report All Separable Layers per EPA 600
  - [x] Report Composite for Drywall Systems per NESHAP
  - [ ] Report All Layers and Composite Where Applicable
  - [ ] Only Analyze and Report Specifically Noted Layer

- [ ] PLM: Analyze Until Positive (Positive Stop)
  - [ ] AUP: by Homogenous Area as Noted
  - [ ] AUP: by Material Type as Noted
- [ ] PLM: NOB via 198.6
  - [ ] PLM: Friable via EPA 600 2.3
  - [ ] If <1% by PLM, to TEM via 198.4 *
  - [ ] If <1% by PLM, Hold for Instructions

- [ ] PLM: Non-Building Material*,** (Dust, Wipe, Tape)
  - [ ] Soil or Vermiculite Analysis*
  - [ ] CARB 435

Special Instructions: _____

** Additional charge and turnaround may be required* *** Alternative Method (ex: EPA 600/R-04/004) may be recommended by Laboratory*

Turnaround Time

Preliminary Results Requested Date: _____ (Specific date / time) [ ] Verbal [x] Email [ ] Fax

[ ] 10 Day [x] 5 Day [ ] 3 Day [ ] 2 Day [ ] 1 Day* [ ] 12 Hour** [ ] 6 Hour** [ ] RUSH**

* End of next business day unless otherwise specified. ** Matrix Dependent. ***Please notify the lab before shipping***

Chain of Custody

Relinquished (Name/Organization):	[signature]	Date: 09/18/19	Time:	
Received (Name / iATL):		Date:	Time:	
Sample Login (Name / iATL):		Date:	Time:	
Analysis(Name(s) / iATL):	ZS	Date: 9/25/19	Time:	SEP 19 2019
QA/QC Review (Name / iATL):	[signature]	Date: 9/26/19	Time:	
Archived / Released: _____ QA/QC InterLAB Use:		Date:	Time:	

iATL INTERNATIONAL
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Phone: 877-428-4285/856-231-9449 • Fax: 856-231-9818

Chain of Custody

–Bulk Asbestos –

Contact Information

Client Company:	Terracon Consultants, Inc.	**Project Number:**	N1197373
Office Address:	611 Lunken Park Drive	**Project Name:**	Chillicothe VAMC B27
City, State, Zip:	Cincinnati, OH 45226	**Primary Contact:**	Joshua Vogel
Fax Number:	513-321-0294	**Office Phone:**	513-612-9085
Email Address:	joshua.vogel@terracon.com	**Cell Phone:**	513-332-5034

PLM Instructions:

- ☒ PLM: Bulk Asbestos Building Materials EPA 600 R-93/116, 1993
- ☐ PLM: Bulk Asbestos Building Materials EPA 600 M-4/82-020, 1982
- ☐ PLM: Bulk Asbestos Building Materials NIOSH 9002, 1985
- ☐ PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.1, 2002
- ☐ PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.6, 2010
- ☐ TEM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.4, 2009

☒ PLM: Point Counting
- ☐ PC: via ELAP 198.1
- ☒ PC: 400 Points
- ☐ PC: 800 Points *
- ☐ PC: 1600 Points *

☒ PLM: Instructions for Multi-Layered Samples
- ☒ Analyze and Report All Separable Layers per EPA 600
- ☒ Report Composite for Drywall Systems per NESHAP
- ☐ Report All Layers and Composite Where Applicable
- ☐ Only Analyze and Report Specifically Noted Layer

☐ PLM: Analyze Until Positive (Positive Stop)
- ☐ AUP: by Homogenous Area as Noted
- ☐ AUP: by Material Type as Noted

☐ PLM: NOB via 198.6
- ☐ PLM: Friable via EPA 600 2.3
- ☐ If <1% by PLM, to TEM via 198.4 *
- ☐ If <1% by PLM, Hold for Instructions

☐ PLM: Non-Building Material*,** (Dust, Wipe, Tape)
- ☐ Soil or Vermiculite Analysis*
- ☐ CARB 435

Special Instructions: _____

** Additional charge and turnaround may be required* *** Alternative Method (ex: EPA 600/R-04/004) may be recommended by Laboratory*

Turnaround Time

Preliminary Results Requested Date: _____ (Specific date / time) ☐ Verbal ☒ Email ☐ Fax

☐ 10 Day ☒ 5 Day ☐ 3 Day ☐ 2 Day ☐ 1 Day* ☐ 12 Hour** ☐ 6 Hour** ☐ RUSH**

* End of next business day unless otherwise specified. ** Matrix Dependent. ***Please notify the lab before shipping***

Chain of Custody

Relinquished (Name/Organization):	[signature]	Date: 09/18/19	Time:
Received (Name / iATL):		Date:	Time:
Sample Login (Name / iATL):		Date:	Time:
Analysis(Name(s) / iATL):	ZS	Date: 9/25/19	Time:
QA/QC Review (Name / iATL):	[signature]	Date: 9/24/19	Time:
Archived / Released:	QA/QC InterLAB Use:	Date:	Time:

SEP 19 2019

ZS 9/26/19

SUSPECT ACM - BULK MATERIAL SAMPLE LOG

Date: September 18, 2019
Inspector: Joshua Vogel
Project: Chillicothe VAMC Building 27
Project # N1197373

Page ____ of ____

Terracon
611 Lunken Park Drive
Cincinnati, Ohio 45226
(513) 321.5816

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
27-1	001	White Mastic on Fiberglass Pipe Insulation	Northeast Corner of Room 20	Various Locations Throughout	6879969
	002		Hallway Outside Room 34		6879970
	003		Middle of Room 135		6879971
27-2	004	2'x2' Ceiling Tile with Bumpy Pattern	Hallway Outside Room 1	Corridor 1C, Outside Room 11B, Suite 5, Outside Room 16 and 17	6879972
	005		Hallway Outside Room 11B		6879973
	006		Outside Room 30A		6879974
27-3	007	2'x4' Drywall Ceiling Tile	Just Inside Door of Room 13	Room: 13, 5D, 3, 32	6879975
	008		Just Inside Door of Room 5D		6879976
	009		Center of Room 3		6879977
27-4	010	Red Fire Stop Caulking	Just Inside Door of Room 13	Various Locations Throughout	6879978
	011		Just Inside Door of Room 256		6879979
	012		Just Inside Room 256		6879980
27-5	013	2'x4' Ceiling Tile with Bird Track Pattern	Room 22A Near Ceiling Vent	Rooms: 22A, 22I, 22K, 27, 129, 135, 102, 120, 150, 234A, 252	6879981
	014		Center of Room 27		6879982
	015		Room 135 Next to Sprinkler Head		6879983

End

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
27-6	016	Spray-On Fire Proofing	Middle of Room 120	Various Locations Throughout	6879984
	017		Middle of Room 129		6879985
	018		Middle of Room 135		6879986
	019		Near Window of Room 234A		6879987
	020		Center of Room 252		6879988
	021		Middle of Room 256		6879989
	022		Near Window of Room 102		6879990
27-7	-	Air-Cell Pipe Insulation and Associated Fittings	-	Pipe Chase in Room 252	[redacted]
27-8	023	Drywall System: Drywall and Joint Compound	North Wall in Room 252	North Wall in Room 252	6879991
	024		North Wall in Room 252		6879992
	025		North Wall in Room 252		6879993

SUSPECT ACM - BULK MATERIAL SAMPLE LOG

Page ____ of ____

Date: September 18, 2019
Inspector: Joshua Vogel
Project: Chillicothe VAMC Building 27
Project # N1197373

Terracon
611 Lunken Park Drive
Cincinnati, Ohio 45226
(513) 321.5816

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
27-1	001	White Mastic on Fiberglass Pipe Insulation	Northeast Corner of Room 20	Various Locations Throughout	6879969
	002		Hallway Outside Room 34		6879970
	003		Middle of Room 135		6879971
27-2	004	2'x2' Ceiling Tile with Bumpy Pattern	Hallway Outside Room 1	Corridor 1C, Outside Room 11B, Suite 5, Outside Room 16 and 17	~~6879972~~
	005		Hallway Outside Room 11B		6879973
	006		Outside Room 30A		6879974
Start 27-3	007	2'x4' Drywall Ceiling Tile	Just Inside Door of Room 13	Room: 13, 5D, 3, 32	6879975
	008		Just Inside Door of Room 5D		6879976
	009		Center of Room 3		6879977
27-4	010	Red Fire Stop Caulking	Just Inside Door of Room 13	Various Locations Throughout	6879978
	011		Just Inside Door of Room 256		6879979
	012		Just Inside Room 256		6879980
27-5	013	2'x4' Ceiling Tile with Bird Track Pattern	Room 22A Near Ceiling Vent	Rooms: 22A, 22I, 22K, 27, 129, 135, 102, 120, 150, 234A, 252	6879981
	014		Center of Room 27		6879982
	015		Room 135 Next to Sprinkler Head		6879983

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
27-6	016	Spray-On Fire Proofing	Middle of Room 120	Various Locations Throughout	6879984
	017		Middle of Room 129		6879985
	018		Middle of Room 135		6879986
	019		Near Window of Room 234A		6879987
	020		Center of Room 252		6879988
	021		Middle of Room 256		6879989
	022		Near Window of Room 102		6879990
27-7	-	Air-Cell Pipe Insulation and Associated Fittings	-	Pipe Chase in Room 252	[illegible]
27-8	023	Drywall System: Drywall and Joint Compound	North Wall in Room 252	North Wall in Room 252	6879991
	024		North Wall in Room 252		6879992
	025		North Wall in Room 252		6879993

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599953 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B30
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880148
Client No.: 30-1-001
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2'x2' Ceiling Tile With Bumpy Pattern
Location: Hallway Outside Room 1
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
20 Cellulose
50 Mineral Wool

Percent Non-Fibrous Material:
30

Lab No.: 6880149
Client No.: 30-1-002
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2'x2' Ceiling Tile With Bumpy Pattern
Location: Hallway Outside Room 205
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
15 Cellulose
50 Mineral Wool

Percent Non-Fibrous Material:
35

Lab No.: 6880150
Client No.: 30-1-003
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2'x2' Ceiling Tile With Bumpy Pattern
Location: Hallway Outside Room 210
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
15 Cellulose
50 Mineral Wool

Percent Non-Fibrous Material:
35

Lab No.: 6880151
Client No.: 30-2-004
Analyst Observation: White/Silver Wrap / Mastic
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Hallway Outside Room 1
Facility:

Percent Asbestos:
PC 1.2 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
35 Cellulose
10 Fibrous Glass

Percent Non-Fibrous Material:
53.8

Lab No.: 6880152
Client No.: 30-2-005
Analyst Observation: White/Silver Wrap / Mastic
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Hallway Outside Room 8A
Facility:

Percent Asbestos:
PC 1.3 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
40 Cellulose
10 Fibrous Glass

Percent Non-Fibrous Material:
48.7

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599953 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B30
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880152(L2)
Client No.: 30-2-005
Analyst Observation: Yellow Insulation
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Hallway Outside Room 8A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
98 Mineral Wool

Percent Non-Fibrous Material:
2

Lab No.: 6880153
Client No.: 30-2-006
Analyst Observation: White/Silver Wrap / Mastic
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Above Door In Room 129
Facility:

Percent Asbestos:
PC 1.1 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
40 Cellulose
10 Fibrous Glass

Percent Non-Fibrous Material:
48.9

Lab No.: 6880154
Client No.: 30-3-007
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2'x4' Ceiling Tile With Large Fissure Pattern
Location: Southwest Corner Of Corridor 0C
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
40 Mineral Wool

Percent Non-Fibrous Material:
20

Lab No.: 6880155
Client No.: 30-3-008
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2'x4' Ceiling Tile With Large Fissure Pattern
Location: Corridor 100E Near Ice Machine
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
40 Mineral Wool

Percent Non-Fibrous Material:
20

Lab No.: 6880156
Client No.: 30-3-009
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2'x4' Ceiling Tile With Large Fissure Pattern
Location: Middle Of West Wall In Room 131
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
30 Mineral Wool

Percent Non-Fibrous Material:
30

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599953 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B30
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880157
Client No.: 30-4-010
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2'x2' Ceiling Tile With Large Fissure Pattern
Location: Room 10D On South Wall
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 50 Cellulose, 10 Mineral Wool
Percent Non-Fibrous Material: 40

Lab No.: 6880158
Client No.: 30-4-011
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2'x2' Ceiling Tile With Large Fissure Pattern
Location: Northeast Corner Corridor 10E
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 60 Cellulose, 5 Mineral Wool
Percent Non-Fibrous Material: 35

Lab No.: 6880159
Client No.: 30-4-012
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2'x2' Ceiling Tile With Large Fissure Pattern
Location: Southwest Corner Of Corridor 10E
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 50 Cellulose, 5 Mineral Wool
Percent Non-Fibrous Material: 45

Lab No.: 6880160
Client No.: 30-5-013
Analyst Observation: Red Firestop
Client Description: Red Fire Stop Caulking
Location: Southeast Corner Of Room14
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880161
Client No.: 30-5-014
Analyst Observation: Red Firestop
Client Description: Red Fire Stop Caulking
Location: Above Door In Room 129
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 10 Fibrous Glass
Percent Non-Fibrous Material: 90

Lab No.: 6880162
Client No.: 30-5-015
Analyst Observation: Red Firestop
Client Description: Red Fire Stop Caulking
Location: Pipe Chase Near Room 212
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 10 Fibrous Glass
Percent Non-Fibrous Material: 90

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599953 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B30
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880163
Client No.: 30-6-016
Analyst Observation: White/Brown Ceiling Tile
Client Description: 2'x4' Drywall Ceiling Tile
Location: North Wall of Room 135
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
30 Mineral Wool

Percent Non-Fibrous Material:
30

Lab No.: 6880164
Client No.: 30-6-017
Analyst Observation: White/Brown Ceiling Tile
Client Description: 2'x4' Drywall Ceiling Tile
Location: Next to Vent in Room 220
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
30 Mineral Wool

Percent Non-Fibrous Material:
30

Lab No.: 6880165
Client No.: 30-6-018
Analyst Observation: White/Brown Ceiling Tile
Client Description: 2'x4' Drywall Ceiling Tile
Location: Just Inside Room of Room 232A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
40 Mineral Wool

Percent Non-Fibrous Material:
20

Lab No.: 6880166
Client No.: 30-7-019
Analyst Observation: Tan Spray-On Fireproofing
Client Description: Spray on Fire Proofing
Location: Above Sink in Room 135
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
75 Mineral Wool

Percent Non-Fibrous Material:
25

Lab No.: 6880167
Client No.: 30-7-020
Analyst Observation: Tan Spray-On Fireproofing
Client Description: Spray on Fire Proofing
Location: Southeast Corner of Room 138
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
80 Mineral Wool

Percent Non-Fibrous Material:
20

Lab No.: 6880168
Client No.: 30-7-021
Analyst Observation: Tan Spray-On Fireproofing
Client Description: Spray on Fire Proofing
Location: Pipe Chase Next to Room 212
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
75 Mineral Wool

Percent Non-Fibrous Material:
25

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599953 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B30
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880169
Client No.: 30-7-022
Analyst Observation: Tan Spray-On Fireproofing
Client Description: Spray on Fire Proofing
Location: Next to Vent in Room 220
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 85 Mineral Wool
Percent Non-Fibrous Material: 15

Lab No.: 6880170
Client No.: 30-7-023
Analyst Observation: Tan Spray-On Fireproofing
Client Description: Spray on Fire Proofing
Location: Hallway Outside in Room 205
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 80 Mineral Wool
Percent Non-Fibrous Material: 20

Lab No.: 6880171
Client No.: 30-7-024
Analyst Observation: Tan Spray-On Fireproofing
Client Description: Spray on Fire Proofing
Location: Hallway Across from Room 249
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 80 Mineral Wool
Percent Non-Fibrous Material: 20

Lab No.: 6880172
Client No.: 30-7-025
Analyst Observation: Tan Spray-On Fireproofing
Client Description: Spray on Fire Proofing
Location: Room 232A Just Inside Door
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 80 Mineral Wool
Percent Non-Fibrous Material: 20

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599953 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B30
		Project No.:	N1197373
Client:	TER940		

Appendix to Analytical Report

Customer Contact:
Method:40 CFR Appendix E to Subpart E of Part 763, interim method for the Determination of Asbestos in Bulk Insulation Samples, and USEPA 600, R93-116 as needed.

This appendix seeks to promote greater understanding of any observations, exceptions, special instructions, or circumstances that the laboratory needs to communicate to the client concerning the above samples. The information below is used to help promote your ability to make the most informed decisions for you and your customers. Please note the following points of contact for any questions you may have.

iATL Customer Service: customerservice@iatl.com
iATL Office Manager:wchampion@iatl.com
iATL Account Representative: Cassie Doherty
Sample Login Notes: See Batch Sheet Attached
Sample Matrix: Bulk Building Materials
Exceptions Noted: See Following Pages

General Terms, Warrants, Limits, Qualifiers:

General information about iATL capabilities and client/laboratory relationships and responsibilities are spelled out in iATL policies that are listed at www.iATL.com and ir our Quality Assurance Manual per ISO 17025 standard requirements. The information therein is a representation of iATL definitions and policies for turnaround times, sample submittal, collection media, blank definitions, quantification issues and limit of detection, analytical methods and procedures, sub-contracting policies, results reporting options, fees, terms, and discounts, confidentiality, sample archival and disposal, and data interpretation.

iATL warrants the test results to be of a precision normal for the type and methodology employed for each sample submitted. iATL disclaims any other warrants, expressed or implied, including warranty of fitness for a particular purpose and warranty of merchantability. iATL accepts no legal responsibility for the purpose for which the client uses test results. Any analytical work performed must be governed by our Standard Terms and Conditions. Prices, methods and detection limits may be changed without notification. Please contact your Customer Service Representative for the most current information.

This confidential report relates only to those item(s) tested and does not represent an endorsement by NIST-NVLAP, AIHA LAP LLC, or any agency of local, state or province governments nor of any agency of the U.S. government.

This report shall not be reproduced except in full, without written approval of the laboratory.

Information Pertinent to this Report:

Analysis by US EPA 600 93-116: Determination of Asbestos in Bulk Building Materials by Polarized Light Microscopy (PLM).

Certifications:

- NIST-NVLAP No. 101165-0
- NYSDOH-ELAP No. 11021
- AIHA-LAP, LLC No. 100188

Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. PC Trace represents a <0.25% amount. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

Analytical Methodology Alternatives: Your initial request for analysis may not have accounted for recent advances in regulatory requirements or advances in technology that are routinely used in similar situations for other qualified projects. You may have the option to explore additional analysis for further information. Below are a few options, listed as the matrix followed by the appropriate methodology. Also included are links to more information on our website.

Bulk Building Materials that are Non-Friable Organically Bound (NOB) by Gravimetric Reduction techniques employing PLM and TEM: ELAP 198.6 (PLM-NOB), ELAP 198.4 (TEM-NOB)

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Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599953 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B30
		Project No.:	N1197373
Client:	TER940		

Loose Fill Vermiculite Insulation, Attic Insulation, Zonolite (copyright), etc.: US EPA 600 R-4/004 (multi-tiered analytical process)
Sprayed On Insulation/Fireproofing with Vermiculite (SOF-V): ELAP 198.8 (PLM-SOF-V)

Soil, sludge, sediment, aggregate, and like materials analyzed for asbestos or other elongated mineral particles (ex. erionite, etc.): ASTM D7521, CARB 435, and other options available

Asbestos in Surface Dust according to one of ASTM's Methods (very dependent on sampling collection technique – by TEM): ASTM D 5755, D5756, or D6480

Various other asbestos matrices (air, water, etc.) and analytical methods are available.

Disclaimers / Qualifiers:

There may be some samples in this project that have a "NOTE:" associated with a sample result. We use added disclaimers or qualifiers to inform the client about something that requires further explanation. Here is a list with highlighted disclaimers that may be pertinent to this project. For a full explanation of these and other disclaimers, please inquire at **customerservice@iatl.com**.

1) Note: No mastic provided for analysis.
2) Note: Insufficient mastic provided for analysis.
3) Note: Insufficient material provided for analysis.
4) Note: Insufficient sample provided for QC reanalysis.
5) Note: Different material than indicated on Sample Log / Description.
6) Note: Sample not submitted.
7) Note: Attached to asbestos containing material.
8) Note: Received wet.
9) Note: Possible surface contamination.
10) Note: Not building material. 1% threshold may not apply.
11) Note: Recommend TEM-NOB analysis as per EPA recommendations.
12) Note: Asbestos detected but not quantifiable.
13) Note: Multiple identical samples submitted, only one analyzed.
14) Note: Analyzed by EPA 600/R-93/116. Point Counting detection limit at 0.080%.
15) Note: Analyzed by EPA 600/R-93/116. Point Counting detection limit at 0.125%.
16) Note: This sample contains >10% vermiculite mineral. See Appendix for Recommendations for Vermiculite Analysis.

Recommendations for Vermiculite Analysis:

Several analytical protocols exist for the analysis of asbestos in vermiculite. These analytical approaches vary depending upon the nature of the vermiculite mineral being tested (e.g. un-processed gange, homogeneous exfoliated books of mica, or mixed mineral composites).Please contact your client representative for pricing and turnaround time options available.

iATL recommends initial testing using the EPA 600/R-93/116 method. This method is specifically designed for the analysis of asbestos in bulk building materials. It provides an acceptable starting point for primary screening of vermiculite for possible asbestos.

Results from this testing may be inconclusive. EPA suggests proceeding to a multi-tiered analysis involving wet separation techniques in conjunction with PLM and TEM gravimetric analysis (EPA 600/R-04/004).

For New York State customers, NYSDOH requires disclaimers and qualifiers for various vermiculite containing samples that direct analysis via ELAP198.6 and ELAP198.8 for samples that contain >10% vermiculite mineral where ELAP198.6 may be used to evaluate the asbestos content of the material. However, any test result using ELAP198.6 will be reported with the following disclaimer: “ELAP198.6 method does not remove vermiculite and may underestimate the level of asbestos present in a sample containing >10% vermiculite.”

Further information on this method and other vermiculite and asbestos issues can be found at the following: Agency for Toxic Substances and Disease Registry (ATSDR) www.atsdr.cdc.gov, United States Geological Survey (USGS) www.minerals.usgs.gov/minerals/, US EPA www.epa.gov/asbestos. The USEPA also has an informative brochure "Current Best Practices for Vermiculite Attic Insulation" EPA 747F03001 May 2003, that may assist the health and remediation professional.

The following is a summary of the analytical process outlines in the EPA 600/R-04/004 Method:

1)**Analytical Step/Method:** Initial Screening by PLM, EPA 600R-93/116
Requirements/Comments: Minimum of 0.1 g of sample. ~0.25% LOQ for most samples.

2)**Analytical Step/Method:** Wet Separation by PLM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Sinks" only.

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CERTIFICATE OF ANALYSIS

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	611 Lunken Park Drive	Report No.:	599953 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B30
		Project No.:	N1197373
Client:	TER940		

3)**Analytical Step/Method:** Wet Separation by PLM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Floats" only.

4)**Analytical Step/Method:** Wet Separation by TEM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Sinks" only.

5)**Analytical Step/Method:** Wet Separation by TEM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Suspension" only.

LOQ, Limit of Quantitation estimates for mass and volume analyses.
*With advance notice and confirmation by the laboratory.
**Approximately 1 Liter of sample in double-bagged container (~9x6 inch bag of sample).

iATL INTERNATIONAL
ASBESTOS TESTING LABORATORIES

9000 Commerce Parkway, Suite B • Mount Laurel, NJ 08054
Phone: 877-428-4285/856-231-9449 • Fax: 856-231-9818

Chain of Custody

–Bulk Asbestos –

Contact Information

Client Company: Terracon Consultants, Inc.
Office Address: 611 Lunken Park Drive
City, State, Zip: Cincinnati, OH 45226
Fax Number: 513-321-0294
Email Address: joshua.vogel@terracon.com

Project Number: N1197373
Project Name: Chillicothe VAMC B30
Primary Contact: Joshua Vogel
Office Phone: 513-612-9085
Cell Phone: 513-332-5034

PLM Instructions:

- [x] PLM: Bulk Asbestos Building Materials EPA 600 R-93/116, 1993
- [ ] PLM: Bulk Asbestos Building Materials EPA 600 M-4/82-020, 1982
- [ ] PLM: Bulk Asbestos Building Materials NIOSH 9002, 1985
- [ ] PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.1, 2002
- [ ] PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.6, 2010
- [ ] TEM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.4, 2009

- [x] PLM: Point Counting
  - [ ] PC: via ELAP 198.1
  - [x] PC: 400 Points
  - [ ] PC: 800 Points *
  - [ ] PC: 1600 Points *

- [x] PLM: Instructions for Multi-Layered Samples
  - [x] Analyze and Report All Separable Layers per EPA 600
  - [x] Report Composite for Drywall Systems per NESHAP
  - [ ] Report All Layers and Composite Where Applicable
  - [ ] Only Analyze and Report Specifically Noted Layer

- [ ] PLM: Analyze Until Positive (Positive Stop)
  - [ ] AUP: by Homogenous Area as Noted
  - [ ] AUP: by Material Type as Noted
- [ ] PLM: NOB via 198.6
  - [ ] PLM: Friable via EPA 600 2.3
  - [ ] If <1% by PLM, to TEM via 198.4 *
  - [ ] If <1% by PLM, Hold for Instructions

- [ ] PLM: Non-Building Material*,** (Dust, Wipe, Tape)
  - [ ] Soil or Vermiculite Analysis*
  - [ ] CARB 435

Special Instructions: _____

** Additional charge and turnaround may be required* *** Alternative Method (ex: EPA 600/R-04/004) may be recommended by Laboratory*

Turnaround Time

Preliminary Results Requested Date: _____ (Specific date / time) ☐ Verbal ☒ Email ☐ Fax

☐ 10 Day ☒ 5 Day ☐ 3 Day ☐ 2 Day ☐ 1 Day* ☐ 12 Hour** ☐ 6 Hour** ☐ RUSH**

* End of next business day unless otherwise specified. ** Matrix Dependent. ***Please notify the lab before shipping***

Chain of Custody

Relinquished (Name/Organization):	[signature]	Date: 09/19/19	Time:
Received (Name / iATL):		Date:	Time:
Sample Login (Name / iATL):		Date:	Time:
Analysis(Name(s) / iATL):	LSC 9-25-19	Date:	Time:
QA/QC Review (Name / iATL):	KMM	Date: 9/26/19	Time:
Archived / Released:	QA/QC InterLAB Use:	Date:	Time: SEP 10 2019

SUSPECT ACM - BULK MATERIAL SAMPLE LOG

Page ____ of ____

Date: September 28, 2019
Inspector: Joshua Vogel
Project: Chillicothe VAMC Building 30
Project # N1197373

Terracon
611 Lunken Park Drive
Cincinnati, Ohio 45226
(513) 321.5816

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
30-1	001	2'x2' Ceiling Tile with Bumpy Pattern	Hallway Outside Room 1	Corridor 0B, 205, 210	6880140
	002		Hallway Outside Room 205		6880149
	003		Hallway Outside Room 210		6880150
30-2	004	White Mastic on Fiberglass Pipe Insulation	Hallway Outside Room 1	Various Locations Throughout	688015_
	005		Hallway Outside Room 8A		6880152
	006		Above Door in Room 129		6880153
30-3	007	2'x4' Ceiling Tile with Large Fissure Pattern	Southwest Corner of Corridor 0C	Corridor: 10C, 0C Rooms: 100E, 131, 129, 138, 144, 152, 242	6880151
	008		Corridor 100E near Ice Machine		6880155
	009		Middle of West Wall in Room 131		6880153
30-4	010	2'x2' Ceiling Tile with Large Fissure Pattern	Room 10D on South Wall	Morgue Suite	6880157
	011		Northeast Corner of Corridor 10E		6880158
	012		Southwest Corner of Corridor 10E		6880159
30-5	013	Red Fire Stop Caulking	Southeast Corner of Room 14	Various Locations Throughout	6880160
	014		Above Door in Room 129		688016_
	015		Pipe Chase Near Room 212		6880162

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
30-6	016	2'x4' Drywall Ceiling Tile	North Wall of Room 135	Room: 135, 220, 232A	6880163
	017		Next to Vent in Room 220		6880164
	018		Just Inside Room of Room 232A		6880165
30-7	019	Spray on Fire Proofing	Above Sink in Room 135	Various Locations Throughout	6880166
	020		Southeast Corner of Room 138		6880167
	021		Pipe Chase Next to Room 212		6880168
	022		Next to Vent in Room 220		6880169
	023		Hallway Outside in Room 205		6880170
	024		Hallway Across from Room 249		688017_
	025		Room 232A Just Inside Door		6880172

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599951 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B31
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880084
Client No.: 31-1-001
Analyst Observation: White Ceiling Tile
Client Description: 2'x4' Bird Track Ceiling Tile
Location: Building 303- Center Of Room
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
40 Fibrous Glass

Percent Non-Fibrous Material:
20

Lab No.: 6880085
Client No.: 31-1-002
Analyst Observation: White Ceiling Tile
Client Description: 2'x4' Bird Track Ceiling Tile
Location: Hallway Outside Room 1-112
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
40 Fibrous Glass

Percent Non-Fibrous Material:
20

Lab No.: 6880086
Client No.: 31-1-003
Analyst Observation: White Ceiling Tile
Client Description: 2'x4' Bird Track Ceiling Tile
Location: In Corridor 1C5 On East Side
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
40 Fibrous Glass

Percent Non-Fibrous Material:
20

Lab No.: 6880087
Client No.: 31-2-004
Analyst Observation: Tan Spray-On Fireproofing
Client Description: Spray On Fireproofing
Location: Building 303- Center Of Room
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
10 Cellulose
10 Fibrous Glass

Percent Non-Fibrous Material:
80

This sample contains vermiculite mineral. It is not vermiculite attic insulation, but may be considered for possible future analysis. See attached.

Lab No.: 6880088
Client No.: 31-2-005
Analyst Observation: White Spray-On Fireproofing
Client Description: Spray On Fireproofing
Location: Outside Room G349
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
90 Fibrous Glass

Percent Non-Fibrous Material:
10

Lab No.: 6880089
Client No.: 31-2-006
Analyst Observation: White Spray-On Fireproofing
Client Description: Spray On Fireproofing
Location: Middle Of Room G347E
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
90 Fibrous Glass

Percent Non-Fibrous Material:
10

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature: Tiffany Lowe
Analyst: Tiffany Lowe

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599951 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B31
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880090
Client No.: 31-2-007
Analyst Observation: White Spray-On Fireproofing
Client Description: Spray On Fireproofing
Location: Hallway Outside Room 1-112
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
90 Fibrous Glass

Percent Non-Fibrous Material:
10

Lab No.: 6880091
Client No.: 31-2-008
Analyst Observation: White Spray-On Fireproofing
Client Description: Spray On Fireproofing
Location: At Entry To G347A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
90 Fibrous Glass

Percent Non-Fibrous Material:
10

Lab No.: 6880092
Client No.: 31-2-009
Analyst Observation: White Spray-On Fireproofing
Client Description: Spray On Fireproofing
Location: Outside Room G344
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
90 Fibrous Glass

Percent Non-Fibrous Material:
10

Lab No.: 6880093
Client No.: 31-2-010
Analyst Observation: Tan Spray-On Fireproofing
Client Description: Spray On Fireproofing
Location: Outside Room G322A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
10 Cellulose
10 Fibrous Glass

Percent Non-Fibrous Material:
80

This sample contains vermiculite mineral. It is not vermiculite attic insulation, but may be considered for possible future analysis. See attached.

Lab No.: 6880094
Client No.: 31-3-011
Analyst Observation: White Ceiling Tile
Client Description: 2'x2' Textured Ceiling Tile
Location: Outside Room G349
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
50 Fibrous Glass

Percent Non-Fibrous Material:
10

Lab No.: 6880095
Client No.: 31-3-012
Analyst Observation: White Ceiling Tile
Client Description: 2'x2' Textured Ceiling Tile
Location: Outside G343E
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
50 Fibrous Glass

Percent Non-Fibrous Material:
10

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature: Tiffany Lowe
Analyst: Tiffany Lowe

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599951 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B31
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880096
Client No.: 31-3-013
Analyst Observation: White Ceiling Tile
Client Description: 2'x2' Textured Ceiling Tile
Location: At Entry To Room G347A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
50 Fibrous Glass

Percent Non-Fibrous Material:
10

Lab No.: 6880097
Client No.: 31-4-014
Analyst Observation: White Mastic
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Outside Room G349
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880097(L2)
Client No.: 31-4-014
Analyst Observation: Yellow/White Insulation
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Outside Room G349
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Fibrous Glass
30 Cellulose

Percent Non-Fibrous Material:
30

Lab No.: 6880098
Client No.: 31-4-015
Analyst Observation: White Mastic
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Hallway Outside Room 1-112
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880098(L2)
Client No.: 31-4-015
Analyst Observation: Yellow/White Insulation
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Hallway Outside Room 1-112
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
60 Fibrous Glass
20 Cellulose

Percent Non-Fibrous Material:
20

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature: Tiffany Lowe
Analyst: Tiffany Lowe

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599951 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B31
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880099
Client No.: 31-4-016
Analyst Observation: White Mastic
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Middle of Room 1-310
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880099(L2)
Client No.: 31-4-016
Analyst Observation: Yellow/White Insulation
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Middle of Room 1-310
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 60 Fibrous Glass, 20 Cellulose
Percent Non-Fibrous Material: 20

Lab No.: 6880100
Client No.: 31-5-017
Analyst Observation: White Ceiling Tile
Client Description: 2'x2' Drywall Ceiling Tile
Location: Center of Room G345E
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 40 Cellulose, 40 Fibrous Glass
Percent Non-Fibrous Material: 20

Lab No.: 6880101
Client No.: 31-5-018
Analyst Observation: White Ceiling Tile
Client Description: 2'x2' Drywall Ceiling Tile
Location: Southeast Corner of Room G345E
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 40 Cellulose, 40 Fibrous Glass
Percent Non-Fibrous Material: 20

Lab No.: 6880102
Client No.: 31-5-019
Analyst Observation: White Ceiling Tile
Client Description: 2'x2' Drywall Ceiling Tile
Location: Southwest Corner of Room G345E
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 40 Cellulose, 40 Fibrous Glass
Percent Non-Fibrous Material: 20

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature: Tiffany Lowe
Analyst: Tiffany Lowe

Approved By: Frank E. Ehrenfeld, III
Laboratory Director

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599951 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B31
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880103
Client No.: 31-6-020
Analyst Observation: White Drywall
Client Description: Drywall System: Drywall and Joint Compound
Location: Outside Room G311
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
90

Lab No.: 6880103(L2)
Client No.: 31-6-020
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall and Joint Compound
Location: Outside Room G311
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880103(L3)
Client No.: 31-6-020
Analyst Observation: Composite
Client Description: Drywall System: Drywall and Joint Compound
Location: Outside Room G311
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
3 Cellulose
3 Fibrous Glass

Percent Non-Fibrous Material:
94

Lab No.: 6880104
Client No.: 31-6-021
Analyst Observation: White Drywall
Client Description: Drywall System: Drywall and Joint Compound
Location: Outside Room G311
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
90

Lab No.: 6880104(L2)
Client No.: 31-6-021
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall and Joint Compound
Location: Outside Room G311
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature: Tiffany Lowe
Analyst: Tiffany Lowe

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599951 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B31
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880104(L3)
Client No.: 31-6-021
Analyst Observation: Composite
Client Description: Drywall System: Drywall and Joint Compound
Location: Outside Room G311
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
3 Cellulose
3 Fibrous Glass

Percent Non-Fibrous Material:
94

Lab No.: 6880105
Client No.: 31-6-022
Analyst Observation: White Drywall
Client Description: Drywall System: Drywall and Joint Compound
Location: Outside Room G311
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
90

Lab No.: 6880105(L2)
Client No.: 31-6-022
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall and Joint Compound
Location: Outside Room G311
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880105(L3)
Client No.: 31-6-022
Analyst Observation: Composite
Client Description: Drywall System: Drywall and Joint Compound
Location: Outside Room G311
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
3 Cellulose
3 Fibrous Glass

Percent Non-Fibrous Material:
94

Lab No.: 6880106
Client No.: 31-7-023
Analyst Observation: White Ceiling Tile
Client Description: 2'x4' Large Fissure Ceiling Tile
Location: Center of Room G301
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
40 Fibrous Glass

Percent Non-Fibrous Material:
20

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature: Tiffany Lowe
Analyst: Tiffany Lowe

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599951 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B31
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880107
Client No.: 31-7-024
Analyst Observation: White Ceiling Tile
Client Description: 2'x4' Large Fissure Ceiling Tile
Location: Center of Room G128
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
40 Fibrous Glass

Percent Non-Fibrous Material:
20

Lab No.: 6880108
Client No.: 31-7-025
Analyst Observation: White Ceiling Tile
Client Description: 2'x4' Large Fissure Ceiling Tile
Location: Center or Room B108
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
40 Fibrous Glass

Percent Non-Fibrous Material:
20

Lab No.: 6880109
Client No.: 31-8-026
Analyst Observation: White Drywall
Client Description: Drywall System: Drywall and Joint Compound
Location: Hallway Across From Room G217B
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
90

Lab No.: 6880109(L2)
Client No.: 31-8-026
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall and Joint Compound
Location: Hallway Across From Room G217B
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880109(L3)
Client No.: 31-8-026
Analyst Observation: Composite
Client Description: Drywall System: Drywall and Joint Compound
Location: Hallway Across From Room G217B
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
3 Cellulose
3 Fibrous Glass

Percent Non-Fibrous Material:
94

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature: Tiffany Lowe
Analyst: Tiffany Lowe

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599951 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B31
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880110
Client No.: 31-8-027
Analyst Observation: White Drywall
Client Description: Drywall System: Drywall and Joint Compound
Location: Hallway Across From Room G217B
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
90

Lab No.: 6880110(L2)
Client No.: 31-8-027
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall and Joint Compound
Location: Hallway Across From Room G217B
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880110(L3)
Client No.: 31-8-027
Analyst Observation: Composite
Client Description: Drywall System: Drywall and Joint Compound
Location: Hallway Across From Room G217B
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
3 Cellulose
3 Fibrous Glass

Percent Non-Fibrous Material:
94

Lab No.: 6880111
Client No.: 31-8-028
Analyst Observation: White Drywall
Client Description: Drywall System: Drywall and Joint Compound
Location: Hallway Across From Room G217B
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
90

Lab No.: 6880111(L2)
Client No.: 31-8-028
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall and Joint Compound
Location: Hallway Across From Room G217B
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature: Tiffany Lowe
Analyst: Tiffany Lowe

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599951 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B31
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880111(L3)
Client No.: 31-8-028
Analyst Observation: Composite
Client Description: Drywall System: Drywall and Joint Compound
Location: Hallway Across From Room G217B
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
3 Cellulose
3 Fibrous Glass

Percent Non-Fibrous Material:
94

Lab No.: 6880112
Client No.: 31-9-029
Analyst Observation: White Drywall
Client Description: Drywall System: Drywall and Joint Compound
Location: Southeast Corner
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
90

Lab No.: 6880112(L2)
Client No.: 31-9-029
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall and Joint Compound
Location: Southeast Corner
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880112(L3)
Client No.: 31-9-029
Analyst Observation: Composite
Client Description: Drywall System: Drywall and Joint Compound
Location: Southeast Corner
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
3 Cellulose
3 Fibrous Glass

Percent Non-Fibrous Material:
94

Lab No.: 6880113
Client No.: 31-9-030
Analyst Observation: White Drywall
Client Description: Drywall System: Drywall and Joint Compound
Location: Southeast Corner
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
90

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature: Tiffany Lowe
Analyst: Tiffany Lowe

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599951 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B31
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880113(L2)
Client No.: 31-9-030
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall and Joint Compound
Location: Southeast Corner
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880113(L3)
Client No.: 31-9-030
Analyst Observation: Composite
Client Description: Drywall System: Drywall and Joint Compound
Location: Southeast Corner
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
3 Cellulose
3 Fibrous Glass

Percent Non-Fibrous Material:
94

Lab No.: 6880114
Client No.: 31-9-031
Analyst Observation: White Drywall
Client Description: Drywall System: Drywall and Joint Compound
Location: Southeast Corner
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
90

Lab No.: 6880114(L2)
Client No.: 31-9-031
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall and Joint Compound
Location: Southeast Corner
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880114(L3)
Client No.: 31-9-031
Analyst Observation: Composite
Client Description: Drywall System: Drywall and Joint Compound
Location: Southeast Corner
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
3 Cellulose
3 Fibrous Glass

Percent Non-Fibrous Material:
94

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature: Tiffany Lowe
Analyst: Tiffany Lowe

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599951 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B31
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880115
Client No.: 31-10-032
Analyst Observation: Grey Plaster
Client Description: Plaster: Base Coat and Finished Coat
Location: Southeast Corner Of Corridor 1C5
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880115(L2)
Client No.: 31-10-032
Analyst Observation: White Plaster
Client Description: Plaster: Base Coat and Finished Coat
Location: Southeast Corner Of Corridor 1C5
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880116
Client No.: 31-10-033
Analyst Observation: Grey Plaster
Client Description: Plaster: Base Coat and Finished Coat
Location: Southeast Corner Of Corridor 1C5
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880116(L2)
Client No.: 31-10-033
Analyst Observation: White Plaster
Client Description: Plaster: Base Coat and Finished Coat
Location: Southeast Corner Of Corridor 1C5
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880117
Client No.: 31-10-034
Analyst Observation: Grey Plaster
Client Description: Plaster: Base Coat and Finished Coat
Location: Southeast Corner Of Corridor 1C5
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880117(L2)
Client No.: 31-10-034
Analyst Observation: White Plaster
Client Description: Plaster: Base Coat and Finished Coat
Location: Southeast Corner Of Corridor 1C5
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature: Tiffany Lowe
Analyst: Tiffany Lowe

Approved By: Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599951 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B31
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880118
Client No.: 31-11-035
Analyst Observation: White Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: Northeast Corner Of Room 2-108
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
90

Lab No.: 6880118(L2)
Client No.: 31-11-035
Analyst Observation: White Texture
Client Description: Drywall System: Drywall And Joint Compound
Location: Northeast Corner Of Room 2-108
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880119
Client No.: 31-11-036
Analyst Observation: White Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: Northeast Corner Of Room 2-108
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
90

Lab No.: 6880119(L2)
Client No.: 31-11-036
Analyst Observation: White Texture
Client Description: Drywall System: Drywall And Joint Compound
Location: Northeast Corner Of Room 2-108
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880120
Client No.: 31-11-037
Analyst Observation: White Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: Northeast Corner Of Room 2-102
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
90

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature: Tiffany Lowe
Analyst: Tiffany Lowe

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599951 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B31
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880120(L2)
Client No.: 31-11-037
Analyst Observation: White Texture
Client Description: Drywall System: Drywall And Joint Compound
Location: Northeast Corner Of Room 2-102
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880121
Client No.: 31-12-038
Analyst Observation: White Ceiling Tile
Client Description: 2'x4' Drywall Ceiling Tile
Location: Middle Of Room 2-112
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
40 Fibrous Glass

Percent Non-Fibrous Material:
20

Lab No.: 6880122
Client No.: 31-12-039
Analyst Observation: White Ceiling Tile
Client Description: 2'x4' Drywall Ceiling Tile
Location: Middle Of Room 2-116
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
40 Fibrous Glass

Percent Non-Fibrous Material:
20

Lab No.: 6880123
Client No.: 31-12-040
Analyst Observation: White Ceiling Tile
Client Description: 2'x4' Drywall Ceiling Tile
Location: Middle Of Room 2-117
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
40 Fibrous Glass

Percent Non-Fibrous Material:
20

Lab No.: 6880124
Client No.: 31-13-041
Analyst Observation: White Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: Northeast Corner
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
90

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature: Tiffany Lowe
Analyst: Tiffany Lowe

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599951 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B31
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880124(L2)
Client No.: 31-13-041
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: Northeast Corner
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880124(L3)
Client No.: 31-13-041
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: Northeast Corner
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
2 Cellulose
2 Fibrous Glass

Percent Non-Fibrous Material:
96

Lab No.: 6880125
Client No.: 31-13-042
Analyst Observation: White Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: Northeast Corner
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
90

Lab No.: 6880125(L2)
Client No.: 31-13-042
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: Northeast Corner
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880125(L3)
Client No.: 31-13-042
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: Northeast Corner
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
2 Cellulose
2 Fibrous Glass

Percent Non-Fibrous Material:
96

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature: Tiffany Lowe
Analyst: Tiffany Lowe

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599951 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B31
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880126
Client No.: 31-13-043

Analyst Observation: White Drywall
Client Description: Drywall System: Drywall And Joint Compound

Location: Northeast Corner
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
5 Fibrous Glass

Percent Non-Fibrous Material:
90

Lab No.: 6880126(L2)
Client No.: 31-13-043

Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound

Location: Northeast Corner
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880126(L3)
Client No.: 31-13-043

Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound

Location: Northeast Corner
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
2 Cellulose
2 Fibrous Glass

Percent Non-Fibrous Material:
96

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received:	9/19/2019	Approved By:	Frank E. Ehrenfeld, III
Date Analyzed:	09/25/2019		Laboratory Director
Signature:	Tiffany Lowe		
Analyst:	Tiffany Lowe		

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599951 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B31
		Project No.:	N1197373
Client:	TER940		

Appendix to Analytical Report

Customer Contact:
Method:40 CFR Appendix E to Subpart E of Part 763, interim method for the Determination of Asbestos in Bulk Insulation Samples, and USEPA 600, R93-116 as needed.

This appendix seeks to promote greater understanding of any observations, exceptions, special instructions, or circumstances that the laboratory needs to communicate to the client concerning the above samples. The information below is used to help promote your ability to make the most informed decisions for you and your customers. Please note the following points of contact for any questions you may have.

iATL Customer Service: customerservice@iatl.com
iATL Office Manager:wchampion@iatl.com
iATL Account Representative: Cassie Doherty
Sample Login Notes: See Batch Sheet Attached
Sample Matrix: Bulk Building Materials
Exceptions Noted: See Following Pages

General Terms, Warrants, Limits, Qualifiers:

General information about iATL capabilities and client/laboratory relationships and responsibilities are spelled out in iATL policies that are listed at www.iATL.com and ir our Quality Assurance Manual per ISO 17025 standard requirements. The information therein is a representation of iATL definitions and policies for turnaround times, sample submittal, collection media, blank definitions, quantification issues and limit of detection, analytical methods and procedures, sub-contracting policies, results reporting options, fees, terms, and discounts, confidentiality, sample archival and disposal, and data interpretation.

iATL warrants the test results to be of a precision normal for the type and methodology employed for each sample submitted. iATL disclaims any other warrants, expressed or implied, including warranty of fitness for a particular purpose and warranty of merchantability. iATL accepts no legal responsibility for the purpose for which the client uses test results. Any analytical work performed must be governed by our Standard Terms and Conditions. Prices, methods and detection limits may be changed without notification. Please contact your Customer Service Representative for the most current information.

This confidential report relates only to those item(s) tested and does not represent an endorsement by NIST-NVLAP, AIHA LAP LLC, or any agency of local, state or province governments nor of any agency of the U.S. government.

This report shall not be reproduced except in full, without written approval of the laboratory.

Information Pertinent to this Report:

Analysis by US EPA 600 93-116: Determination of Asbestos in Bulk Building Materials by Polarized Light Microscopy (PLM).

Certifications:

- NIST-NVLAP No. 101165-0
- NYSDOH-ELAP No. 11021
- AIHA-LAP, LLC No. 100188

Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. PC Trace represents a <0.25% amount. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

Analytical Methodology Alternatives: Your initial request for analysis may not have accounted for recent advances in regulatory requirements or advances in technology that are routinely used in similar situations for other qualified projects. You may have the option to explore additional analysis for further information. Below are a few options, listed as the matrix followed by the appropriate methodology. Also included are links to more information on our website.

Bulk Building Materials that are Non-Friable Organically Bound (NOB) by Gravimetric Reduction techniques employing PLM and TEM: ELAP 198.6 (PLM-NOB), ELAP 198.4 (TEM-NOB)

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Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599951 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B31
		Project No.:	N1197373
Client:	TER940		

Loose Fill Vermiculite Insulation, Attic Insulation, Zonolite (copyright), etc.: US EPA 600 R-4/004 (multi-tiered analytical process)
Sprayed On Insulation/Fireproofing with Vermiculite (SOF-V): ELAP 198.8 (PLM-SOF-V)

Soil, sludge, sediment, aggregate, and like materials analyzed for asbestos or other elongated mineral particles (ex. erionite, etc.): ASTM D7521, CARB 435, and other options available

Asbestos in Surface Dust according to one of ASTM's Methods (very dependent on sampling collection technique – by TEM): ASTM D 5755, D5756, or D6480

Various other asbestos matrices (air, water, etc.) and analytical methods are available.

Disclaimers / Qualifiers:

There may be some samples in this project that have a "NOTE:" associated with a sample result. We use added disclaimers or qualifiers to inform the client about something that requires further explanation. Here is a list with highlighted disclaimers that may be pertinent to this project. For a full explanation of these and other disclaimers, please inquire at **customerservice@iatl.com**.

1) Note: No mastic provided for analysis.
2) Note: Insufficient mastic provided for analysis.
3) Note: Insufficient material provided for analysis.
4) Note: Insufficient sample provided for QC reanalysis.
5) Note: Different material than indicated on Sample Log / Description.
6) Note: Sample not submitted.
7) Note: Attached to asbestos containing material.
8) Note: Received wet.
9) Note: Possible surface contamination.
10) Note: Not building material. 1% threshold may not apply.
11) Note: Recommend TEM-NOB analysis as per EPA recommendations.
12) Note: Asbestos detected but not quantifiable.
13) Note: Multiple identical samples submitted, only one analyzed.
14) Note: Analyzed by EPA 600/R-93/116. Point Counting detection limit at 0.080%.
15) Note: Analyzed by EPA 600/R-93/116. Point Counting detection limit at 0.125%.
16) Note: This sample contains >10% vermiculite mineral. See Appendix for Recommendations for Vermiculite Analysis.

Recommendations for Vermiculite Analysis:

Several analytical protocols exist for the analysis of asbestos in vermiculite. These analytical approaches vary depending upon the nature of the vermiculite mineral being tested (e.g. un-processed gange, homogeneous exfoliated books of mica, or mixed mineral composites).Please contact your client representative for pricing and turnaround time options available.

iATL recommends initial testing using the EPA 600/R-93/116 method. This method is specifically designed for the analysis of asbestos in bulk building materials. It provides an acceptable starting point for primary screening of vermiculite for possible asbestos.

Results from this testing may be inconclusive. EPA suggests proceeding to a multi-tiered analysis involving wet separation techniques in conjunction with PLM and TEM gravimetric analysis (EPA 600/R-04/004).

For New York State customers, NYSDOH requires disclaimers and qualifiers for various vermiculite containing samples that direct analysis via ELAP198.6 and ELAP198.8 for samples that contain >10% vermiculite mineral where ELAP198.6 may be used to evaluate the asbestos content of the material. However, any test result using ELAP198.6 will be reported with the following disclaimer: “ELAP198.6 method does not remove vermiculite and may underestimate the level of asbestos present in a sample containing >10% vermiculite.”

Further information on this method and other vermiculite and asbestos issues can be found at the following: Agency for Toxic Substances and Disease Registry (ATSDR) www.atsdr.cdc.gov, United States Geological Survey (USGS) www.minerals.usgs.gov/minerals/, US EPA www.epa.gov/asbestos. The USEPA also has an informative brochure "Current Best Practices for Vermiculite Attic Insulation" EPA 747F03001 May 2003, that may assist the health and remediation professional.

The following is a summary of the analytical process outlines in the EPA 600/R-04/004 Method:

1)**Analytical Step/Method:** Initial Screening by PLM, EPA 600R-93/116
Requirements/Comments: Minimum of 0.1 g of sample. ~0.25% LOQ for most samples.

2)**Analytical Step/Method:** Wet Separation by PLM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Sinks" only.

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Telephone: 856-231-9449
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CERTIFICATE OF ANALYSIS

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	611 Lunken Park Drive	Report No.:	599951 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B31
		Project No.:	N1197373
Client:	TER940		

3)**Analytical Step/Method:** Wet Separation by PLM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Floats" only.

4)**Analytical Step/Method:** Wet Separation by TEM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Sinks" only.

5)**Analytical Step/Method:** Wet Separation by TEM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Suspension" only.

LOQ, Limit of Quantitation estimates for mass and volume analyses.
*With advance notice and confirmation by the laboratory.
**Approximately 1 Liter of sample in double-bagged container (~9x6 inch bag of sample).

iATL INTERNATIONAL
ASBESTOS TESTING LABORATORIES

9000 Commerce Parkway, Suite B • Mount Laurel, NJ 08054
Phone: 877-428-4285/856-231-9449 • Fax: 856-231-9818

Chain of Custody

–Bulk Asbestos –

Contact Information

Client Company:	Terracon Consultants, Inc.	**Project Number:**	N1197373
Office Address:	611 Lunken Park Drive	**Project Name:**	Chillicothe VAMC B31
City, State, Zip:	Cincinnati, OH 45226	**Primary Contact:**	Joshua Vogel
Fax Number:	513-321-0294	**Office Phone:**	513-612-9085
Email Address:	joshua.vogel@terracon.com	**Cell Phone:**	513-332-5034

PLM Instructions:

- [x] PLM: Bulk Asbestos Building Materials EPA 600 R-93/116, 1993
- [ ] PLM: Bulk Asbestos Building Materials EPA 600 M-4/82-020, 1982
- [ ] PLM: Bulk Asbestos Building Materials NIOSH 9002, 1985
- [ ] PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.1, 2002
- [ ] PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.6, 2010
- [ ] TEM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.4, 2009

- [x] PLM: Point Counting
  - [ ] PC: via ELAP 198.1
  - [x] PC: 400 Points
  - [ ] PC: 800 Points *
  - [ ] PC: 1600 Points *

- [x] PLM: Instructions for Multi-Layered Samples
  - [x] Analyze and Report All Separable Layers per EPA 600
  - [x] Report Composite for Drywall Systems per NESHAP
  - [ ] Report All Layers and Composite Where Applicable
  - [ ] Only Analyze and Report Specifically Noted Layer

- [ ] PLM: Analyze Until Positive (Positive Stop)
  - [ ] AUP: by Homogenous Area as Noted
  - [ ] AUP: by Material Type as Noted
- [ ] PLM: NOB via 198.6
  - [ ] PLM: Friable via EPA 600 2.3
  - [ ] If <1% by PLM, to TEM via 198.4 *
  - [ ] If <1% by PLM, Hold for Instructions

- [ ] PLM: Non-Building Material*,** (Dust, Wipe, Tape)
  - [ ] Soil or Vermiculite Analysis*
  - [ ] CARB 435

Special Instructions: _____

** Additional charge and turnaround may be required* *** Alternative Method (ex: EPA 600/R-04/004) may be recommended by Laboratory*

Turnaround Time

Preliminary Results Requested Date: _____ (Specific date / time) ☐ Verbal ☒ Email ☐ Fax

☐ 10 Day ☒ 5 Day ☐ 3 Day ☐ 2 Day ☐ 1 Day* ☐ 12 Hour** ☐ 6 Hour** ☐ RUSH**

* End of next business day unless otherwise specified. ** Matrix Dependent. ***Please notify the lab before shipping***

Chain of Custody

Relinquished (Name/Organization):	[signature]	Date: 09/18/19	Time:
Received (Name / iATL):		Date:	Time:
Sample Login (Name / iATL):		Date:	Time:
Analysis(Name(s) / iATL):	[signature]	Date: 9.25.19	Time:
QA/QC Review (Name / iATL):	[signature]	Date: 9/26/19	Time:
Archived / Released: _____ QA/QC InterLAB Use:		Date:	Time:

SEP 19 2019

SUSPECT ACM - BULK MATERIAL SAMPLE LOG

Page ____ of ____

Date: September 18, 2019
Inspector: Joshua Vogel
Project: Chillicothe VAMC Building 31
Project # N1197373

Terracon
611 Lunken Park Drive
Cincinnati, Ohio 45226
(513) 321.5816

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
31-1	001	2'x4' Bird Track Ceiling Tile	Building 303 – Center of Room	Rooms: B303, G-319, 1-310, 1-112, 1-1104, , 1-150, 1-311, 1-201, 1-302, 1-307, 2-308, 2-203, 2-119, 2-300C, Corridor 1C5	6880084
	002		Hallway Outside Room 1-112		6880085
	003		In Corridor 1C5 on East Side		6880086
31-2	004	Spray on Fire Proofing	Building 303 – Center of Room	Various Locations Throughout	6880087
	005		Outside Room G349		6880088
	006		Middle of Room G347E		6880089
	007		Hallway Outside Room 1-112		6880090
	008		At Entry to G347A		6880091
	009		Outside Room G344		6880092
	010		Outside Room G322A		6880093
31-3	011	2'x2' Textured Ceiling Tile	Outside Room G349	Hallway out side G349, C343E, G311, 327, G217B	6880094
	012		Outside G343E		6880095
	013		At Entry to Room G347A		6880096
31-4	014	White Mastic on Fiberglass Pipe Insulation	Outside Room G349	Throughout Building	6880097
	015		Hallway Outside Room 1-112		6880098

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
	016		Middle of Room 1-310		6880099
31-5	017	2'x2' Drywall Ceiling Tile	Center of Room G345E	Room G345E	6880100
	018		Southeast Corner of Room G345E		6880101
	019		Southwest Corner of Room G345E		6880102
31-6	020	Drywall System: Drywall and Joint Compound	Outside Room G311	Outside Room G311	6880103
	021		Outside Room G311		6880104
	022		Outside Room G311		6880105
31-7	023	2'x4' Large Fissure Ceiling Tile	Center of Room G301	Rooms: G301, G128, G126, B108, 1-140, 1-150, 1-149, 1-161, 3-201C, CL132, G217B	6880106
	024		Center of Room G128		6880107
	025		Center of Room B108		6880108
31-8	026	Drywall System: Drywall and Joint Compound	Hallway Across Froom Room G217B	Hallway Across Froom Room G217B	6880109
	027		Hallway Across Froom Room G217B		6880110
	028		Hallway Across Froom Room G217B		6880111
31-9	029	Drywall System: Drywall and Joint Compound	Southeast Corner	Room G126	6880112
	030		Southeast Corner		6880113
	031		Southeast Corner		6880114
31-10	032	Plaster: Base Coat and Finished Coat	Southeast Corner of Corridor 1C5	Corridor 1C5	6880115
	033		Southeast Corner of Corridor 1C5		6880116

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
	034		Southeast Corner of Corridor 1C5		6880117
31-11	035	Drywall System: Drywall and Joint Compound	Northeast Corner of Room 2-108	Rooms 2-108 and 2-102	6880113
	036		Northeast Corner of Room 2-108		6880119
	037		Northeast Corner of Room 2-102		6880120
31-12	038	2'x4' Drywall Ceiling Tile	Middle of Room 2-112	Rooms: 2-112, 2-121, 2-120, 2-116, 2-117	6880121
	039		Middle of Room 2-116		6880122
	040		Middle of Room 2-117		6880123
31-13	041	Drywall System: Drywall and Joint Compound	Northeast Corner	Room 2-120	6880124
	042		Northeast Corner		6880125
	043		Northeast Corner		6880126

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/20/2019
	611 Lunken Park Drive	Report No.:	599950 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B35
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880046
Client No.: 35-1-001
Analyst Observation: White Mastic
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Center Of Tank Room
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880046(L2)
Client No.: 35-1-001
Analyst Observation: Yellow/Off-White Insulation
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Center Of Tank Room
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 90 Fibrous Glass, 10 Cellulose
Percent Non-Fibrous Material: None Detected

Lab No.: 6880047
Client No.: 35-1-002
Analyst Observation: White Mastic
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Pipe Chase BC-109
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880047(L2)
Client No.: 35-1-002
Analyst Observation: Yellow Insulation
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Pipe Chase BC-109
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 95 Fibrous Glass
Percent Non-Fibrous Material: 5

Lab No.: 6880048
Client No.: 35-1-003
Analyst Observation: White Mastic
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Pipe Chase A1-105
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880048(L2)
Client No.: 35-1-003
Analyst Observation: Yellow Insulation
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Pipe Chase A1-105
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 95 Fibrous Glass
Percent Non-Fibrous Material: 5

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/19/2019
Signature:
Analyst: Christopher Riffe

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880049
Client No.: 35-2-004
Analyst Observation: White/Tan Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: North Wall Of Room BB-113
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 10 Cellulose, 1 Fibrous Glass
Percent Non-Fibrous Material: 89

Lab No.: 6880049(L2)
Client No.: 35-2-004
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: North Wall Of Room BB-113
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880049(L3)
Client No.: 35-2-004
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: North Wall Of Room BB-113
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 8 Cellulose, Trace Fibrous Glass
Percent Non-Fibrous Material: 92

Lab No.: 6880050
Client No.: 35-2-005
Analyst Observation: White/Tan Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: North Wall Of Room BB-113
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 10 Cellulose, 1 Fibrous Glass
Percent Non-Fibrous Material: 89

Lab No.: 6880050(L2)
Client No.: 35-2-005
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: North Wall Of Room BB-113
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

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Client:	Terracon	Report Date:	9/20/2019
	611 Lunken Park Drive	Report No.:	599950 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B35
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880050(L3)
Client No.: 35-2-005
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: North Wall Of Room BB-113
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
8 Cellulose
1 Fibrous Glass

Percent Non-Fibrous Material:
91

Lab No.: 6880051
Client No.: 35-2-006
Analyst Observation: White/Tan Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: North Wall Of Room BB-113
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
10 Cellulose
1 Fibrous Glass

Percent Non-Fibrous Material:
89

Lab No.: 6880051(L2)
Client No.: 35-2-006
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: North Wall Of Room BB-113
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880051(L3)
Client No.: 35-2-006
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: North Wall Of Room BB-113
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
8 Cellulose
1 Fibrous Glass

Percent Non-Fibrous Material:
91

Lab No.: 6880052
Client No.: 35-3-007
Analyst Observation: Tan/White Ceiling Tile
Client Description: 2'x4' Bird Track Ceiling Tile
Location: At Entry To Room BC-107
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
30 Mineral Wool

Percent Non-Fibrous Material:
30

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Analyst: Christopher Riffe

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	Cincinnati OH 45226	Project:	Chillicothe VAMC B35
Client:	TER940	Project No.:	N1197373

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880053
Client No.: 35-3-008
Analyst Observation: Tan/Brown Ceiling Tile
Client Description: 2'x4' Bird Track Ceiling Tile
Location: Above The Door In Room 1B-116
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
50 Cellulose
20 Mineral Wool

Percent Non-Fibrous Material:
30

Lab No.: 6880054
Client No.: 35-3-009
Analyst Observation: Tan/White/Brown Ceiling Tile
Client Description: 2'x4' Bird Track Ceiling Tile
Location: At Entry To Room 2B-100
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
50 Cellulose
20 Mineral Wool

Percent Non-Fibrous Material:
30

Lab No.: 6880055
Client No.: 35-4-010
Analyst Observation: Tan/White/Brown Ceiling Tile
Client Description: 2'x4' Large Fissure Ceiling Tile
Location: Center Of Room BB112
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
50 Cellulose
20 Mineral Wool

Percent Non-Fibrous Material:
30

Lab No.: 6880056
Client No.: 35-4-011
Analyst Observation: Tan/White Ceiling Tile
Client Description: 2'x4' Large Fissure Ceiling Tile
Location: Above The Door In Room 1B-121
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
50 Cellulose
20 Mineral Wool

Percent Non-Fibrous Material:
30

Lab No.: 6880057
Client No.: 35-4-012
Analyst Observation: Tan/White Ceiling Tile
Client Description: 2'x4' Large Fissure Ceiling Tile
Location: Above The Door In Room 2C111
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
50 Cellulose
20 Mineral Wool

Percent Non-Fibrous Material:
30

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Client:	TER940	Project No.:	N1197373

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880058
Client No.: 35-5-013
Analyst Observation: White/Tan Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: Center Of The North Wall In Room 1B141
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
10 Cellulose
1 Fibrous Glass

Percent Non-Fibrous Material:
89

Lab No.: 6880058(L2)
Client No.: 35-5-013
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: Center Of The North Wall In Room 1B141
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880058(L3)
Client No.: 35-5-013
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: Center Of The North Wall In Room 1B141
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
8 Cellulose
Trace Fibrous Glass

Percent Non-Fibrous Material:
92

Lab No.: 6880059
Client No.: 35-5-014
Analyst Observation: White/Tan Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: NE Corner Of Room 1D-132
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
10 Cellulose
1 Fibrous Glass

Percent Non-Fibrous Material:
89

Lab No.: 6880059(L2)
Client No.: 35-5-014
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: NE Corner Of Room 1D-132
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

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Date Received: 9/19/2019
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Analyst: Christopher Riffe

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		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880059(L3)
Client No.: 35-5-014
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: NE Corner Of Room 1D-132
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
8 Cellulose
Trace Fibrous Glass

Percent Non-Fibrous Material:
92

Lab No.: 6880060
Client No.: 35-5-015
Analyst Observation: White/Tan Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: NE Corner Of Room 1B-128
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
10 Cellulose
1 Fibrous Glass

Percent Non-Fibrous Material:
89

Lab No.: 6880060(L2)
Client No.: 35-5-015
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: NE Corner Of Room 1B-128
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880060(L3)
Client No.: 35-5-015
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: NE Corner Of Room 1B-128
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880060(L4)
Client No.: 35-5-015
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: NE Corner Of Room 1B-128
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
8 Cellulose
Trace Fibrous Glass

Percent Non-Fibrous Material:
92

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		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880061
Client No.: 35-5-016
Analyst Observation: White/Tan Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: Above The Door In Room 1B-121
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 10 Cellulose
Percent Non-Fibrous Material: 90

Lab No.: 6880061(L2)
Client No.: 35-5-016
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: Above The Door In Room 1B-121
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880061(L3)
Client No.: 35-5-016
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: Above The Door In Room 1B-121
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 8 Cellulose
Trace Fibrous Glass
Percent Non-Fibrous Material: 92

Lab No.: 6880062
Client No.: 35-5-017
Analyst Observation: White/Tan Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: SE Corner Of Room 1A-102
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 10 Cellulose
1 Fibrous Glass
Percent Non-Fibrous Material: 89

Lab No.: 6880062(L2)
Client No.: 35-5-017
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: SE Corner Of Room 1A-102
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Please refer to the Appendix of this report for further information regarding your analysis.

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Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880062(L3)
Client No.: 35-5-017
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: SE Corner Of Room 1A-102
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880062(L4)
Client No.: 35-5-017
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: SE Corner Of Room 1A-102
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
8 Cellulose
Trace Fibrous Glass

Percent Non-Fibrous Material:
92

Lab No.: 6880063
Client No.: 35-5-018
Analyst Observation: White/Tan Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: Middle Of The North Wall In Room 1C104
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
10 Cellulose

Percent Non-Fibrous Material:
90

Lab No.: 6880063(L2)
Client No.: 35-5-018
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: Middle Of The North Wall In Room 1C104
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880063(L3)
Client No.: 35-5-018
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: Middle Of The North Wall In Room 1C104
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Please refer to the Appendix of this report for further information regarding your analysis.

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/20/2019
	611 Lunken Park Drive	Report No.:	599950 - PLM
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		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880063(L4)
Client No.: 35-5-018
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: Middle Of The North Wall In Room 1C104
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
8 Cellulose
Trace Fibrous Glass

Percent Non-Fibrous Material:
92

Lab No.: 6880064
Client No.: 35-5-019
Analyst Observation: White/Tan Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: Center Of The South Wall In Room 1C116
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
10 Cellulose
1 Fibrous Glass

Percent Non-Fibrous Material:
89

Lab No.: 6880064(L2)
Client No.: 35-5-019
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: Center Of The South Wall In Room 1C116
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880064(L3)
Client No.: 35-5-019
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: Center Of The South Wall In Room 1C116
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
8 Cellulose
Trace Fibrous Glass

Percent Non-Fibrous Material:
92

Lab No.: 6880065
Client No.: 35-6-020
Analyst Observation: White Plaster
Client Description: Plaster: Base Coat And Finished Coat
Location: SE Corner Of Room 1B-136
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880065(L2)
Client No.: 35-6-020
Analyst Observation: Grey Plaster
Client Description: Plaster: Base Coat And Finished Coat
Location: SE Corner Of Room 1B-136
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/19/2019
Signature:
Analyst: Christopher Riffe

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/20/2019
	611 Lunken Park Drive	Report No.:	599950 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B35
Client:	TER940	Project No.:	N1197373

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880066
Client No.: 35-6-021
Analyst Observation: White Plaster
Client Description: Plaster: Base Coat And Finished Coat
Location: NE Corner Of Room 1B-136
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880066(L2)
Client No.: 35-6-021
Analyst Observation: Grey Plaster
Client Description: Plaster: Base Coat And Finished Coat
Location: NE Corner Of Room 1B-136
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880067
Client No.: 35-6-022
Analyst Observation: White Plaster
Client Description: Plaster: Base Coat And Finished Coat
Location: SW Corner Of Room 1B-136
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880067(L2)
Client No.: 35-6-022
Analyst Observation: Grey Plaster
Client Description: Plaster: Base Coat And Finished Coat
Location: SW Corner Of Room 1B-136
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880068
Client No.: 35-7-023
Analyst Observation: Tan/White Ceiling Tile
Client Description: 2'x2 Textured Ceiling Tile
Location: SW Corner In Room 1C-132
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Mineral Wool
30 Cellulose

Percent Non-Fibrous Material:
30

Lab No.: 6880069
Client No.: 35-7-024
Analyst Observation: Tan/White Ceiling Tile
Client Description: 2'x2 Textured Ceiling Tile
Location: Middle Of East Wall In Room 1C -132
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/19/2019
Signature:
Analyst: Christopher Riffe

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/20/2019
	611 Lunken Park Drive	Report No.:	599950 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B35
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880070
Client No.: 35-7-025
Analyst Observation: Tan/White Ceiling Tile
Client Description: 2'x2 Textured Ceiling Tile
Location: NW Corner In Room 1C-132
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880071
Client No.: 35-8-026
Analyst Observation: White/Tan Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: NW Corner Of Room 2C-116
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 10 Cellulose, 1 Fibrous Glass
Percent Non-Fibrous Material: 89

Lab No.: 6880071(L2)
Client No.: 35-8-026
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: NW Corner Of Room 2C-116
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880071(L3)
Client No.: 35-8-026
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: NW Corner Of Room 2C-116
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 8 Cellulose, Trace Fibrous Glass
Percent Non-Fibrous Material: 92

Lab No.: 6880072
Client No.: 35-8-027
Analyst Observation: White/Tan Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: Middle Of The West Wall In Room 2C-116
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 10 Cellulose, 1 Fibrous Glass
Percent Non-Fibrous Material: 89

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/19/2019
Signature:
Analyst: Christopher Riffe

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/20/2019
	611 Lunken Park Drive	Report No.:	599950 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B35
Client:	TER940	Project No.:	N1197373

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880072(L2)
Client No.: 35-8-027
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: Middle Of The West Wall In Room 2C-116
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880072(L3)
Client No.: 35-8-027
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: Middle Of The West Wall In Room 2C-116
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
8 Cellulose
Trace Fibrous Glass

Percent Non-Fibrous Material:
92

Lab No.: 6880073
Client No.: 35-8-028
Analyst Observation: White/Tan Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: SW Corner In Room 2C-116
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
10 Cellulose
1 Fibrous Glass

Percent Non-Fibrous Material:
89

Lab No.: 6880073(L2)
Client No.: 35-8-028
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: SW Corner In Room 2C-116
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880073(L3)
Client No.: 35-8-028
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: SW Corner In Room 2C-116
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
8 Cellulose
Trace Fibrous Glass

Percent Non-Fibrous Material:
92

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/20/2019
	611 Lunken Park Drive	Report No.:	599950 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B35
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880074
Client No.: 35-8-029
Analyst Observation: Off-White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: NW Corner Of Room 2B-117C
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880074(L2)
Client No.: 35-8-029
Analyst Observation: Brown Mastic
Client Description: Drywall System: Drywall And Joint Compound
Location: NW Corner Of Room 2B-117C
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880074(L3)
Client No.: 35-8-029
Analyst Observation: White Plaster
Client Description: Drywall System: Drywall And Joint Compound
Location: NW Corner Of Room 2B-117C
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880075
Client No.: 35-8-030
Analyst Observation: White/Tan Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: Middle Of The South Wall In Room 2B-118
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 10 Cellulose, 1 Fibrous Glass
Percent Non-Fibrous Material: 89

Lab No.: 6880075(L2)
Client No.: 35-8-030
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: Middle Of The South Wall In Room 2B-118
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/19/2019
Signature:
Analyst: Christopher Riffe

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/20/2019
	611 Lunken Park Drive	Report No.:	599950 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B35
Client:	TER940	Project No.:	N1197373

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880075(L3)
Client No.: 35-8-030
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: Middle Of The South Wall In Room 2B-118
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
8 Cellulose
Trace Fibrous Glass

Percent Non-Fibrous Material:
92

Lab No.: 6880076
Client No.: 35-8-031
Analyst Observation: White/Tan Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: Outside The Entrance Of Room 2B-122
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
10 Cellulose
1 Fibrous Glass

Percent Non-Fibrous Material:
89

Lab No.: 6880076(L2)
Client No.: 35-8-031
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: Outside The Entrance Of Room 2B-122
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880076(L3)
Client No.: 35-8-031
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: Outside The Entrance Of Room 2B-122
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880076(L4)
Client No.: 35-8-031
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: Outside The Entrance Of Room 2B-122
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
8 Cellulose
Trace Fibrous Glass

Percent Non-Fibrous Material:
92

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/19/2019
Signature:
Analyst: Christopher Riffe

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/20/2019
	611 Lunken Park Drive	Report No.:	599950 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B35
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880077
Client No.: 35-8-032
Analyst Observation: White/Tan Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: Outside The Entrance Of Room 2B-123
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
10 Cellulose
1 Fibrous Glass

Percent Non-Fibrous Material:
89

Lab No.: 6880077(L2)
Client No.: 35-8-032
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: Outside The Entrance Of Room 2B-123
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880077(L3)
Client No.: 35-8-032
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: Outside The Entrance Of Room 2B-123
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
8 Cellulose
Trace Fibrous Glass

Percent Non-Fibrous Material:
92

Lab No.: 6880078
Client No.: 35-9-033
Analyst Observation: White/Tan Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: SW Corner Of Room 3B-124
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
10 Cellulose
1 Fibrous Glass

Percent Non-Fibrous Material:
89

Lab No.: 6880078(L2)
Client No.: 35-9-033
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: SW Corner Of Room 3B-124
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/19/2019
Signature:
Analyst: Christopher Riffe

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/20/2019
	611 Lunken Park Drive	Report No.:	599950 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B35
Client:	TER940	Project No.:	N1197373

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880078(L3)
Client No.: 35-9-033
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: SW Corner Of Room 3B-124
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
8 Cellulose
Trace Fibrous Glass

Percent Non-Fibrous Material:
92

Lab No.: 6880079
Client No.: 35-9-034
Analyst Observation: White/Tan Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: SW Corner Of Room 3B-120
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
10 Cellulose
1 Fibrous Glass

Percent Non-Fibrous Material:
89

Lab No.: 6880079(L2)
Client No.: 35-9-034
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: SW Corner Of Room 3B-120
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880079(L3)
Client No.: 35-9-034
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: SW Corner Of Room 3B-120
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
8 Cellulose
Trace Fibrous Glass

Percent Non-Fibrous Material:
92

Lab No.: 6880080
Client No.: 35-9-035
Analyst Observation: White/Tan Drywall
Client Description: Plaster: Base Coat And Finished Coat
Location: SW Corner Of Room 3B-120
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
10 Cellulose
1 Fibrous Glass

Percent Non-Fibrous Material:
89

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/19/2019
Signature:
Analyst: Christopher Riffe

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/20/2019
	611 Lunken Park Drive	Report No.:	599950 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B35
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880080(L2)
Client No.: 35-9-035

Analyst Observation: White Joint Compound
Client Description: Plaster: Base Coat And Finished Coat

Location: SW Corner Of Room 3B-120
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880080(L3)
Client No.: 35-9-035

Analyst Observation: Composite
Client Description: Plaster: Base Coat And Finished Coat

Location: SW Corner Of Room 3B-120
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
8 Cellulose
Trace Fibrous Glass

Percent Non-Fibrous Material:
92

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
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Signature:
Analyst: Christopher Riffe

Approved By:
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Laboratory Director

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/20/2019
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		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880081
Client No.: 35-10-036
Analyst Observation: Grey Plaster
Client Description: Plaster: Base Coat And Finished Coat
Location: North Shower In Room 3C-132
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880081(L2)
Client No.: 35-10-036
Analyst Observation: White Plaster
Client Description: Plaster: Base Coat And Finished Coat
Location: North Shower In Room 3C-132
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880082
Client No.: 35-10-037
Analyst Observation: Grey Plaster
Client Description: Plaster: Base Coat And Finished Coat
Location: Center Shower In Room 3C-132
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880082(L2)
Client No.: 35-10-037
Analyst Observation: White Plaster
Client Description: Plaster: Base Coat And Finished Coat
Location: Center Shower In Room 3C-132
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880083
Client No.: 35-10-038
Analyst Observation: Grey Plaster
Client Description: Plaster: Base Coat And Finished Coat
Location: South Shower In Room 3C-132
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880083(L2)
Client No.: 35-10-038
Analyst Observation: White Plaster
Client Description: Plaster: Base Coat And Finished Coat
Location: South Shower In Room 3C-132
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
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	Cincinnati OH 45226	Project:	Chillicothe VAMC B35
		Project No.:	N1197373
Client:	TER940		

Appendix to Analytical Report

Customer Contact:
Method:40 CFR Appendix E to Subpart E of Part 763, interim method for the Determination of Asbestos in Bulk Insulation Samples, and USEPA 600, R93-116 as needed.

This appendix seeks to promote greater understanding of any observations, exceptions, special instructions, or circumstances that the laboratory needs to communicate to the client concerning the above samples. The information below is used to help promote your ability to make the most informed decisions for you and your customers. Please note the following points of contact for any questions you may have.

iATL Customer Service: customerservice@iatl.com
iATL Office Manager:wchampion@iatl.com
iATL Account Representative: Cassie Doherty
Sample Login Notes: See Batch Sheet Attached
Sample Matrix: Bulk Building Materials
Exceptions Noted: See Following Pages

General Terms, Warrants, Limits, Qualifiers:

General information about iATL capabilities and client/laboratory relationships and responsibilities are spelled out in iATL policies that are listed at www.iATL.com and ir our Quality Assurance Manual per ISO 17025 standard requirements. The information therein is a representation of iATL definitions and policies for turnaround times, sample submittal, collection media, blank definitions, quantification issues and limit of detection, analytical methods and procedures, sub-contracting policies, results reporting options, fees, terms, and discounts, confidentiality, sample archival and disposal, and data interpretation.

iATL warrants the test results to be of a precision normal for the type and methodology employed for each sample submitted. iATL disclaims any other warrants, expressed or implied, including warranty of fitness for a particular purpose and warranty of merchantability. iATL accepts no legal responsibility for the purpose for which the client uses test results. Any analytical work performed must be governed by our Standard Terms and Conditions. Prices, methods and detection limits may be changed without notification. Please contact your Customer Service Representative for the most current information.

This confidential report relates only to those item(s) tested and does not represent an endorsement by NIST-NVLAP, AIHA LAP LLC, or any agency of local, state or province governments nor of any agency of the U.S. government.

This report shall not be reproduced except in full, without written approval of the laboratory.

Information Pertinent to this Report:

Analysis by US EPA 600 93-116: Determination of Asbestos in Bulk Building Materials by Polarized Light Microscopy (PLM).

Certifications:

- NIST-NVLAP No. 101165-0
- NYSDOH-ELAP No. 11021
- AIHA-LAP, LLC No. 100188

Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. PC Trace represents a <0.25% amount. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

Analytical Methodology Alternatives: Your initial request for analysis may not have accounted for recent advances in regulatory requirements or advances in technology that are routinely used in similar situations for other qualified projects. You may have the option to explore additional analysis for further information. Below are a few options, listed as the matrix followed by the appropriate methodology. Also included are links to more information on our website.

Bulk Building Materials that are Non-Friable Organically Bound (NOB) by Gravimetric Reduction techniques employing PLM and TEM: ELAP 198.6 (PLM-NOB), ELAP 198.4 (TEM-NOB)

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CERTIFICATE OF ANALYSIS

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	611 Lunken Park Drive	Report No.:	599950 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B35
		Project No.:	N1197373
Client:	TER940		

Loose Fill Vermiculite Insulation, Attic Insulation, Zonolite (copyright), etc.: US EPA 600 R-4/004 (multi-tiered analytical process)
Sprayed On Insulation/Fireproofing with Vermiculite (SOF-V): ELAP 198.8 (PLM-SOF-V)

Soil, sludge, sediment, aggregate, and like materials analyzed for asbestos or other elongated mineral particles (ex. erionite, etc.): ASTM D7521, CARB 435, and other options available

Asbestos in Surface Dust according to one of ASTM's Methods (very dependent on sampling collection technique – by TEM): ASTM D 5755, D5756, or D6480

Various other asbestos matrices (air, water, etc.) and analytical methods are available.

Disclaimers / Qualifiers:

There may be some samples in this project that have a "NOTE:" associated with a sample result. We use added disclaimers or qualifiers to inform the client about something that requires further explanation. Here is a list with highlighted disclaimers that may be pertinent to this project. For a full explanation of these and other disclaimers, please inquire at **customerservice@iatl.com**.

1) Note: No mastic provided for analysis.
2) Note: Insufficient mastic provided for analysis.
3) Note: Insufficient material provided for analysis.
4) Note: Insufficient sample provided for QC reanalysis.
5) Note: Different material than indicated on Sample Log / Description.
6) Note: Sample not submitted.
7) Note: Attached to asbestos containing material.
8) Note: Received wet.
9) Note: Possible surface contamination.
10) Note: Not building material. 1% threshold may not apply.
11) Note: Recommend TEM-NOB analysis as per EPA recommendations.
12) Note: Asbestos detected but not quantifiable.
13) Note: Multiple identical samples submitted, only one analyzed.
14) Note: Analyzed by EPA 600/R-93/116. Point Counting detection limit at 0.080%.
15) Note: Analyzed by EPA 600/R-93/116. Point Counting detection limit at 0.125%.
16) Note: This sample contains >10% vermiculite mineral. See Appendix for Recommendations for Vermiculite Analysis.

Recommendations for Vermiculite Analysis:

Several analytical protocols exist for the analysis of asbestos in vermiculite. These analytical approaches vary depending upon the nature of the vermiculite mineral being tested (e.g. un-processed gange, homogeneous exfoliated books of mica, or mixed mineral composites).Please contact your client representative for pricing and turnaround time options available.

iATL recommends initial testing using the EPA 600/R-93/116 method. This method is specifically designed for the analysis of asbestos in bulk building materials. It provides an acceptable starting point for primary screening of vermiculite for possible asbestos.

Results from this testing may be inconclusive. EPA suggests proceeding to a multi-tiered analysis involving wet separation techniques in conjunction with PLM and TEM gravimetric analysis (EPA 600/R-04/004).

For New York State customers, NYSDOH requires disclaimers and qualifiers for various vermiculite containing samples that direct analysis via ELAP198.6 and ELAP198.8 for samples that contain >10% vermiculite mineral where ELAP198.6 may be used to evaluate the asbestos content of the material. However, any test result using ELAP198.6 will be reported with the following disclaimer: “ELAP198.6 method does not remove vermiculite and may underestimate the level of asbestos present in a sample containing >10% vermiculite.”

Further information on this method and other vermiculite and asbestos issues can be found at the following: Agency for Toxic Substances and Disease Registry (ATSDR) www.atsdr.cdc.gov, United States Geological Survey (USGS) www.minerals.usgs.gov/minerals/, US EPA www.epa.gov/asbestos. The USEPA also has an informative brochure "Current Best Practices for Vermiculite Attic Insulation" EPA 747F03001 May 2003, that may assist the health and remediation professional.

The following is a summary of the analytical process outlines in the EPA 600/R-04/004 Method:

1)**Analytical Step/Method:** Initial Screening by PLM, EPA 600R-93/116
Requirements/Comments: Minimum of 0.1 g of sample. ~0.25% LOQ for most samples.

2)**Analytical Step/Method:** Wet Separation by PLM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Sinks" only.

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Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/20/2019
	611 Lunken Park Drive	Report No.:	599950 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B35
		Project No.:	N1197373
Client:	TER940		

3)**Analytical Step/Method:** Wet Separation by PLM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Floats" only.

4)**Analytical Step/Method:** Wet Separation by TEM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Sinks" only.

5)**Analytical Step/Method:** Wet Separation by TEM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Suspension" only.

LOQ, Limit of Quantitation estimates for mass and volume analyses.
*With advance notice and confirmation by the laboratory.
**Approximately 1 Liter of sample in double-bagged container (~9x6 inch bag of sample).

iATL INTERNATIONAL
ASBESTOS TESTING LABORATORIES

9000 Commerce Parkway, Suite B • Mount Laurel, NJ 08054
Phone: 877-428-4285/856-231-9449 • Fax: 856-231-9818

Chain of Custody

–Bulk Asbestos –

Contact Information

Client Company:	Terracon Consultants, Inc.	**Project Number:**	N1197373
Office Address:	611 Lunken Park Drive	**Project Name:**	Chillicothe VAMC B35
City, State, Zip:	Cincinnati, OH 45226	**Primary Contact:**	Joshua Vogel
Fax Number:	513-321-0294	**Office Phone:**	513-612-9085
Email Address:	joshua.vogel@terracon.com	**Cell Phone:**	513-332-5034

PLM Instructions:

- [x] PLM: Bulk Asbestos Building Materials EPA 600 R-93/116, 1993
- [ ] PLM: Bulk Asbestos Building Materials EPA 600 M-4/82-020, 1982
- [ ] PLM: Bulk Asbestos Building Materials NIOSH 9002, 1985
- [ ] PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.1, 2002
- [ ] PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.6, 2010
- [ ] TEM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.4, 2009

- [x] PLM: Point Counting
  - [ ] PC: via ELAP 198.1
  - [x] PC: 400 Points
  - [ ] PC: 800 Points *
  - [ ] PC: 1600 Points *

- [x] PLM: Instructions for Multi-Layered Samples
  - [x] Analyze and Report All Separable Layers per EPA 600
  - [x] Report Composite for Drywall Systems per NESHAP
  - [ ] Report All Layers and Composite Where Applicable
  - [ ] Only Analyze and Report Specifically Noted Layer

- [ ] PLM: Analyze Until Positive (Positive Stop)
  - [ ] AUP: by Homogenous Area as Noted
  - [ ] AUP: by Material Type as Noted
- [ ] PLM: NOB via 198.6
  - [ ] PLM: Friable via EPA 600 2.3
  - [ ] If <1% by PLM, to TEM via 198.4 *
  - [ ] If <1% by PLM, Hold for Instructions

- [ ] PLM: Non-Building Material*,** (Dust, Wipe, Tape)
  - [ ] Soil or Vermiculite Analysis*
  - [ ] CARB 435

Special Instructions: _____

** Additional charge and turnaround may be required* *** Alternative Method (ex: EPA 600/R-04/004) may be recommended by Laboratory*

Turnaround Time

Preliminary Results Requested Date: _____ (Specific date / time) ☐ Verbal ☒ Email ☐ Fax

☐ 10 Day ☒ 5 Day ☐ 3 Day ☐ 2 Day ☐ 1 Day* ☐ 12 Hour** ☐ 6 Hour** ☐ RUSH**

* End of next business day unless otherwise specified. ** Matrix Dependent. ***Please notify the lab before shipping***

Chain of Custody

Relinquished (Name/Organization):	[signature]	Date: 09/18/19	Time:
Received (Name / iATL):		Date:	Time:
Sample Login (Name / iATL):		Date:	Time:
Analysis(Name(s) / iATL):	[signature]	Date: 9/20/19	Time:
QA/QC Review (Name / iATL):	[signature]	Date: 9/20/19	Time:
Archived / Released: _____ QA/QC InterLAB Use:		Date:	Time:

SEP 1 9 2019

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ASBESTOS TESTING LABORATORIES

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Chain of Custody

–Bulk Asbestos –

Contact Information

Client Company:	Terracon Consultants, Inc.	**Project Number:**	N1197373
Office Address:	611 Lunken Park Drive	**Project Name:**	Chillicothe VAMC B35
City, State, Zip:	Cincinnati, OH 45226	**Primary Contact:**	Joshua Vogel
Fax Number:	513-321-0294	**Office Phone:**	513-612-9085
Email Address:	joshua.vogel@terracon.com	**Cell Phone:**	513-332-5034

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- ☒ PLM: Bulk Asbestos Building Materials EPA 600 R-93/116, 1993
- ☐ PLM: Bulk Asbestos Building Materials EPA 600 M-4/82-020, 1982
- ☐ PLM: Bulk Asbestos Building Materials NIOSH 9002, 1985
- ☐ PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.1, 2002
- ☐ PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.6, 2010
- ☐ TEM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.4, 2009

☒ PLM: Point Counting
- ☐ PC: via ELAP 198.1
- ☒ PC: 400 Points
- ☐ PC: 800 Points *
- ☐ PC: 1600 Points *

☒ PLM: Instructions for Multi-Layered Samples
- ☒ Analyze and Report All Separable Layers per EPA 600
- ☒ Report Composite for Drywall Systems per NESHAP
- ☐ Report All Layers and Composite Where Applicable
- ☐ Only Analyze and Report Specifically Noted Layer

☐ PLM: Analyze Until Positive (Positive Stop)
- ☐ AUP: by Homogenous Area as Noted
- ☐ AUP: by Material Type as Noted

☐ PLM: NOB via 198.6
- ☐ PLM: Friable via EPA 600 2.3
- ☐ If <1% by PLM, to TEM via 198.4 *
- ☐ If <1% by PLM, Hold for Instructions

☐ PLM: Non-Building Material*,** (Dust, Wipe, Tape)
- ☐ Soil or Vermiculite Analysis*
- ☐ CARB 435

Special Instructions: _____

** Additional charge and turnaround may be required* *** Alternative Method (ex: EPA 600/R-04/004) may be recommended by Laboratory*

Turnaround Time

Preliminary Results Requested Date: _____ (Specific date / time) ☐ Verbal ☒ Email ☐ Fax

☐ 10 Day ☒ 5 Day ☐ 3 Day ☐ 2 Day ☐ 1 Day* ☐ 12 Hour** ☐ 6 Hour** ☐ RUSH**

* End of next business day unless otherwise specified. ** Matrix Dependent. ***Please notify the lab before shipping***

Chain of Custody

Relinquished (Name/Organization):	[signature]	Date: 09/18/19	Time:
Received (Name / iATL):		Date:	Time:
Sample Login (Name / iATL):		Date:	Time:
Analysis(Name(s) / iATL):	[signature]	Date: 9/19/19	Time:
QA/QC Review (Name / iATL):	Kamron	Date: 9/20/19	Time:
Archived / Released: _____ QA/QC InterLAB Use:		Date:	Time:

SEP 19 2019

SUSPECT ACM - BULK MATERIAL SAMPLE LOG

Date: September 18, 2019
Inspector: Joshua Vogel
Project: Chillicothe VAMC Building 35
Project # N1197373

Page ____ of ____

Terracon
611 Lunken Park Drive
Cincinnati, Ohio 45226
(513) 321.5816

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
35-1	001	White Mastic on Fiberglass Pipe Insulation	Center of Tank Room	Throughout Building	6880046
	002		Pipe Chase BC-109		6880047
	003		Pipe Chase A1-105		6880048
35-2	004	Drywall System: Drywall and Joint Compound	North Wall of room BB-113	Room BB-113	6880049
	005		North Wall of room BB-113		6880050
	006		North Wall of room BB-113		6880051
35-3	007	2'x4' Bird Track Ceiling Tile	At Entry to Room BC-107	Corridor BB113 Rooms BC108F, BC101, 1B-116, 1C-116, 1C-104, 2B-100, 3B-132	6880052
	008		Above the Door in Room 1B-116		6880053
	009		At Entry to Room 2B-100		6880054
35-4	010	2'x4' Large Fissure Ceiling Tile	Center of Room BB112	Rooms BB112, 1B140, 1B121, 2C-111	6880055
	011		Above the Door in Room 1B-121		6880056
	012		Above the Door in Room 2C111		6880057
35-5	013	Drywall System: Drywall and Joint Compound	Center of the North Wall in Room 1B141	Rooms 1B-141, 1B-132, 1B-128, 1B121, 1A-102, 1C-116,1C104	6880058
	014		NE Corner of Room 1D-132		6880059
	015		NE Corner of Room 1B-128		6880060

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
	016		Above the door in Room 1B-121		6880061
	017		SE Corner of Room 1A-102		6880062
	018		Middle of the North Wall in Room 1C104		6880063
	019		Center of the South Wall in Room 1C116		6880064
35-6	020	Plaster: Base Coat and Finished Coat	SE Corner of Room 1B-136	Room 1B-136	6880065
	021		NE Corner of Room 1B-136		6880066
	022		SW Corner of Room 1B-136		6880067
35-7	023	2'x2' Textured Ceiling Tile	SW Corner in Room 1C-132	Room 1C-132	6880068
	024		Middle of the East Wall in Room 1C-132		6880069
	025		NW Corner in Room 1C-132		6880070
35-8	026	Drywall System: Drywall and Joint Compound	NW Corner of Room 2C-116	Rooms 2C-116, 2B-117C, 2B-118, 2B-122, 2B-123	6880071
	027		Middle of the West Wall in Room 2C-116		6880072
	028		SW Corner in Room 2C-116		6880073
	029		NW Corner of Room 2B-117C		6880074
	030		Middle of the South Wall in Room 2B-118		6880075
	031		Outside the Entrance of Room 2B-122		6880076
	032		Outside the Entrance of Room 2B-123		6880077
35-9	033	Drywall System: Drywall and Joint Compound	SW Corner of Room 3B-124	Rooms 3B-124, 3B-120, 3B-102	6880078

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
	034		SW Corner of Room 3B-120		6880079
	035		SW Corner of Room 3B-102		6880080
35-10	036	Plaster: Base Coat and Finished Coat	North Shower in Room 3C-132	Room 3C-132	6880081
	037		Center Shower in Room 3C-132		6880082
	038		South Shower in Room 3C-132		6880083

SUSPECT ACM - BULK MATERIAL SAMPLE LOG

Date: September 18, 2019
Inspector: Joshua Vogel
Project: Chillicothe VAMC Building 35
Project # N1197373

Page ____ of ____

Terracon
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Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
35-1	001	White Mastic on Fiberglass Pipe Insulation	Center of Tank Room	Throughout Building	6880046
	002		Pipe Chase BC-109		6880047
	003		Pipe Chase A1-105		6880048
35-2	004	Drywall System: Drywall and Joint Compound	North Wall of room BB-113	Room BB-113	6880049
	005		North Wall of room BB-113		6880050
	006		North Wall of room BB-113		6880051
35-3	007	2'x4' Bird Track Ceiling Tile	At Entry to Room BC-107	Corridor BB113 Rooms BC108F, BC101, 1B-116, 1C-116, 1C-104, 2B-100, 3B-132	6880052
	008		Above the Door in Room 1B-116		6880053
	009		At Entry to Room 2B-100		6880054
35-4	010	2'x4' Large Fissure Ceiling Tile	Center of Room BB112	Rooms BB112, 1B140, 1B121, 2C-111	6880055
	011		Above the Door in Room 1B-121		6880056
	012		Above the Door in Room 2C111		6880057
35-5	013	Drywall System: Drywall and Joint Compound	Center of the North Wall in Room 1B141	Rooms 1B-141, 1B-132, 1B-128, 1B121, 1A-102, 1C-116,1C104	6880058
	014		NE Corner of Room 1D-132		6880059
	015		NE Corner of Room 1B-128		6880060

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
	034		SW Corner of Room 3B-120		6880079
	035		SW Corner of Room 3B-102		6880080
35-10	036	Plaster: Base Coat and Finished Coat	North Shower in Room 3C-132	Room 3C-132	6880081
	037		Center Shower in Room 3C-132		6880082
	038		South Shower in Room 3C-132		6880083

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Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599949 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B210
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880025
Client No.: 210-1-001
Analyst Observation: White/Yellow Mastic/Fibrous
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Northwest Corner Of Rm G015B
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 5 Other, 10 Mineral Wool
Percent Non-Fibrous Material: 85

Lab No.: 6880026
Client No.: 210-2-002
Analyst Observation: White/Silver Wrap / Mastic
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Corridor 101 Outside Elevator
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 40 Cellulose, 10 Fibrous Glass
Percent Non-Fibrous Material: 50

Lab No.: 6880026(L2)
Client No.: 210-2-002
Analyst Observation: White/Yellow Insulation
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Corridor 101 Outside Elevator
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 100 Mineral Wool
Percent Non-Fibrous Material: None Detected

Lab No.: 6880027
Client No.: 210-3-003
Analyst Observation: White/Silver Wrap / Mastic
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Outside Rm 265
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 30 Cellulose, 10 Fibrous Glass
Percent Non-Fibrous Material: 60

Lab No.: 6880027(L2)
Client No.: 210-3-003
Analyst Observation: Yellow Insulation
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Outside Rm 265
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 100 Mineral Wool
Percent Non-Fibrous Material: None Detected

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599949 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B210
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880028
Client No.: 210-2-004
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2x4 Ceiling Tile With Large Fissure Pattern
Location: Near Door Of Rm G030
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
30 Cellulose
30 Mineral Wool

Percent Non-Fibrous Material:
40

Lab No.: 6880029
Client No.: 210-2-005
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2x4 Ceiling Tile With Large Fissure Pattern
Location: Center Corridor 101
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
30 Mineral Wool

Percent Non-Fibrous Material:
30

Lab No.: 6880030
Client No.: 210-2-006
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2x4 Ceiling Tile With Large Fissure Pattern
Location: Center of Rm 141B
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
40 Mineral Wool

Percent Non-Fibrous Material:
20

Lab No.: 6880031
Client No.: 210-3-007
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2x2 Ceiling Tile With Small Fissure Pattern
Location: Hallway Outside Rm G025A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
50 Cellulose
25 Mineral Wool

Percent Non-Fibrous Material:
25

Lab No.: 6880032
Client No.: 210-3-008
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2x2 Ceiling Tile With Small Fissure Pattern
Location: Hallway Outside G025T
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
50 Cellulose
25 Mineral Wool

Percent Non-Fibrous Material:
25

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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Mt. Laurel, New Jersey 08054
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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599949 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B210
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880033
Client No.: 210-3-009
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2x2 Ceiling Tile With Small Fissure Pattern
Location: Middle Of Rm G025A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
50 Cellulose
30 Mineral Wool

Percent Non-Fibrous Material:
20

Lab No.: 6880034
Client No.: 210-4-010
Analyst Observation: Tan Spray-On Fireproofing
Client Description: Spray On Fire Proofing
Location: Hallway Outside Rm G025A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
75 Mineral Wool

Percent Non-Fibrous Material:
25

Lab No.: 6880035
Client No.: 210-4-011
Analyst Observation: Tan Spray-On Fireproofing
Client Description: Spray On Fire Proofing
Location: Above Door In Rm 141B
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
80 Mineral Wool

Percent Non-Fibrous Material:
20

Lab No.: 6880036
Client No.: 210-4-012
Analyst Observation: Tan Spray-On Fireproofing
Client Description: Spray On Fire Proofing
Location: Above Door In Rm 241B
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
85 Mineral Wool

Percent Non-Fibrous Material:
15

Lab No.: 6880037
Client No.: 210-5-013
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2x4 Ceiling Tile With Textured Pattern
Location: Above Door In Rm 194
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
40 Mineral Wool

Percent Non-Fibrous Material:
20

Lab No.: 6880038
Client No.: 210-5-014
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2x4 Ceiling Tile With Textured Pattern
Location: Southwest Corner Of 194
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
40 Mineral Wool

Percent Non-Fibrous Material:
20

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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CERTIFICATE OF ANALYSIS

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	611 Lunken Park Drive	Report No.:	599949 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B210
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880039
Client No.: 210-5-015
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2x4 Ceiling Tile With Textured Pattern
Location: Northwest Corner Of Rm 194
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
40 Mineral Wool

Percent Non-Fibrous Material:
20

Lab No.: 6880040
Client No.: 210-6-016
Analyst Observation: Red Firestop
Client Description: Red Fire Stop Caulking
Location: Above Door In Rm 194
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
8 Fibrous Glass

Percent Non-Fibrous Material:
92

Lab No.: 6880041
Client No.: 210-6-017
Analyst Observation: Red Firestop
Client Description: Red Fire Stop Caulking
Location: Above Door In Rm 241B
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
10 Fibrous Glass

Percent Non-Fibrous Material:
90

Lab No.: 6880042
Client No.: 210-6-018
Analyst Observation: Red Firestop
Client Description: Red Fire Stop Caulking
Location: Above Door In Rm G030
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
8 Fibrous Glass

Percent Non-Fibrous Material:
92

Lab No.: 6880043
Client No.: 210-7-019
Analyst Observation: White/Brown Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: Southwest Corner
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
12 Cellulose

Percent Non-Fibrous Material:
88

Lab No.: 6880043(L2)
Client No.: 210-7-019
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: Southwest Corner
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599949 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B210
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880043(L3) **Analyst Observation:** Composite **Location:** Southwest Corner
Client No.: 210-7-019 **Client Description:** Drywall System: Drywall And Joint Compound **Facility:**

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 10 Cellulose
Percent Non-Fibrous Material: 90

Lab No.: 6880044 **Analyst Observation:** White/Brown Drywall **Location:** Southwest Corner
Client No.: 210-7-020 **Client Description:** Drywall System: Drywall And Joint Compound **Facility:**

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 10 Cellulose
Percent Non-Fibrous Material: 90

Lab No.: 6880044(L2) **Analyst Observation:** White Joint Compound **Location:** Southwest Corner
Client No.: 210-7-020 **Client Description:** Drywall System: Drywall And Joint Compound **Facility:**

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880044(L3) **Analyst Observation:** White Tape **Location:** Southwest Corner
Client No.: 210-7-020 **Client Description:** Drywall System: Drywall And Joint Compound **Facility:**

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 100 Cellulose
Percent Non-Fibrous Material: None Detected

Lab No.: 6880044(L4) **Analyst Observation:** Composite **Location:** Southwest Corner
Client No.: 210-7-020 **Client Description:** Drywall System: Drywall And Joint Compound **Facility:**

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 35 Cellulose
Percent Non-Fibrous Material: 65

Lab No.: 6880045 **Analyst Observation:** White/Brown Drywall **Location:** Southwest Corner
Client No.: 210-7-021 **Client Description:** Drywall System: Drywall And Joint Compound **Facility:**

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 10 Cellulose
Percent Non-Fibrous Material: 90

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599949 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B210
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880045(L2)
Client No.: 210-7-021
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: Southwest Corner
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880045(L3)
Client No.: 210-7-021
Analyst Observation: White Tape
Client Description: Drywall System: Drywall And Joint Compound
Location: Southwest Corner
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 100 Cellulose
Percent Non-Fibrous Material: None Detected

Lab No.: 6880045(L4)
Client No.: 210-7-021
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: Southwest Corner
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 30 Cellulose
Percent Non-Fibrous Material: 70

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/25/2019
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599949 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B210
		Project No.:	N1197373
Client:	TER940		

Appendix to Analytical Report

Customer Contact:
Method:40 CFR Appendix E to Subpart E of Part 763, interim method for the Determination of Asbestos in Bulk Insulation Samples, and USEPA 600, R93-116 as needed.

This appendix seeks to promote greater understanding of any observations, exceptions, special instructions, or circumstances that the laboratory needs to communicate to the client concerning the above samples. The information below is used to help promote your ability to make the most informed decisions for you and your customers. Please note the following points of contact for any questions you may have.

iATL Customer Service: customerservice@iatl.com
iATL Office Manager:wchampion@iatl.com
iATL Account Representative: Cassie Doherty
Sample Login Notes: See Batch Sheet Attached
Sample Matrix: Bulk Building Materials
Exceptions Noted: See Following Pages

General Terms, Warrants, Limits, Qualifiers:

General information about iATL capabilities and client/laboratory relationships and responsibilities are spelled out in iATL policies that are listed at www.iATL.com and ir our Quality Assurance Manual per ISO 17025 standard requirements. The information therein is a representation of iATL definitions and policies for turnaround times, sample submittal, collection media, blank definitions, quantification issues and limit of detection, analytical methods and procedures, sub-contracting policies, results reporting options, fees, terms, and discounts, confidentiality, sample archival and disposal, and data interpretation.

iATL warrants the test results to be of a precision normal for the type and methodology employed for each sample submitted. iATL disclaims any other warrants, expressed or implied, including warranty of fitness for a particular purpose and warranty of merchantability. iATL accepts no legal responsibility for the purpose for which the client uses test results. Any analytical work performed must be governed by our Standard Terms and Conditions. Prices, methods and detection limits may be changed without notification. Please contact your Customer Service Representative for the most current information.

This confidential report relates only to those item(s) tested and does not represent an endorsement by NIST-NVLAP, AIHA LAP LLC, or any agency of local, state or province governments nor of any agency of the U.S. government.

This report shall not be reproduced except in full, without written approval of the laboratory.

Information Pertinent to this Report:

Analysis by US EPA 600 93-116: Determination of Asbestos in Bulk Building Materials by Polarized Light Microscopy (PLM).

Certifications:

- NIST-NVLAP No. 101165-0
- NYSDOH-ELAP No. 11021
- AIHA-LAP, LLC No. 100188

Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. PC Trace represents a <0.25% amount. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

Analytical Methodology Alternatives: Your initial request for analysis may not have accounted for recent advances in regulatory requirements or advances in technology that are routinely used in similar situations for other qualified projects. You may have the option to explore additional analysis for further information. Below are a few options, listed as the matrix followed by the appropriate methodology. Also included are links to more information on our website.

Bulk Building Materials that are Non-Friable Organically Bound (NOB) by Gravimetric Reduction techniques employing PLM and TEM: ELAP 198.6 (PLM-NOB), ELAP 198.4 (TEM-NOB)

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599949 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B210
		Project No.:	N1197373
Client:	TER940		

Loose Fill Vermiculite Insulation, Attic Insulation, Zonolite (copyright), etc.: US EPA 600 R-4/004 (multi-tiered analytical process)
Sprayed On Insulation/Fireproofing with Vermiculite (SOF-V): ELAP 198.8 (PLM-SOF-V)

Soil, sludge, sediment, aggregate, and like materials analyzed for asbestos or other elongated mineral particles (ex. erionite, etc.): ASTM D7521, CARB 435, and other options available

Asbestos in Surface Dust according to one of ASTM's Methods (very dependent on sampling collection technique – by TEM): ASTM D 5755, D5756, or D6480

Various other asbestos matrices (air, water, etc.) and analytical methods are available.

Disclaimers / Qualifiers:

There may be some samples in this project that have a "NOTE:" associated with a sample result. We use added disclaimers or qualifiers to inform the client about something that requires further explanation. Here is a list with highlighted disclaimers that may be pertinent to this project. For a full explanation of these and other disclaimers, please inquire at **customerservice@iatl.com**.

1) Note: No mastic provided for analysis.
2) Note: Insufficient mastic provided for analysis.
3) Note: Insufficient material provided for analysis.
4) Note: Insufficient sample provided for QC reanalysis.
5) Note: Different material than indicated on Sample Log / Description.
6) Note: Sample not submitted.
7) Note: Attached to asbestos containing material.
8) Note: Received wet.
9) Note: Possible surface contamination.
10) Note: Not building material. 1% threshold may not apply.
11) Note: Recommend TEM-NOB analysis as per EPA recommendations.
12) Note: Asbestos detected but not quantifiable.
13) Note: Multiple identical samples submitted, only one analyzed.
14) Note: Analyzed by EPA 600/R-93/116. Point Counting detection limit at 0.080%.
15) Note: Analyzed by EPA 600/R-93/116. Point Counting detection limit at 0.125%.
16) Note: This sample contains >10% vermiculite mineral. See Appendix for Recommendations for Vermiculite Analysis.

Recommendations for Vermiculite Analysis:

Several analytical protocols exist for the analysis of asbestos in vermiculite. These analytical approaches vary depending upon the nature of the vermiculite mineral being tested (e.g. un-processed gange, homogeneous exfoliated books of mica, or mixed mineral composites).Please contact your client representative for pricing and turnaround time options available.

iATL recommends initial testing using the EPA 600/R-93/116 method. This method is specifically designed for the analysis of asbestos in bulk building materials. It provides an acceptable starting point for primary screening of vermiculite for possible asbestos.

Results from this testing may be inconclusive. EPA suggests proceeding to a multi-tiered analysis involving wet separation techniques in conjunction with PLM and TEM gravimetric analysis (EPA 600/R-04/004).

For New York State customers, NYSDOH requires disclaimers and qualifiers for various vermiculite containing samples that direct analysis via ELAP198.6 and ELAP198.8 for samples that contain >10% vermiculite mineral where ELAP198.6 may be used to evaluate the asbestos content of the material. However, any test result using ELAP198.6 will be reported with the following disclaimer: “ELAP198.6 method does not remove vermiculite and may underestimate the level of asbestos present in a sample containing >10% vermiculite.”

Further information on this method and other vermiculite and asbestos issues can be found at the following: Agency for Toxic Substances and Disease Registry (ATSDR) www.atsdr.cdc.gov, United States Geological Survey (USGS) www.minerals.usgs.gov/minerals/, US EPA www.epa.gov/asbestos. The USEPA also has an informative brochure "Current Best Practices for Vermiculite Attic Insulation" EPA 747F03001 May 2003, that may assist the health and remediation professional.

The following is a summary of the analytical process outlines in the EPA 600/R-04/004 Method:

1)**Analytical Step/Method:** Initial Screening by PLM, EPA 600R-93/116
Requirements/Comments: Minimum of 0.1 g of sample. ~0.25% LOQ for most samples.

2)**Analytical Step/Method:** Wet Separation by PLM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Sinks" only.

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/25/2019
	611 Lunken Park Drive	Report No.:	599949 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B210
		Project No.:	N1197373
Client:	TER940		

3)**Analytical Step/Method:** Wet Separation by PLM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Floats" only.

4)**Analytical Step/Method:** Wet Separation by TEM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Sinks" only.

5)**Analytical Step/Method:** Wet Separation by TEM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Suspension" only.

LOQ, Limit of Quantitation estimates for mass and volume analyses.
*With advance notice and confirmation by the laboratory.
**Approximately 1 Liter of sample in double-bagged container (~9x6 inch bag of sample).

iATL INTERNATIONAL
ASBESTOS TESTING LABORATORIES

9000 Commerce Parkway, Suite B • Mount Laurel, NJ 08054
Phone: 877-428-4285/856-231-9449 • Fax: 856-231-9818

Chain of Custody

–Bulk Asbestos –

Contact Information

Client Company:	Terracon Consultants, Inc.	**Project Number:**	N1197373
Office Address:	611 Lunken Park Drive	**Project Name:**	Chillicothe VAMC B210
City, State, Zip:	Cincinnati, OH 45226	**Primary Contact:**	Joshua Vogel
Fax Number:	513-321-0294	**Office Phone:**	513-612-9085
Email Address:	joshua.vogel@terracon.com	**Cell Phone:**	513-332-5034

PLM Instructions:

- ☒ PLM: Bulk Asbestos Building Materials EPA 600 R-93/116, 1993
- ☐ PLM: Bulk Asbestos Building Materials EPA 600 M-4/82-020, 1982
- ☐ PLM: Bulk Asbestos Building Materials NIOSH 9002, 1985
- ☐ PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.1, 2002
- ☐ PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.6, 2010
- ☐ TEM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.4, 2009

- ☒ PLM: Point Counting
  - ☐ PC: via ELAP 198.1
  - ☒ PC: 400 Points
  - ☐ PC: 800 Points *
  - ☐ PC: 1600 Points *
- ☒ PLM: Instructions for Multi-Layered Samples
  - ☒ Analyze and Report All Separable Layers per EPA 600
  - ☒ Report Composite for Drywall Systems per NESHAP
  - ☐ Report All Layers and Composite Where Applicable
  - ☐ Only Analyze and Report Specifically Noted Layer
- ☐ PLM: Analyze Until Positive (Positive Stop)
  - ☐ AUP: by Homogenous Area as Noted
  - ☐ AUP: by Material Type as Noted
- ☐ PLM: NOB via 198.6
  - ☐ PLM: Friable via EPA 600 2.3
  - ☐ If <1% by PLM, to TEM via 198.4 *
  - ☐ If <1% by PLM, Hold for Instructions
- ☐ PLM: Non-Building Material*,** (Dust, Wipe, Tape)
  - ☐ Soil or Vermiculite Analysis*
  - ☐ CARB 435

Special Instructions: _____

** Additional charge and turnaround may be required* *** Alternative Method (ex: EPA 600/R-04/004) may be recommended by Laboratory*

Turnaround Time

Preliminary Results Requested Date: _____ (Specific date / time) ☐ Verbal ☒ Email ☐ Fax

☐ 10 Day ☒ 5 Day ☐ 3 Day ☐ 2 Day ☐ 1 Day* ☐ 12 Hour** ☐ 6 Hour** ☐ RUSH**

* End of next business day unless otherwise specified. ** Matrix Dependent. ***Please notify the lab before shipping***

Chain of Custody

Relinquished (Name/Organization):	JM Vogel	Date: 09/18/19	Time:
Received (Name / iATL):		Date:	Time:
Sample Login (Name / iATL):		Date:	Time: SEP 19 20
Analysis(Name(s) / iATL):	ES,C 9-25-19	Date:	Time:
QA/QC Review (Name / iATL):	KMyers	Date: 9/26/19	Time:
Archived / Released: _____	QA/QC InterLAB Use: _____	Date:	Time:

SUSPECT ACM - BULK MATERIAL SAMPLE LOG

Page ____ of ____

Date: September 18, 2019
Inspector: Joshua Vogel
Project: Chillicothe VAMC Building 210
Project # N1198373

Terracon
611 Lunken Park Drive
Cincinnati, Ohio 45226
(513) 321.5816

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
210-1	001	White Mastic on Fiberglass Pipe Insulation	Northwest Corner of Room G015B	Various Locations Throughout	6880025
	002		Corridor 101 Outside Elevator		6880026
	003		Outside Room 265		6880027
210-2	004	2'x4' Ceiling Tile with Large Fissure Pattern	Near Door of Room G030	Rooms G030, 141B, 241B and Corridor 101	6880028
	005		Center Corridor 101		6880029
	006		Center of Room 141B		6880030
210-3	007	2x'2' Ceiling Tile with Small Fissure Pattern	Hallway Outside Room G025A	Rooms G025A, G025T, Hallway Outside G025a and G025T	6880031
	008		Hallway Outside G025T		6880032
	009		Middle of Room G025A		6880033
210-4	010	Spray on Fire Proofing	Hallway Outside Room G025A	Rooms 141B, 241B, G025A,	6880034
	011		Above Door in Room 141B		6880035
	012		Above Door in Room 241B		6880036
210-5	013	2'x4' Ceiling Tile with Textured Pattern	Above Door in Room 194	Room 194	6880037
	014		Southwest Corner of 194		6880038
	015		Northwest Corner of Room 194		6880039

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
210-6	016	Red Fire Stop Caulking	Above Door in Room 194	Rooms G030, 194 and 241B	6880040
	017		Above Door in Room 241B		6880041
	018		Above Door in Room G030		6880042
210-7	019	Drywall System: Drywall and Joint Compound	Southwest Corner	South Wall in Room 241B	6880043
	020		Southwest Corner		6880044
	021		Southwest Corner		6880045

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Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/19/2019
	611 Lunken Park Drive	Report No.:	599948 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B211
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6879994
Client No.: 211-1-001
Analyst Observation: Yellow Insulation
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Middle Of Room F12
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
100 Fibrous Glass

Percent Non-Fibrous Material:
None Detected

Lab No.: 6879994(L2)
Client No.: 211-1-001
Analyst Observation: White Wrap
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Middle Of Room F12
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
4 Cellulose
3 Fibrous Glass

Percent Non-Fibrous Material:
93

Lab No.: 6879995
Client No.: 211-1-002
Analyst Observation: White/Silver Wrap
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Middle Of East Wall In Room G022
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
4 Cellulose
3 Fibrous Glass

Percent Non-Fibrous Material:
93

Lab No.: 6879996
Client No.: 211-1-003
Analyst Observation: White/Silver Wrap
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Middle Of Corridor 267
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
4 Cellulose
3 Fibrous Glass

Percent Non-Fibrous Material:
93

Lab No.: 6879997
Client No.: 211-2-004
Analyst Observation: White Ceiling Tile
Client Description: 2'x4' Ceiling Tile With Small Fissure Pattern
Location: Hallway Outside Room G018
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
50 Cellulose
30 Mineral Wool

Percent Non-Fibrous Material:
20

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/19/2019
Signature:
Analyst: Michael Moore

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/19/2019
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	Cincinnati OH 45226	Project:	Chillicothe VAMC B211
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6879998
Client No.: 211-2-005
Analyst Observation: White Ceiling Tile
Client Description: 2'x4' Ceiling Tile With Small Fissure Pattern
Location: Northeast Corner Of Room 164
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
50 Cellulose
30 Mineral Wool

Percent Non-Fibrous Material:
20

Lab No.: 6879999
Client No.: 211-2-006
Analyst Observation: White Ceiling Tile
Client Description: 2'x4' Ceiling Tile With Small Fissure Pattern
Location: Center Of Room 109A
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
50 Cellulose
30 Mineral Wool

Percent Non-Fibrous Material:
20

Lab No.: 6880000
Client No.: 211-3-007
Analyst Observation: White Ceiling Tile
Client Description: 2'x4' Ceiling Tile With Bird Track Pattern
Location: Center Of Room G027
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
50 Cellulose
30 Mineral Wool

Percent Non-Fibrous Material:
20

Lab No.: 6880001
Client No.: 211-3-008
Analyst Observation: White Ceiling Tile
Client Description: 2'x4' Ceiling Tile With Bird Track Pattern
Location: Center Of Room G027B
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
50 Cellulose
30 Mineral Wool

Percent Non-Fibrous Material:
20

Lab No.: 6880002
Client No.: 211-3-009
Analyst Observation: White Ceiling Tile
Client Description: 2'x4' Ceiling Tile With Bird Track Pattern
Location: Center Of Room G027B
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
50 Cellulose
30 Mineral Wool

Percent Non-Fibrous Material:
20

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/19/2019
Signature:
Analyst: Michael Moore

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/19/2019
	611 Lunken Park Drive	Report No.:	599948 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B211
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880003
Client No.: 211-4-010
Analyst Observation: White Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: Northwest Corner Of Room G027B
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 5 Cellulose
Percent Non-Fibrous Material: 95

Lab No.: 6880003(L2)
Client No.: 211-4-010
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: Northwest Corner Of Room G027B
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880003(L3)
Client No.: 211-4-010
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: Northwest Corner Of Room G027B
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 2 Cellulose
Percent Non-Fibrous Material: 98

Lab No.: 6880004
Client No.: 211-4-011
Analyst Observation: White Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: Northwest Corner Of Room G027B
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 5 Cellulose, 2 Fibrous Glass
Percent Non-Fibrous Material: 93

Lab No.: 6880004(L2)
Client No.: 211-4-011
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: Northwest Corner Of Room G027B
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880004(L3)
Client No.: 211-4-011
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: Northwest Corner Of Room G027B
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 2 Cellulose
Percent Non-Fibrous Material: 98

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/19/2019
Signature:
Analyst: Michael Moore

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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CERTIFICATE OF ANALYSIS

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	Cincinnati OH 45226	Project:	Chillicothe VAMC B211
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880005
Client No.: 211-4-012
Analyst Observation: White Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: Northwest Corner Of Room G027B
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
2 Fibrous Glass

Percent Non-Fibrous Material:
93

Lab No.: 6880005(L2)
Client No.: 211-4-012
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: Northwest Corner Of Room G027B
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880005(L3)
Client No.: 211-4-012
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: Northwest Corner Of Room G027B
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
2 Cellulose

Percent Non-Fibrous Material:
98

Lab No.: 6880006
Client No.: 211-5-013
Analyst Observation: White Ceiling Tile
Client Description: 2'x2' Ceiling Tile With Textured Pattern
Location: Center Of West Wall In Room 22
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
50 Cellulose
30 Mineral Wool

Percent Non-Fibrous Material:
20

Lab No.: 6880007
Client No.: 211-5-014
Analyst Observation: White Ceiling Tile
Client Description: 2'x2' Ceiling Tile With Textured Pattern
Location: Above Door In Room G024G
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
50 Cellulose
30 Mineral Wool

Percent Non-Fibrous Material:
20

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/19/2019
Signature:
Analyst: Michael Moore

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/19/2019
	611 Lunken Park Drive	Report No.:	599948 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B211
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880008
Client No.: 211-5-015
Analyst Observation: White Ceiling Tile
Client Description: 2'x2' Ceiling Tile With Textured Pattern
Location: Above Door In Room G022
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
50 Cellulose
30 Mineral Wool

Percent Non-Fibrous Material:
20

Lab No.: 6880009
Client No.: 211-6-016
Analyst Observation: White Ceiling Tile
Client Description: 2'x2' Ceiling Tile With Small Fissure Pattern
Location: Outside Room G037
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
50 Cellulose
30 Mineral Wool

Percent Non-Fibrous Material:
20

Lab No.: 6880010
Client No.: 211-6-017
Analyst Observation: White Ceiling Tile
Client Description: 2'x2' Ceiling Tile With Small Fissure Pattern
Location: Outside Room G0080
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
50 Cellulose
30 Mineral Wool

Percent Non-Fibrous Material:
20

Lab No.: 6880011
Client No.: 211-6-018
Analyst Observation: White Ceiling Tile
Client Description: 2'x2' Ceiling Tile With Small Fissure Pattern
Location: Outside Room G026
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
50 Cellulose
30 Mineral Wool

Percent Non-Fibrous Material:
20

Lab No.: 6880012
Client No.: 211-7-019
Analyst Observation: Off-White Insulation
Client Description: Spray On Fireproofing
Location: Outside Room G037
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
80 Fibrous Glass

Percent Non-Fibrous Material:
20

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/19/2019
Signature:
Analyst: Michael Moore

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/19/2019
	611 Lunken Park Drive	Report No.:	599948 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B211
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880013
Client No.: 211-7-020
Analyst Observation: Off-White Insulation
Client Description: Spray On Fireproofing
Location: Outside Room G037
Facility:
Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 80 Fibrous Glass
Percent Non-Fibrous Material: 20

Lab No.: 6880014
Client No.: 211-7-021
Analyst Observation: Off-White Insulation
Client Description: Spray On Fireproofing
Location: Outside Room G037
Facility:
Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 80 Fibrous Glass
Percent Non-Fibrous Material: 20

Lab No.: 6880015
Client No.: 211-7-022
Analyst Observation: Beige Insulation
Client Description: Spray On Fireproofing
Location: Outside Room G0080
Facility:
Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 80 Cellulose
Percent Non-Fibrous Material: 20

Lab No.: 6880016
Client No.: 211-7-023
Analyst Observation: White Insulation
Client Description: Spray On Fireproofing
Location: Outside Room G002
Facility:
Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 80 Fibrous Glass
Percent Non-Fibrous Material: 20

Lab No.: 6880017
Client No.: 211-7-024
Analyst Observation: White Insulation
Client Description: Spray On Fireproofing
Location: Outside Room 242
Facility:
Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 80 Fibrous Glass
Percent Non-Fibrous Material: 20

Lab No.: 6880018
Client No.: 211-7-025
Analyst Observation: White Insulation
Client Description: Spray On Fireproofing
Location: Outside Room 243
Facility:
Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 80 Fibrous Glass
Percent Non-Fibrous Material: 20

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/19/2019
Signature:
Analyst: Michael Moore

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/19/2019
	611 Lunken Park Drive	Report No.:	599948 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B211
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880019
Client No.: 211-8-026
Analyst Observation: White Caulk
Client Description: White Fire Stop Caulking
Location: Outside Room G0084
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880020
Client No.: 211-8-027
Analyst Observation: White Caulk
Client Description: White Fire Stop Caulking
Location: Above Door On Room 209
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880021
Client No.: 211-8-028
Analyst Observation: White Caulk
Client Description: White Fire Stop Caulking
Location: Above Door Of Room 234
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880022
Client No.: 211-9-029
Analyst Observation: White Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: Above Door Of Room 209
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 5 Cellulose, 2 Fibrous Glass
Percent Non-Fibrous Material: 93

Lab No.: 6880022(L2)
Client No.: 211-9-029
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: Above Door Of Room 209
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880022(L3)
Client No.: 211-9-029
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: Above Door Of Room 209
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 2 Cellulose, 2 Fibrous Glass
Percent Non-Fibrous Material: 96

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/19/2019
Signature:
Analyst: Michael Moore

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/19/2019
	611 Lunken Park Drive	Report No.:	599948 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B211
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880023
Client No.: 211-9-030
Analyst Observation: White Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: Above Door Of Room 205
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
2 Fibrous Glass

Percent Non-Fibrous Material:
93

Lab No.: 6880023(L2)
Client No.: 211-9-030
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: Above Door Of Room 205
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880023(L3)
Client No.: 211-9-030
Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound
Location: Above Door Of Room 205
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
2 Cellulose
2 Fibrous Glass

Percent Non-Fibrous Material:
96

Lab No.: 6880024
Client No.: 211-9-031
Analyst Observation: White Drywall
Client Description: Drywall System: Drywall And Joint Compound
Location: Southwest Corner Of Room 234
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
5 Cellulose
2 Fibrous Glass

Percent Non-Fibrous Material:
93

Lab No.: 6880024(L2)
Client No.: 211-9-031
Analyst Observation: White Joint Compound
Client Description: Drywall System: Drywall And Joint Compound
Location: Southwest Corner Of Room 234
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/19/2019
Signature:
Analyst: Michael Moore

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/19/2019
	611 Lunken Park Drive	Report No.:	599948 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B211
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880024(L3)
Client No.: 211-9-031

Analyst Observation: Composite
Client Description: Drywall System: Drywall And Joint Compound

Location: Southwest Corner Of Room 234
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
2 Cellulose
2 Fibrous Glass

Percent Non-Fibrous Material:
96

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/19/2019
Signature:
Analyst: Michael Moore

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

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Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/19/2019
	611 Lunken Park Drive	Report No.:	599948 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B211
		Project No.:	N1197373
Client:	TER940		

Appendix to Analytical Report

Customer Contact:
Method:40 CFR Appendix E to Subpart E of Part 763, interim method for the Determination of Asbestos in Bulk Insulation Samples, and USEPA 600, R93-116 as needed.

This appendix seeks to promote greater understanding of any observations, exceptions, special instructions, or circumstances that the laboratory needs to communicate to the client concerning the above samples. The information below is used to help promote your ability to make the most informed decisions for you and your customers. Please note the following points of contact for any questions you may have.

iATL Customer Service: customerservice@iatl.com
iATL Office Manager:wchampion@iatl.com
iATL Account Representative: Cassie Doherty
Sample Login Notes: See Batch Sheet Attached
Sample Matrix: Bulk Building Materials
Exceptions Noted: See Following Pages

General Terms, Warrants, Limits, Qualifiers:

General information about iATL capabilities and client/laboratory relationships and responsibilities are spelled out in iATL policies that are listed at www.iATL.com and ir our Quality Assurance Manual per ISO 17025 standard requirements. The information therein is a representation of iATL definitions and policies for turnaround times, sample submittal, collection media, blank definitions, quantification issues and limit of detection, analytical methods and procedures, sub-contracting policies, results reporting options, fees, terms, and discounts, confidentiality, sample archival and disposal, and data interpretation.

iATL warrants the test results to be of a precision normal for the type and methodology employed for each sample submitted. iATL disclaims any other warrants, expressed or implied, including warranty of fitness for a particular purpose and warranty of merchantability. iATL accepts no legal responsibility for the purpose for which the client uses test results. Any analytical work performed must be governed by our Standard Terms and Conditions. Prices, methods and detection limits may be changed without notification. Please contact your Customer Service Representative for the most current information.

This confidential report relates only to those item(s) tested and does not represent an endorsement by NIST-NVLAP, AIHA LAP LLC, or any agency of local, state or province governments nor of any agency of the U.S. government.

This report shall not be reproduced except in full, without written approval of the laboratory.

Information Pertinent to this Report:

Analysis by US EPA 600 93-116: Determination of Asbestos in Bulk Building Materials by Polarized Light Microscopy (PLM).

Certifications:

- NIST-NVLAP No. 101165-0
- NYSDOH-ELAP No. 11021
- AIHA-LAP, LLC No. 100188

Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. PC Trace represents a <0.25% amount. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

Analytical Methodology Alternatives: Your initial request for analysis may not have accounted for recent advances in regulatory requirements or advances in technology that are routinely used in similar situations for other qualified projects. You may have the option to explore additional analysis for further information. Below are a few options, listed as the matrix followed by the appropriate methodology. Also included are links to more information on our website.

Bulk Building Materials that are Non-Friable Organically Bound (NOB) by Gravimetric Reduction techniques employing PLM and TEM: ELAP 198.6 (PLM-NOB), ELAP 198.4 (TEM-NOB)

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/19/2019
	611 Lunken Park Drive	Report No.:	599948 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B211
		Project No.:	N1197373
Client:	TER940		

Loose Fill Vermiculite Insulation, Attic Insulation, Zonolite (copyright), etc.: US EPA 600 R-4/004 (multi-tiered analytical process)
Sprayed On Insulation/Fireproofing with Vermiculite (SOF-V): ELAP 198.8 (PLM-SOF-V)

Soil, sludge, sediment, aggregate, and like materials analyzed for asbestos or other elongated mineral particles (ex. erionite, etc.): ASTM D7521, CARB 435, and other options available

Asbestos in Surface Dust according to one of ASTM's Methods (very dependent on sampling collection technique – by TEM): ASTM D 5755, D5756, or D6480

Various other asbestos matrices (air, water, etc.) and analytical methods are available.

Disclaimers / Qualifiers:

There may be some samples in this project that have a "NOTE:" associated with a sample result. We use added disclaimers or qualifiers to inform the client about something that requires further explanation. Here is a list with highlighted disclaimers that may be pertinent to this project. For a full explanation of these and other disclaimers, please inquire at **customerservice@iatl.com**.

1) Note: No mastic provided for analysis.
2) Note: Insufficient mastic provided for analysis.
3) Note: Insufficient material provided for analysis.
4) Note: Insufficient sample provided for QC reanalysis.
5) Note: Different material than indicated on Sample Log / Description.
6) Note: Sample not submitted.
7) Note: Attached to asbestos containing material.
8) Note: Received wet.
9) Note: Possible surface contamination.
10) Note: Not building material. 1% threshold may not apply.
11) Note: Recommend TEM-NOB analysis as per EPA recommendations.
12) Note: Asbestos detected but not quantifiable.
13) Note: Multiple identical samples submitted, only one analyzed.
14) Note: Analyzed by EPA 600/R-93/116. Point Counting detection limit at 0.080%.
15) Note: Analyzed by EPA 600/R-93/116. Point Counting detection limit at 0.125%.
16) Note: This sample contains >10% vermiculite mineral. See Appendix for Recommendations for Vermiculite Analysis.

Recommendations for Vermiculite Analysis:

Several analytical protocols exist for the analysis of asbestos in vermiculite. These analytical approaches vary depending upon the nature of the vermiculite mineral being tested (e.g. un-processed gange, homogeneous exfoliated books of mica, or mixed mineral composites).Please contact your client representative for pricing and turnaround time options available.

iATL recommends initial testing using the EPA 600/R-93/116 method. This method is specifically designed for the analysis of asbestos in bulk building materials. It provides an acceptable starting point for primary screening of vermiculite for possible asbestos.

Results from this testing may be inconclusive. EPA suggests proceeding to a multi-tiered analysis involving wet separation techniques in conjunction with PLM and TEM gravimetric analysis (EPA 600/R-04/004).

For New York State customers, NYSDOH requires disclaimers and qualifiers for various vermiculite containing samples that direct analysis via ELAP198.6 and ELAP198.8 for samples that contain >10% vermiculite mineral where ELAP198.6 may be used to evaluate the asbestos content of the material. However, any test result using ELAP198.6 will be reported with the following disclaimer: “ELAP198.6 method does not remove vermiculite and may underestimate the level of asbestos present in a sample containing >10% vermiculite.”

Further information on this method and other vermiculite and asbestos issues can be found at the following: Agency for Toxic Substances and Disease Registry (ATSDR) www.atsdr.cdc.gov, United States Geological Survey (USGS) www.minerals.usgs.gov/minerals/, US EPA www.epa.gov/asbestos. The USEPA also has an informative brochure "Current Best Practices for Vermiculite Attic Insulation" EPA 747F03001 May 2003, that may assist the health and remediation professional.

The following is a summary of the analytical process outlines in the EPA 600/R-04/004 Method:

1)**Analytical Step/Method:** Initial Screening by PLM, EPA 600R-93/116
Requirements/Comments: Minimum of 0.1 g of sample. ~0.25% LOQ for most samples.

2)**Analytical Step/Method:** Wet Separation by PLM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Sinks" only.

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Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/19/2019
	611 Lunken Park Drive	Report No.:	599948 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B211
		Project No.:	N1197373
Client:	TER940		

3)**Analytical Step/Method:** Wet Separation by PLM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Floats" only.

4)**Analytical Step/Method:** Wet Separation by TEM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Sinks" only.

5)**Analytical Step/Method:** Wet Separation by TEM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Suspension" only.

LOQ, Limit of Quantitation estimates for mass and volume analyses.
*With advance notice and confirmation by the laboratory.
**Approximately 1 Liter of sample in double-bagged container (~9x6 inch bag of sample).

iATL INTERNATIONAL
ASBESTOS TESTING LABORATORIES

9000 Commerce Parkway, Suite B • Mount Laurel, NJ 08054
Phone: 877-428-4285/856-231-9449 • Fax: 856-231-9818

Chain of Custody

–Bulk Asbestos –

Contact Information

Client Company:	Terracon Consultants, Inc.	**Project Number:**	N1197373
Office Address:	611 Lunken Park Drive	**Project Name:**	Chillicothe VAMC B211
City, State, Zip:	Cincinnati, OH 45226	**Primary Contact:**	Joshua Vogel
Fax Number:	513-321-0294	**Office Phone:**	513-612-9085
Email Address:	joshua.vogel@terracon.com	**Cell Phone:**	513-332-5034

PLM Instructions:

- ☒ PLM: Bulk Asbestos Building Materials EPA 600 R-93/116, 1993
- ☐ PLM: Bulk Asbestos Building Materials EPA 600 M-4/82-020, 1982
- ☐ PLM: Bulk Asbestos Building Materials NIOSH 9002, 1985
- ☐ PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.1, 2002
- ☐ PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.6, 2010
- ☐ TEM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.4, 2009

☒ PLM: Point Counting
- ☐ PC: via ELAP 198.1
- ☒ PC: 400 Points
- ☐ PC: 800 Points *
- ☐ PC: 1600 Points *

☒ PLM: Instructions for Multi-Layered Samples
- ☒ Analyze and Report All Separable Layers per EPA 600
- ☒ Report Composite for Drywall Systems per NESHAP
- ☐ Report All Layers and Composite Where Applicable
- ☐ Only Analyze and Report Specifically Noted Layer

☐ PLM: Analyze Until Positive (Positive Stop)
- ☐ AUP: by Homogenous Area as Noted
- ☐ AUP: by Material Type as Noted

☐ PLM: NOB via 198.6
- ☐ PLM: Friable via EPA 600 2.3
- ☐ If <1% by PLM, to TEM via 198.4 *
- ☐ If <1% by PLM, Hold for Instructions

☐ PLM: Non-Building Material*,** (Dust, Wipe, Tape)
- ☐ Soil or Vermiculite Analysis*
- ☐ CARB 435

Special Instructions: _____

** Additional charge and turnaround may be required* *** Alternative Method (ex: EPA 600/R-04/004) may be recommended by Laboratory*

Turnaround Time

Preliminary Results Requested Date: _____ (Specific date / time) ☐ Verbal ☒ Email ☐ Fax

☐ 10 Day ☒ 5 Day ☐ 3 Day ☐ 2 Day ☐ 1 Day* ☐ 12 Hour** ☐ 6 Hour** ☐ RUSH**

* End of next business day unless otherwise specified. ** Matrix Dependent. ***Please notify the lab before shipping***

Chain of Custody

Relinquished (Name/Organization):	[signature]	Date: 09/18/19	Time:
Received (Name / iATL):		Date:	Time:
Sample Login (Name / iATL):		Date:	Time: SEP 19 2019
Analysis(Name(s) / iATL):	[signature]	Date: 9/19/19	Time:
QA/QC Review (Name / iATL):	[signature]	Date: 9/20/19	Time:
Archived / Released: _____	QA/QC InterLAB Use: _____	Date:	Time:

SUSPECT ACM - BULK MATERIAL SAMPLE LOG

Page ____ of ____

Date: September 18, 2019
Inspector: Joshua Vogel
Project: Chillicothe VAMC Building 211
Project # N1197373

Terracon
611 Lunken Park Drive
Cincinnati, Ohio 45226
(513) 321.5816

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
211-1	001	White Mastic on Fiberglass Pipe Insulation	Middle of Room F12	Various Locations Throughout	6879994
	002		Middle of East Wall in Room G022		6879995
	003		Middle of Corridor 267		6879996
211-2	004	2'x4' Ceiling Tile with Small Fissure Pattern	Hallway Outside Room G018	Hallway Outside G018, Rooms: 164, 209A, 109A, Corridor 267	6879997
	005		Northeast Corner of Room 164		6879998
	006		Center of Room 109A		6879999
211-3	007	2'x4' Ceiling Tile with Bird Track Pattern	Center of Room G027	Rooms G027 and G027B	6880000
	008		Center of Room G027B		6880001
	009		Center of Room G027B		6880002
211-4	010	Drywall System: Drywall and Joint Compound	Northwest Corner	Room G027B	6880003
	011		Northwest Corner		6880004
	012		Northwest Corner		6880005
211-5	013	2'x2' Ceiling Tile with Textured Pattern	Center of West Wall in Room 22	Rooms G022 and G024G	6880006
	014		Above Door in Room G024G		6880007
	015		Above Door in Room G022		6880008

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
211-6	016	2'x2' Ceiling Tile with Small Fissure Pattern	Outside Room G037	Outside Room G037 and G080	6880009
	017		Outside Room G0080		6880010
	018		Outside Room G026		6880011
211-7	019	Spray On Fire Proofing	Outside Room G037	Various Locations Throughout	6880012
	020		Outside Room G037		6880013
	021		Outside Room G037		6880014
	022		Outside Room G0080		6880015
	023		Outside Room G002		6880016
	024		Outside Room 242		6880017
	025		Outside Room 243		6880018
211-8	026	White Fire Stop Caulking	Outside Room G0084	Various Locations Throughout	6880019
	027		Above Door on Room 209		6880020
	028		Above Door of Room 234		6880021
211-9	029	Drywall System: Drywall and Joint Compound	Above Door of Room 209	Rooms 209, 205, 234	
	030		Above Door of Room 205		~~6880022~~
	031		Southwest Corner of Room 234		6880023
					~~6880024~~

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CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/24/2019
	611 Lunken Park Drive	Report No.:	599954 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B256
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880173
Client No.: 256-1-001
Analyst Observation: Grey Caulk
Client Description: White Interior Window Caulk
Location: Bottom Of Window In Pump Room
Facility:

Percent Asbestos: ***PC 1.5*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 98.5

Lab No.: 6880174
Client No.: 256-1-002
Analyst Observation: Grey Caulk
Client Description: White Interior Window Caulk
Location: NW Window In Chem. Feed Room
Facility:

Percent Asbestos: ***PC 1.3*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 98.7

Lab No.: 6880175
Client No.: 256-1-003
Analyst Observation: Grey/White Caulk
Client Description: White Interior Window Caulk
Location: SW Window In Chem. Feed Room
Facility:

Percent Asbestos: ***PC 1.1*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 98.9

Lab No.: 6880176
Client No.: 256-2-004
Analyst Observation: White/Yellow Mastic/Fibrous
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: East Side Of Restroom
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 5 Mineral Wool
Percent Non-Fibrous Material: 95

Lab No.: 6880177
Client No.: 256-2-005
Analyst Observation: White/Yellow Mastic/Fibrous
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Pipe Off Of South Tank On Northeast Corner Of Tank
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 15 Mineral Wool
Percent Non-Fibrous Material: 85

Lab No.: 6880178
Client No.: 256-2-006
Analyst Observation: White/Yellow Mastic/Fibrous
Client Description: White Mastic On Fiberglass Pipe Insulation
Location: Middle Of East Wall In Pump Room
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 25 Mineral Wool
Percent Non-Fibrous Material: 75

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Client:	TER940	Project No.:	N1197373

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880179
Client No.: 256-3-007
Analyst Observation: White/Grey Caulk
Client Description: White Expansion Caulking Interior
Location: Bottom Of The Steps 1st Floor Stairs
Facility:
Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 2 Fibrous Glass
Percent Non-Fibrous Material: 98

Lab No.: 6880180
Client No.: 256-3-008
Analyst Observation: White/Grey Caulk
Client Description: White Expansion Caulking Interior
Location: NW Corner Of Pump Room
Facility:
Percent Asbestos: ***PC 1.2*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 98.8

Lab No.: 6880181
Client No.: 256-3-009
Analyst Observation: White/Grey Caulk
Client Description: White Expansion Caulking Interior
Location: Middle Of West Wall In The Chlorination Room
Facility:
Percent Asbestos: ***PC 1.3*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 98.7

Lab No.: 6880182
Client No.: 256-4-010
Analyst Observation: White/Grey Caulk
Client Description: White Interior Door Caulking
Location: Door To Pump Room
Facility:
Percent Asbestos: ***PC 1.5*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 98.5

Lab No.: 6880183
Client No.: 256-4-011
Analyst Observation: White/Grey Caulk
Client Description: White Interior Door Caulking
Location: 1st Floor Door To Stairwell
Facility:
Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 2 Fibrous Glass
Percent Non-Fibrous Material: 98

Lab No.: 6880184
Client No.: 256-4-012
Analyst Observation: White/Grey Caulk
Client Description: White Interior Door Caulking
Location: 3rd Floor Door To Stairwell
Facility:
Percent Asbestos: ***PC 1.3*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 98.7

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Client:	TER940	Project No.:	N1197373

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880185
Client No.: 256-5-013
Analyst Observation: Black/Blue Insulation
Client Description: Black Rubber Tank Insulation
Location: North Tank Northeast Corner
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880186
Client No.: 256-5-014
Analyst Observation: Black/Blue Insulation
Client Description: Black Rubber Tank Insulation
Location: North Tank Northwest Corner
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880187
Client No.: 256-5-015
Analyst Observation: Black/Blue Insulation
Client Description: Black Rubber Tank Insulation
Location: South Tank Northwest Corner
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880188
Client No.: 256-6-016
Analyst Observation: White/Grey Glazing
Client Description: White Interior Window Glazing
Location: 3rd Floor Window
Facility:

Percent Asbestos: ***PC 0.5*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 99.5

Lab No.: 6880189
Client No.: 256-6-017
Analyst Observation: White/Grey Glazing
Client Description: White Interior Window Glazing
Location: 3rd Floor Window
Facility:

Percent Asbestos: ***PC 0.75*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 99.25

Lab No.: 6880190
Client No.: 256-6-018
Analyst Observation: White/Grey Glazing
Client Description: White Interior Window Glazing
Location: 3rd Floor Window
Facility:

Percent Asbestos: ***PC 0.25*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 99.75

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Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880191
Client No.: 256-7-019
Analyst Observation: Grey Floor Tile
Client Description: 9x9 Grey Floor Tile With Black Mastic
Location: At Entry To The Lab
Facility:

Percent Asbestos:
PC 1.3 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
98.7

Lab No.: 6880191(L2)
Client No.: 256-7-019
Analyst Observation: Black Mastic
Client Description: 9x9 Grey Floor Tile With Black Mastic
Location: At Entry To The Lab
Facility:

Percent Asbestos:
PC 1.5 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
98.5

Lab No.: 6880192
Client No.: 256-7-020
Analyst Observation: Grey Floor Tile
Client Description: 9x9 Grey Floor Tile With Black Mastic
Location: Northeast Corner Of Restroom
Facility:

Percent Asbestos:
PC 1.2 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
98.8

Lab No.: 6880192(L2)
Client No.: 256-7-020
Analyst Observation: Black Mastic
Client Description: 9x9 Grey Floor Tile With Black Mastic
Location: Northeast Corner Of Restroom
Facility:

Percent Asbestos:
PC 1.8 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
98.2

Lab No.: 6880193
Client No.: 256-7-021
Analyst Observation: Grey Floor Tile
Client Description: 9x9 Grey Floor Tile With Black Mastic
Location: Northwest Corner Of The Lab
Facility:

Percent Asbestos:
PC 1.5 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
98.5

Lab No.: 6880193(L2)
Client No.: 256-7-021
Analyst Observation: Black Mastic
Client Description: 9x9 Grey Floor Tile With Black Mastic
Location: Northwest Corner Of The Lab
Facility:

Percent Asbestos:
PC 2.1 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
97.9

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PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880194
Client No.: 256-8-022
Analyst Observation: Black Cove Base
Client Description: 4 Inch Black Cove Base With Yellow Mastic
Location: Southwest Corner Of Lab Entry
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880194(L2)
Client No.: 256-8-022
Analyst Observation: Yellow/Brown Mastic
Client Description: 4 Inch Black Cove Base With Yellow Mastic
Location: Southwest Corner Of Lab Entry
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880195
Client No.: 256-8-023
Analyst Observation: Black Cove Base
Client Description: 4 Inch Black Cove Base With Yellow Mastic
Location: Northeast Corner Of Restroom
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880195(L2)
Client No.: 256-8-023
Analyst Observation: Yellow/Brown Mastic
Client Description: 4 Inch Black Cove Base With Yellow Mastic
Location: Northeast Corner Of Restroom
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880196
Client No.: 256-8-024
Analyst Observation: Black Cove Base
Client Description: 4 Inch Black Cove Base With Yellow Mastic
Location: Northwest Corner Of The Lab
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880196(L2)
Client No.: 256-8-024
Analyst Observation: Yellow Mastic
Client Description: 4 Inch Black Cove Base With Yellow Mastic
Location: Northwest Corner Of The Lab
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

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Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880197
Client No.: 256-9-025
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2'x4' Ceiling Tile With Bird Track Pattern
Location: Southwest Corner Of The Lab
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
20 Mineral Wool

Percent Non-Fibrous Material:
40

Lab No.: 6880198
Client No.: 256-9-026
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2'x4' Ceiling Tile With Bird Track Pattern
Location: Northeast Corner Of Restroom
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
50 Cellulose
25 Mineral Wool

Percent Non-Fibrous Material:
25

Lab No.: 6880199
Client No.: 256-9-027
Analyst Observation: White/Tan Ceiling Tile
Client Description: 2'x4' Ceiling Tile With Bird Track Pattern
Location: Northeast Corner Of The Lab
Facility:

Percent Asbestos:
None Detected

Percent Non-Asbestos Fibrous Material:
40 Cellulose
20 Mineral Wool

Percent Non-Fibrous Material:
40

Lab No.: 6880200
Client No.: 256-10-028
Analyst Observation: White Caulk
Client Description: White Window Caulking Interior
Location: South Window
Facility:

Percent Asbestos:
***PC Trace** Chrysotile*

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880201
Client No.: 256-10-029
Analyst Observation: White Caulk
Client Description: White Window Caulking Interior
Location: South Window
Facility:

Percent Asbestos:
***PC Trace** Chrysotile*

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

Lab No.: 6880202
Client No.: 256-10-030
Analyst Observation: White Caulk
Client Description: White Window Caulking Interior
Location: East Window
Facility:

Percent Asbestos:
***PC Trace** Chrysotile*

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
100

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PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880203 | **Analyst Observation:** Black Cementitious | **Location:** On Sink
Client No.: 256-11-031 | **Client Description:** Lab Sink | **Facility:**

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880204 | **Analyst Observation:** Black Cementitious | **Location:** On Sink
Client No.: 256-11-032 | **Client Description:** Lab Sink | **Facility:**

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880205 | **Analyst Observation:** Black Cementitious | **Location:** On Sink
Client No.: 256-11-033 | **Client Description:** Lab Sink | **Facility:**

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880206 | **Analyst Observation:** Black Cementitious | **Location:** On Drying Rack
Client No.: 256-12-034 | **Client Description:** Lab Drying Rack | **Facility:**

Percent Asbestos: ***25*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 75

Lab No.: 6880207 | **Analyst Observation:** Black Cementitious | **Location:** On Drying Rack
Client No.: 256-12-035 | **Client Description:** Lab Drying Rack | **Facility:**

Percent Asbestos: ***20*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 80

Lab No.: 6880208 | **Analyst Observation:** Black Cementitious | **Location:** On Drying Rack
Client No.: 256-12-036 | **Client Description:** Lab Drying Rack | **Facility:**

Percent Asbestos: ***20*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 80

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PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880209
Client No.: 256-13-037
Analyst Observation: White Caulk
Client Description: White Exterior Door Caulking
Location: South Door
Facility:
Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880210
Client No.: 256-13-038
Analyst Observation: Grey Caulk
Client Description: White Exterior Door Caulking
Location: Northeast Door
Facility:
Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 2 Fibrous Glass
Percent Non-Fibrous Material: 98

Lab No.: 6880211
Client No.: 256-13-039
Analyst Observation: White Caulk
Client Description: White Exterior Door Caulking
Location: Northwest Door
Facility:
Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880212
Client No.: 256-14-040
Analyst Observation: White Caulk
Client Description: White Expansion Caulk
Location: Near Elevator Equipment Room
Facility:
Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880213
Client No.: 256-14-041
Analyst Observation: White Caulk
Client Description: White Expansion Caulk
Location: Near Northeast Entry
Facility:
Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880214
Client No.: 256-14-042
Analyst Observation: White Caulk
Client Description: White Expansion Caulk
Location: South Side Of Building
Facility:
Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

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Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880215
Client No.: 256-15-043
Analyst Observation: White/Grey Caulk
Client Description: White Caulking
Location: Around Vent
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880216
Client No.: 256-15-044
Analyst Observation: White/Grey Caulk
Client Description: White Caulking
Location: Around Vent
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880217
Client No.: 256-15-045
Analyst Observation: White Caulk
Client Description: White Caulking
Location: Around Vent
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880218
Client No.: 256-16-046
Analyst Observation: White/Brown Drywall
Client Description: Drywall Ceiling Drywall And Compound
Location: South Side
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 10 Cellulose
Percent Non-Fibrous Material: 90

Lab No.: 6880218(L2)
Client No.: 256-16-046
Analyst Observation: White Joint Compound
Client Description: Drywall Ceiling Drywall And Compound
Location: South Side
Facility:

Percent Asbestos: ***PC 0.75*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 99.25

Lab No.: 6880218(L3)
Client No.: 256-16-046
Analyst Observation: White Tape
Client Description: Drywall Ceiling Drywall And Compound
Location: South Side
Facility:

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 100 Cellulose
Percent Non-Fibrous Material: None Detected

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PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880218(L4) **Analyst Observation:** Composite **Location:** South Side
Client No.: 256-16-046 **Client Description:** Drywall Ceiling Drywall And Compound **Facility:**

Percent Asbestos: ***PC Trace*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: 30 Cellulose
Percent Non-Fibrous Material: 70

Lab No.: 6880219 **Analyst Observation:** White/Brown Drywall **Location:** Northwest Corner
Client No.: 256-16-047 **Client Description:** Drywall Ceiling Drywall And Compound **Facility:**

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 10 Cellulose
Percent Non-Fibrous Material: 90

Lab No.: 6880219(L2) **Analyst Observation:** White Joint Compound **Location:** Northwest Corner
Client No.: 256-16-047 **Client Description:** Drywall Ceiling Drywall And Compound **Facility:**

Percent Asbestos: ***PC 0.5*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 99.5

Lab No.: 6880219(L3) **Analyst Observation:** White Tape **Location:** Northwest Corner
Client No.: 256-16-047 **Client Description:** Drywall Ceiling Drywall And Compound **Facility:**

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 100 Cellulose
Percent Non-Fibrous Material: None Detected

Lab No.: 6880219(L4) **Analyst Observation:** Composite **Location:** Northwest Corner
Client No.: 256-16-047 **Client Description:** Drywall Ceiling Drywall And Compound **Facility:**

Percent Asbestos: ***PC Trace*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: 30 Cellulose
Percent Non-Fibrous Material: 70

Lab No.: 6880220 **Analyst Observation:** White/Brown Drywall **Location:** North Side
Client No.: 256-16-048 **Client Description:** Drywall Ceiling Drywall And Compound **Facility:**

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 12 Cellulose
Percent Non-Fibrous Material: 88

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/24/2019
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/24/2019
	611 Lunken Park Drive	Report No.:	599954 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B256
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880220(L2) **Analyst Observation:** White Joint Compound **Location:** North Side
Client No.: 256-16-048 **Client Description:** Drywall Ceiling Drywall And Compound **Facility:**

Percent Asbestos: ***PC 0.25*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 99.75

Lab No.: 6880220(L3) **Analyst Observation:** White Tape **Location:** North Side
Client No.: 256-16-048 **Client Description:** Drywall Ceiling Drywall And Compound **Facility:**

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: 100 Cellulose
Percent Non-Fibrous Material: None Detected

Lab No.: 6880220(L4) **Analyst Observation:** Composite **Location:** North Side
Client No.: 256-16-048 **Client Description:** Drywall Ceiling Drywall And Compound **Facility:**

Percent Asbestos: ***PC Trace*** *Chrysotile*
Percent Non-Asbestos Fibrous Material: 30 Cellulose
Percent Non-Fibrous Material: 70

Lab No.: 6880221 **Analyst Observation:** Grey Caulk **Location:** East Side
Client No.: 256-17-049 **Client Description:** Grey Exterior Caulking **Facility:**

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: Trace Fibrous Glass
Percent Non-Fibrous Material: 100

Lab No.: 6880222 **Analyst Observation:** Grey Caulk **Location:** East Side
Client No.: 256-17-050 **Client Description:** Grey Exterior Caulking **Facility:**

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Lab No.: 6880223 **Analyst Observation:** Grey Caulk **Location:** West Side
Client No.: 256-17-051 **Client Description:** Grey Exterior Caulking **Facility:**

Percent Asbestos: *None Detected*
Percent Non-Asbestos Fibrous Material: None Detected
Percent Non-Fibrous Material: 100

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/24/2019
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/24/2019
	611 Lunken Park Drive	Report No.:	599954 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B256
		Project No.:	N1197373
Client:	TER940		

PLM BULK SAMPLE ANALYSIS SUMMARY

Lab No.: 6880224
Client No.: 256-18-052
Analyst Observation: White Glazing
Client Description: White Exterior Glazing
Location: Southwest Window In Chemical Feed Room
Facility:

Percent Asbestos:
PC 1.00 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
99

Lab No.: 6880225
Client No.: 256-18-053
Analyst Observation: White Glazing
Client Description: White Exterior Glazing
Location: Pump Room
Facility:

Percent Asbestos:
PC 0.75 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
99.25

Lab No.: 6880226
Client No.: 256-18-054
Analyst Observation: White Glazing
Client Description: White Exterior Glazing
Location: Pump Room
Facility:

Percent Asbestos:
PC 0.75 *Chrysotile*

Percent Non-Asbestos Fibrous Material:
None Detected

Percent Non-Fibrous Material:
99.25

Please refer to the Appendix of this report for further information regarding your analysis.

Date Received: 9/19/2019
Date Analyzed: 09/24/2019
Signature:
Analyst: Linda Price

Approved By:
Frank E. Ehrenfeld, III
Laboratory Director

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/24/2019
	611 Lunken Park Drive	Report No.:	599954 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B256
		Project No.:	N1197373
Client:	TER940		

Appendix to Analytical Report

Customer Contact:
Method:40 CFR Appendix E to Subpart E of Part 763, interim method for the Determination of Asbestos in Bulk Insulation Samples, and USEPA 600, R93-116 as needed.

This appendix seeks to promote greater understanding of any observations, exceptions, special instructions, or circumstances that the laboratory needs to communicate to the client concerning the above samples. The information below is used to help promote your ability to make the most informed decisions for you and your customers. Please note the following points of contact for any questions you may have.

iATL Customer Service: customerservice@iatl.com
iATL Office Manager:wchampion@iatl.com
iATL Account Representative: Cassie Doherty
Sample Login Notes: See Batch Sheet Attached
Sample Matrix: Bulk Building Materials
Exceptions Noted: See Following Pages

General Terms, Warrants, Limits, Qualifiers:

General information about iATL capabilities and client/laboratory relationships and responsibilities are spelled out in iATL policies that are listed at www.iATL.com and ir our Quality Assurance Manual per ISO 17025 standard requirements. The information therein is a representation of iATL definitions and policies for turnaround times, sample submittal, collection media, blank definitions, quantification issues and limit of detection, analytical methods and procedures, sub-contracting policies, results reporting options, fees, terms, and discounts, confidentiality, sample archival and disposal, and data interpretation.

iATL warrants the test results to be of a precision normal for the type and methodology employed for each sample submitted. iATL disclaims any other warrants, expressed or implied, including warranty of fitness for a particular purpose and warranty of merchantability. iATL accepts no legal responsibility for the purpose for which the client uses test results. Any analytical work performed must be governed by our Standard Terms and Conditions. Prices, methods and detection limits may be changed without notification. Please contact your Customer Service Representative for the most current information.

This confidential report relates only to those item(s) tested and does not represent an endorsement by NIST-NVLAP, AIHA LAP LLC, or any agency of local, state or province governments nor of any agency of the U.S. government.

This report shall not be reproduced except in full, without written approval of the laboratory.

Information Pertinent to this Report:

Analysis by US EPA 600 93-116: Determination of Asbestos in Bulk Building Materials by Polarized Light Microscopy (PLM).

Certifications:

- NIST-NVLAP No. 101165-0
- NYSDOH-ELAP No. 11021
- AIHA-LAP, LLC No. 100188

Quantification at <0.25% by volume is possible with this method. (PC) Indicates Stratified Point Count Method performed. (PC-Trace) means that asbestos was detected but is not quantifiable under the Point Counting regimen. PC Trace represents a <0.25% amount. Analysis includes all distinct separable layers in accordance with EPA 600 Method. If not reported or otherwise noted, layer is either not present or the client has specifically requested that it not be analyzed (ex. analyze until positive instructions). Small asbestos fibers may be missed by PLM due to resolution limitations of the optical microscope. Therefore, PLM is not consistently reliable in detecting asbestos in non-friable organically bound (NOB) materials. Quantitative transmission electron microscopy (TEM) is currently the only method that can pronounce materials as non-asbestos containing.

Analytical Methodology Alternatives: Your initial request for analysis may not have accounted for recent advances in regulatory requirements or advances in technology that are routinely used in similar situations for other qualified projects. You may have the option to explore additional analysis for further information. Below are a few options, listed as the matrix followed by the appropriate methodology. Also included are links to more information on our website.

Bulk Building Materials that are Non-Friable Organically Bound (NOB) by Gravimetric Reduction techniques employing PLM and TEM: ELAP 198.6 (PLM-NOB), ELAP 198.4 (TEM-NOB)

9000 Commerce Parkway Suite B
Mt. Laurel, New Jersey 08054
Telephone: 856-231-9449
Email: customerservice@iatl.com

CERTIFICATE OF ANALYSIS

Client:	Terracon	Report Date:	9/24/2019
	611 Lunken Park Drive	Report No.:	599954 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B256
		Project No.:	N1197373
Client:	TER940		

Loose Fill Vermiculite Insulation, Attic Insulation, Zonolite (copyright), etc.: US EPA 600 R-4/004 (multi-tiered analytical process)
Sprayed On Insulation/Fireproofing with Vermiculite (SOF-V): ELAP 198.8 (PLM-SOF-V)

Soil, sludge, sediment, aggregate, and like materials analyzed for asbestos or other elongated mineral particles (ex. erionite, etc.): ASTM D7521, CARB 435, and other options available

Asbestos in Surface Dust according to one of ASTM's Methods (very dependent on sampling collection technique – by TEM): ASTM D 5755, D5756, or D6480

Various other asbestos matrices (air, water, etc.) and analytical methods are available.

Disclaimers / Qualifiers:

There may be some samples in this project that have a "NOTE:" associated with a sample result. We use added disclaimers or qualifiers to inform the client about something that requires further explanation. Here is a list with highlighted disclaimers that may be pertinent to this project. For a full explanation of these and other disclaimers, please inquire at **customerservice@iatl.com**.

1) Note: No mastic provided for analysis.
2) Note: Insufficient mastic provided for analysis.
3) Note: Insufficient material provided for analysis.
4) Note: Insufficient sample provided for QC reanalysis.
5) Note: Different material than indicated on Sample Log / Description.
6) Note: Sample not submitted.
7) Note: Attached to asbestos containing material.
8) Note: Received wet.
9) Note: Possible surface contamination.
10) Note: Not building material. 1% threshold may not apply.
11) Note: Recommend TEM-NOB analysis as per EPA recommendations.
12) Note: Asbestos detected but not quantifiable.
13) Note: Multiple identical samples submitted, only one analyzed.
14) Note: Analyzed by EPA 600/R-93/116. Point Counting detection limit at 0.080%.
15) Note: Analyzed by EPA 600/R-93/116. Point Counting detection limit at 0.125%.
16) Note: This sample contains >10% vermiculite mineral. See Appendix for Recommendations for Vermiculite Analysis.

Recommendations for Vermiculite Analysis:

Several analytical protocols exist for the analysis of asbestos in vermiculite. These analytical approaches vary depending upon the nature of the vermiculite mineral being tested (e.g. un-processed gange, homogeneous exfoliated books of mica, or mixed mineral composites).Please contact your client representative for pricing and turnaround time options available.

iATL recommends initial testing using the EPA 600/R-93/116 method. This method is specifically designed for the analysis of asbestos in bulk building materials. It provides an acceptable starting point for primary screening of vermiculite for possible asbestos.

Results from this testing may be inconclusive. EPA suggests proceeding to a multi-tiered analysis involving wet separation techniques in conjunction with PLM and TEM gravimetric analysis (EPA 600/R-04/004).

For New York State customers, NYSDOH requires disclaimers and qualifiers for various vermiculite containing samples that direct analysis via ELAP198.6 and ELAP198.8 for samples that contain >10% vermiculite mineral where ELAP198.6 may be used to evaluate the asbestos content of the material. However, any test result using ELAP198.6 will be reported with the following disclaimer: “ELAP198.6 method does not remove vermiculite and may underestimate the level of asbestos present in a sample containing >10% vermiculite.”

Further information on this method and other vermiculite and asbestos issues can be found at the following: Agency for Toxic Substances and Disease Registry (ATSDR) www.atsdr.cdc.gov, United States Geological Survey (USGS) www.minerals.usgs.gov/minerals/, US EPA www.epa.gov/asbestos. The USEPA also has an informative brochure "Current Best Practices for Vermiculite Attic Insulation" EPA 747F03001 May 2003, that may assist the health and remediation professional.

The following is a summary of the analytical process outlines in the EPA 600/R-04/004 Method:

1)**Analytical Step/Method:** Initial Screening by PLM, EPA 600R-93/116
Requirements/Comments: Minimum of 0.1 g of sample. ~0.25% LOQ for most samples.

2)**Analytical Step/Method:** Wet Separation by PLM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Sinks" only.

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Telephone: 856-231-9449
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CERTIFICATE OF ANALYSIS

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	611 Lunken Park Drive	Report No.:	599954 - PLM
	Cincinnati OH 45226	Project:	Chillicothe VAMC B256
		Project No.:	N1197373
Client:	TER940		

3)**Analytical Step/Method:** Wet Separation by PLM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Floats" only.

4)**Analytical Step/Method:** Wet Separation by TEM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Sinks" only.

5)**Analytical Step/Method:** Wet Separation by TEM Gravimetric Technique, EPA R-04/004
Requirements/Comments: Minimum 50g** of dry sample. Analysis of "Suspension" only.

LOQ, Limit of Quantitation estimates for mass and volume analyses.
*With advance notice and confirmation by the laboratory.
**Approximately 1 Liter of sample in double-bagged container (~9x6 inch bag of sample).

iATL INTERNATIONAL
ASBESTOS TESTING LABORATORIES

9000 Commerce Parkway, Suite B • Mount Laurel, NJ 08054
Phone: 877-428-4285/856-231-9449 • Fax: 856-231-9818

Chain of Custody

–Bulk Asbestos –

Contact Information

Client Company:	Terracon Consultants, Inc.	**Project Number:**	N1197373
Office Address:	611 Lunken Park Drive	**Project Name:**	Chillicothe VAMC B256
City, State, Zip:	Cincinnati, OH 45226	**Primary Contact:**	Joshua Vogel
Fax Number:	513-321-0294	**Office Phone:**	513-612-9085
Email Address:	joshua.vogel@terracon.com	**Cell Phone:**	513-332-5034

PLM Instructions:

- ☒ PLM: Bulk Asbestos Building Materials EPA 600 R-93/116, 1993
- ☐ PLM: Bulk Asbestos Building Materials EPA 600 M-4/82-020, 1982
- ☐ PLM: Bulk Asbestos Building Materials NIOSH 9002, 1985
- ☐ PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.1, 2002
- ☐ PLM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.6, 2010
- ☐ TEM: Bulk Asbestos Building Materials NYSDOH-ELAP 198.4, 2009

☒ PLM: Point Counting
- ☐ PC: via ELAP 198.1
- ☒ PC: 400 Points
- ☐ PC: 800 Points *
- ☐ PC: 1600 Points *

☒ PLM: Instructions for Multi-Layered Samples
- ☒ Analyze and Report All Separable Layers per EPA 600
- ☒ Report Composite for Drywall Systems per NESHAP
- ☐ Report All Layers and Composite Where Applicable
- ☐ Only Analyze and Report Specifically Noted Layer

☐ PLM: Analyze Until Positive (Positive Stop)
- ☐ AUP: by Homogenous Area as Noted
- ☐ AUP: by Material Type as Noted

☐ PLM: NOB via 198.6
- ☐ PLM: Friable via EPA 600 2.3
- ☐ If <1% by PLM, to TEM via 198.4 *
- ☐ If <1% by PLM, Hold for Instructions

☐ PLM: Non-Building Material*,** (Dust, Wipe, Tape)
- ☐ Soil or Vermiculite Analysis*
- ☐ CARB 435

Special Instructions: _____

** Additional charge and turnaround may be required* *** Alternative Method (ex: EPA 600/R-04/004) may be recommended by Laboratory*

Turnaround Time

Preliminary Results Requested Date: _____ (Specific date / time) ☐ Verbal ☒ Email ☐ Fax

☐ 10 Day ☒ 5 Day ☐ 3 Day ☐ 2 Day ☐ 1 Day* ☐ 12 Hour** ☐ 6 Hour** ☐ RUSH**

* End of next business day unless otherwise specified. ** Matrix Dependent. ***Please notify the lab before shipping***

Chain of Custody

Relinquished (Name/Organization):	[signature]	Date: 09/18/19	Time:
Received (Name / iATL):		Date:	Time:
Sample Login (Name / iATL):		Date:	Time:
Analysis(Name(s) / iATL):	LSP 9.24.19	Date:	Time: SEP 18 2019
QA/QC Review (Name / iATL):	KAMPM	Date: 9/26/19	Time:
Archived / Released: _____ QA/QC InterLAB Use: _____		Date:	Time:

SUSPECT ACM - BULK MATERIAL SAMPLE LOG

Date: September 18, 2019
Inspector: Joshua Vogel
Project: Chillicothe VAMC Building 256
Project # N1197373

Terracon
611 Lunken Park Drive
Cincinnati, Ohio 45226
(513) 321.5816

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
256-1	001	White Interior Window Caulk	Bottom of Window in Pump Room	Pump Room, Chemical Feed Room	6880173
	002		NW Window in Chem. Feed Room		6880174
	003		SW Window in Chem. Feed Room		6880175
256-2	004	White Mastic on Fiberglass Pipe Insulation	East Side of Restroom	Throughout Building	6880176
	005		Pipe off of South Tank on Northeast Corner of Tank		6880177
	006		Middle of East Wall In Pump Room		6880178
256-3	007	White Expansion Caulking Interior	Bottom of the Steps 1st Floor Stairs	Throughout Building	6880179
	008		NW Corner of Pump Room		6880180
	009		Middle of West Wall in the Chlorination Room		6880181
256-4	010	White Interior Door Caulking	Door to Pump Room	Throughout Building	6880182
	011		1St Floor Door to Stairwell		6880183
	012		3Rd Floor Door To Stairwell		6880184
256-5	013	Black Rubber tank Insulation	North Tank North East Corner	On Water Tanks	6880185
	014		North Tank North West Corner		6880186
	015		South Tank North West Corner		6880187

SUSPECT ACM - BULK MATERIAL SAMPLE LOG

Page ____ of ____

Date: September 18, 2019
Inspector: Joshua Vogel
Project: Chillicothe VAMC Building 256
Project # N1197373

Terracon
611 Lunken Park Drive
Cincinnati, Ohio 45226
(513) 321.5816

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
256-1	001	White Interior Window Caulk	Bottom of Window in Pump Room	Pump Room, Chemical Feed Room	6880173
	002		NW Window in Chem. Feed Room		6880174
	003		SW Window in Chem. Feed Room		6880175
256-2	004	White Mastic on Fiberglass Pipe Insulation	East Side of Restroom	Throughout Building	6880176
	005		Pipe off of South Tank on Northeast Corner of Tank		6880177
	006		Middle of East Wall In Pump Room		6880178
256-3	007	White Expansion Caulking Interior	Bottom of the Steps 1st Floor Stairs	Throughout Building	6880179
	008		NW Corner of Pump Room		6880180
	009		Middle of West Wall in the Chlorination Room		6880181
256-4	010	White Interior Door Caulking	Door to Pump Room	Throughout Building	6880182
	011		1St Floor Door to Stairwell		6880183
	012		3Rd Floor Door To Stairwell		6880184
256-5	013	Black Rubber tank Insulation	North Tank North East Corner	On Water Tanks	6880185
	014		North Tank North West Corner		6880186
	015		South Tank North West Corner		6880187

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
256-6	016	White Interior Window Glazing	3Rd Floor Window	3RD Floor Stairwell Landing	
	017		3Rd Floor Window		6880183
	018		3Rd Floor Window		6880190
256-7	019	9X9 Grey Floor Tile with Black Mastic	At Entry To the Lab	Lab Entry, Toilet Room, Lab	6880191
	020		Northeast Corner of Restroom		6880192
	021		Northwest Corner of the Lab		6880193
256-8	022	4 Inch Black Cove Base with Yellow Mastic	Southwest Corner of Lab Entry	Lab Entry, Toilet Room, Lab	6880194
	023		Northeast Corner of Restroom		6880195
	024		Northwest Corner of the Lab		6880196
256-9	025	2'x4' Ceiling Tile with Bird Track Pattern	Southwest Corner of the Lab	Lab Entry, Toilet Room, Lab	6880197
	026		Northeast Corner of Restroom		6880198
	027		Northeast Corner of the Lab		6880199
256-10	028	White Window Caulking Interior	South Window	Lab Windows	
	029		South Window		6880200
	030		East Window		6880201
256-11	031	Lab Sink	On Sink	Lab	
	032		On Sink		6880203
	033		On Sink		6880204

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
256-12	034	Lab Drying Rack	On Drying Rack	East Wall of Lab	6880206
	035		On Drying Rack		6880207
	036		On Drying Rack		6880208
256-13	037	White Exterior Door Caulking	South Door	Exterior Doors	6880209
	038		Northeast Door		6880210
	039		Northwest Door		6880211
256-14	040	White Expansion Caulk	Near Elevator Equipment Room	Exterior Walls	6880212
	041		Near Northeast Entry		6880213
	042		South side of Building		6880214
256-15	043	White Caulking	Around Vent	Around Vent on Northwest side of Building	6880215
	044		Around Vent		6880216
	045		Around Vent		6880217
256-16	046	Drywall Ceiling Drywall and Compound	South Side	Elevator Equipment Room	6880218
	047		Northwest Corner		6880219
	048		North Side		6880220
256-17	049	Grey Exterior Caulking	East Side	Around Louvers on South Side of Building	6880221
	050		East Side		6880222
	051		West Side		6880223

Sample #		Sample Material Description	Sample Location	HA Location(s)	Results (% / Type of Asbestos)
HA #	SEQ. #				
256-18	052	White Exterior Window Glazing	Southwest window in Chemical Feed Room	Chemical Feed Room, Pump Room	6880224
	053		Pump Room		6880225
	054		Pump Room		6880226

APPENDIX E

SAMPLE LOCATION DRAWINGS

Ohio Environmental Protection Agency

Mike DeWine, Governor
Jon Husted, Lt. Governor
Laurie A. Stevenson, Director

January 31, 2019

Joshua Vogel
Terracon
611 Lunken Park Drive
Cincinnati OH 45226

RE: Asbestos Hazard Evaluation Specialist
Certification Number: ES35291
Expiration Date: 03/03/2020

Dear Joshua Vogel:

This letter and enclosed certification card approves your request to be certified as an Asbestos Hazard Evaluation Specialist. You must present your card upon request at any project site while performing duties. Copies of cards are not acceptable as proof of certification.

This certification may be revoked by the Director of the Environmental Protection Agency for violation of any of the requirements of 3745-22 or 3745-20 of the Ohio Administrative Code.

If you have any questions, please call 614-644-0226.

Sincerely,

Joshua S. Koch
Manager, Business Operations Support Section
Division of Air Pollution Control

APPENDIX D

LICENSES AND CERTIFICATIONS

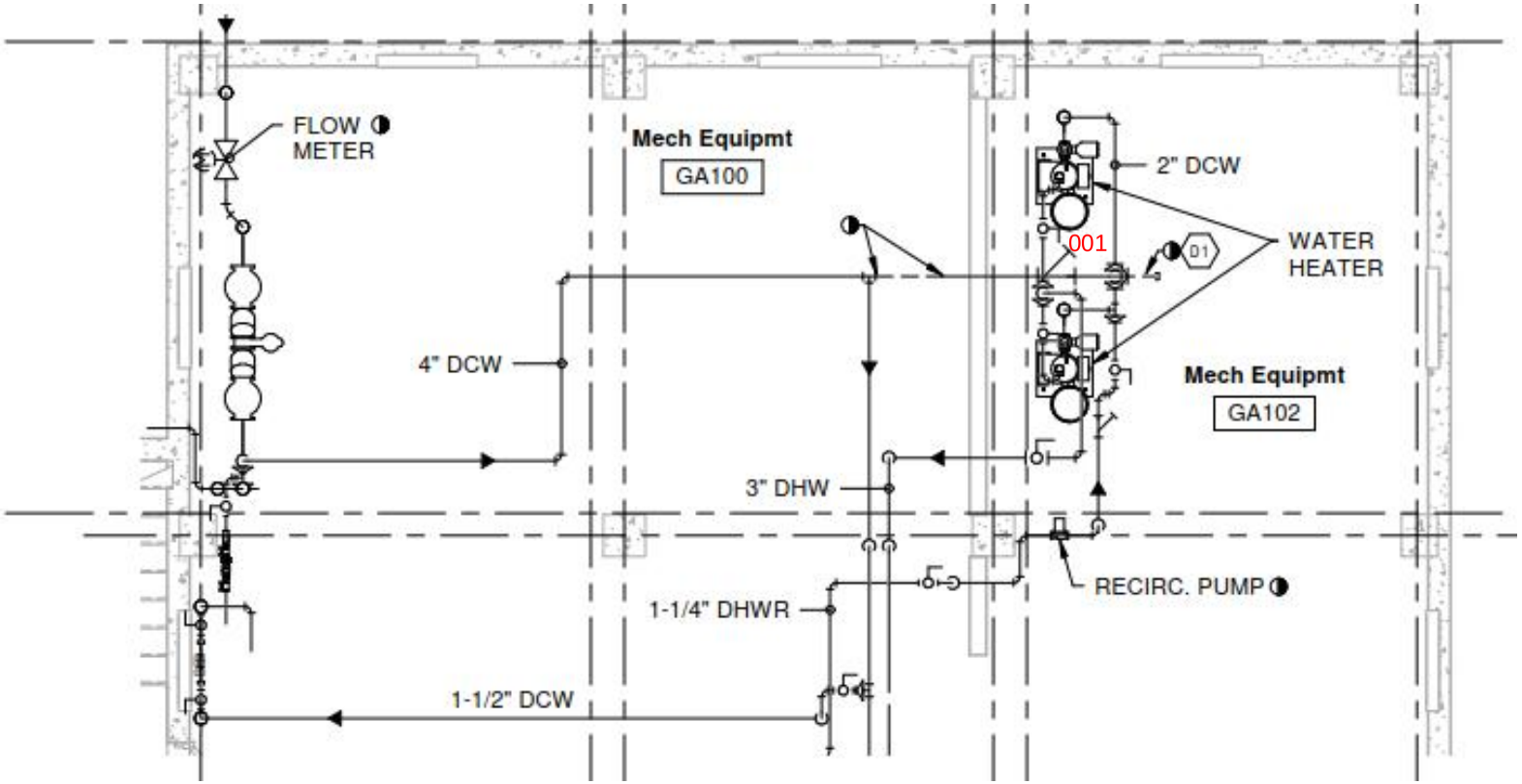


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: JV	Project No. N1197373
Drawn by: GV	Scale: N.T.S.
Checked by: JV	
Approved by: JAT	Date: 09/18/19

Terracon
Consulting Engineers & Scientists
3601 Mojave Court, Suite A Columbia, Missouri 65202
PH. (573) 214-2677 FAX. (573) 214-2714

ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 24 – Mechanical Room

Exhibit

1

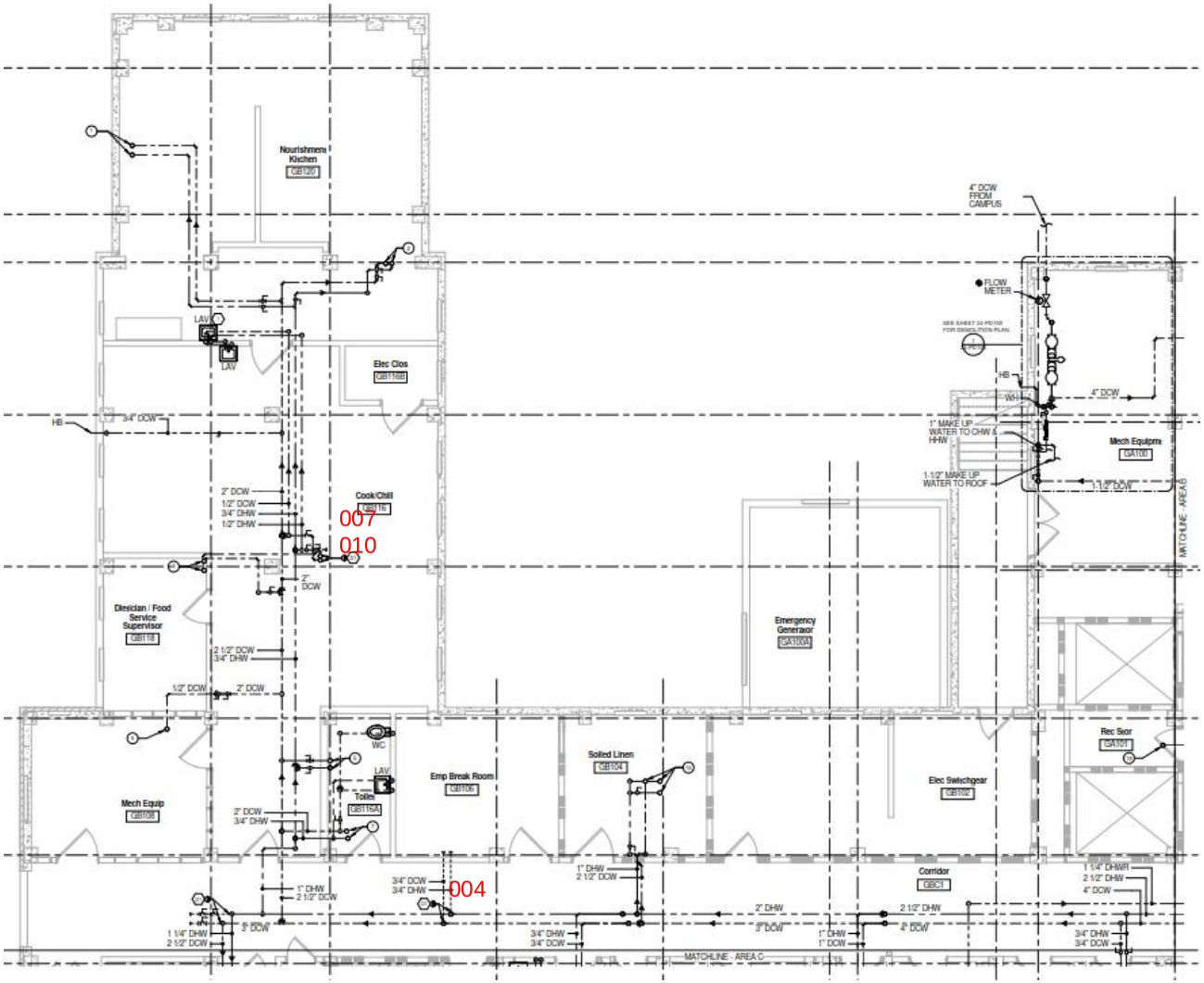


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: JV	Project No. N1197373	Terracon Consulting Engineers & Scientists
Drawn by: GV	Scale: N.T.S.	3601 Mojave Court, Suite A Columbia, Missouri 65202
Checked by: JV		PH. (573) 214-2677 FAX. (573) 214-2714
Approved by: JAT	Date: 09/18/19	

ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 24 – Basement Plan Area A

Exhibit 2

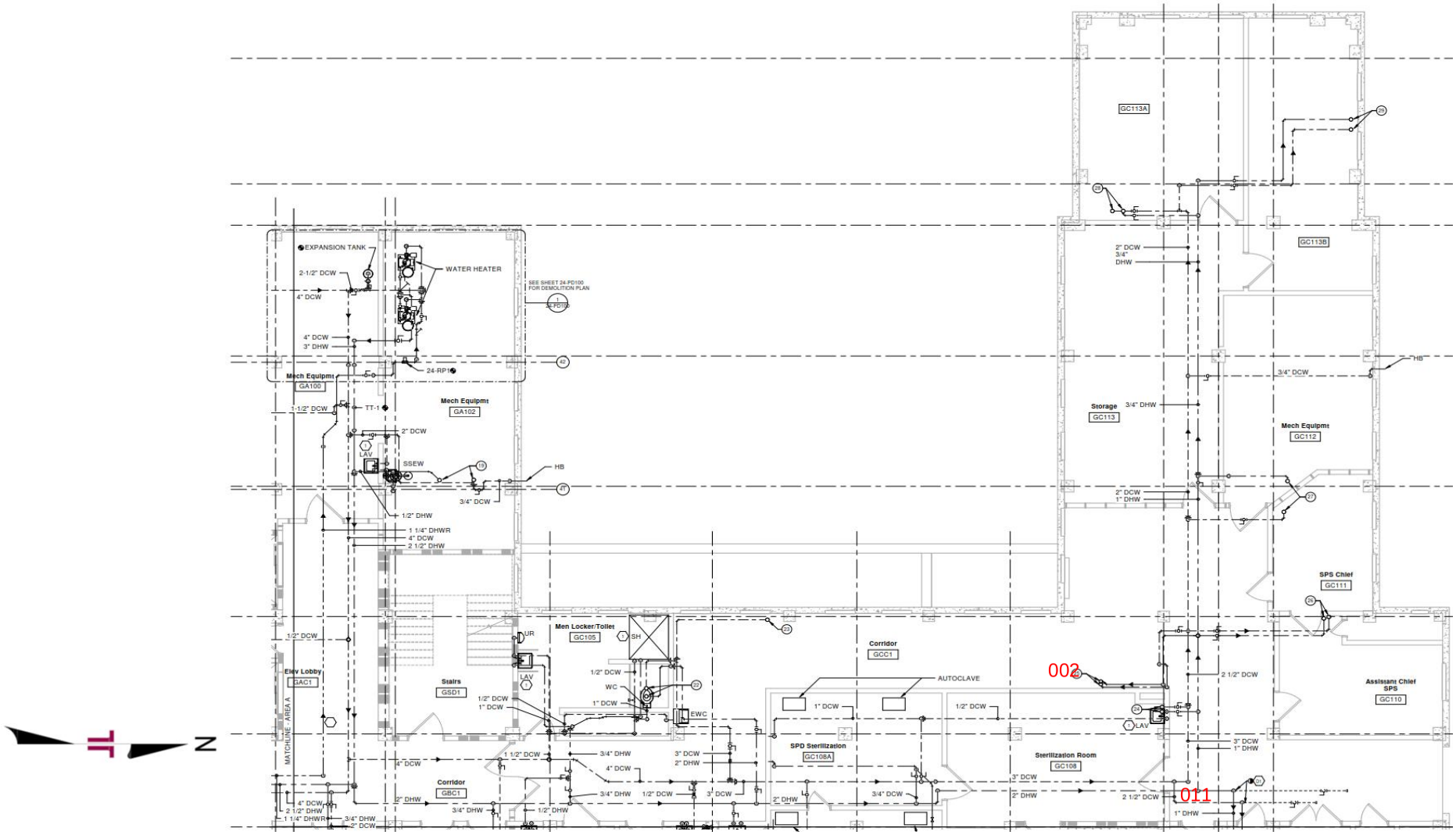


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: JV	Project No. N1197373
Drawn by: GV	Scale: N.T.S.
Checked by: JV	
Approved by: JAT	Date: 09/18/19

Terracon
Consulting Engineers & Scientists
3601 Mojave Court, Suite A Columbia, Missouri 65202
PH. (573) 214-2677 FAX. (573) 214-2714

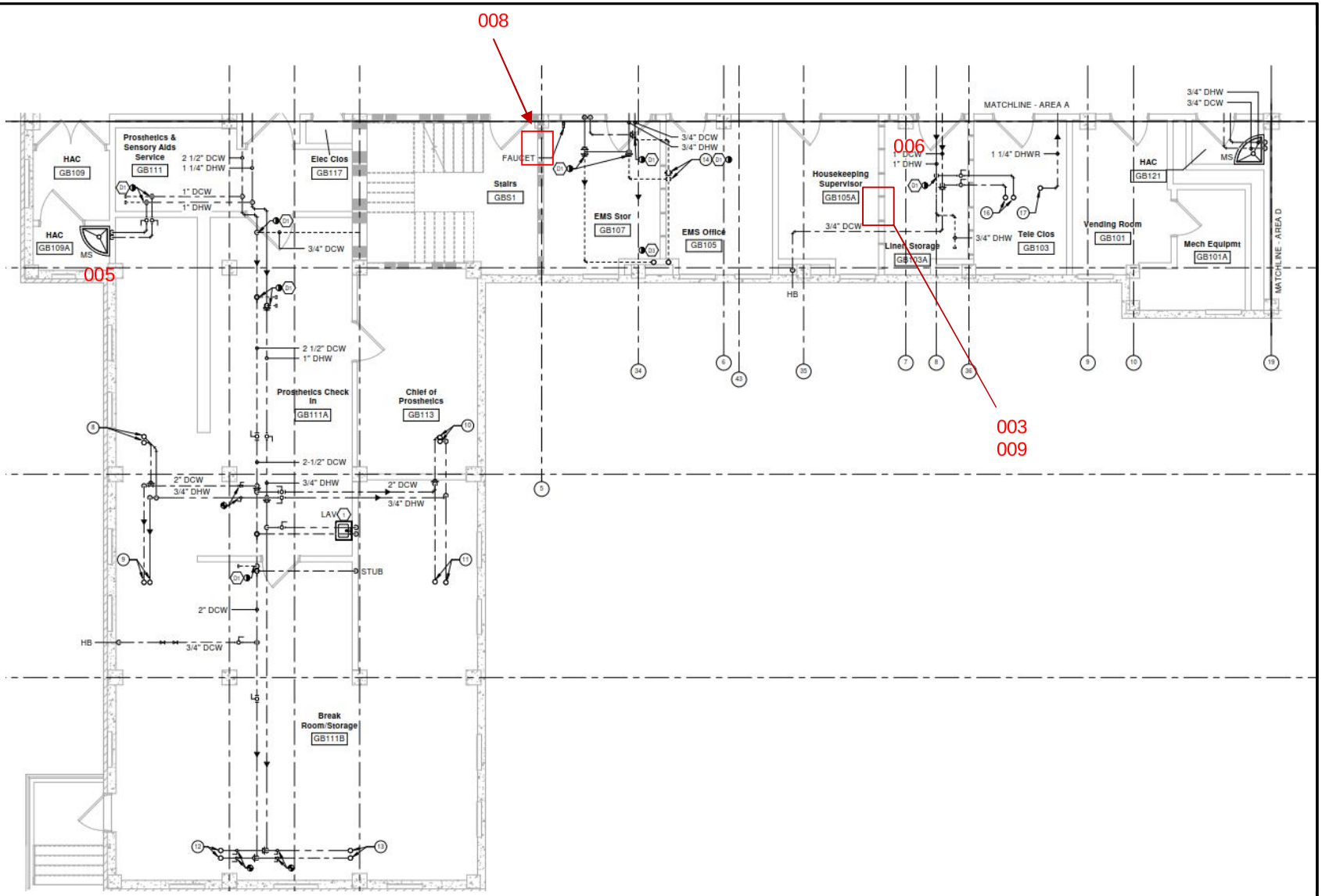
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 24 – Basement Plan Area A

Exhibit

3



N

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: JV	Project No. N1197373	
Drawn by: GV	Scale: N.T.S.	
Checked by: JV		
Approved by: JAT	Date: 09/18/19	

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PH. (573) 214-2677 FAX. (573) 214-2714

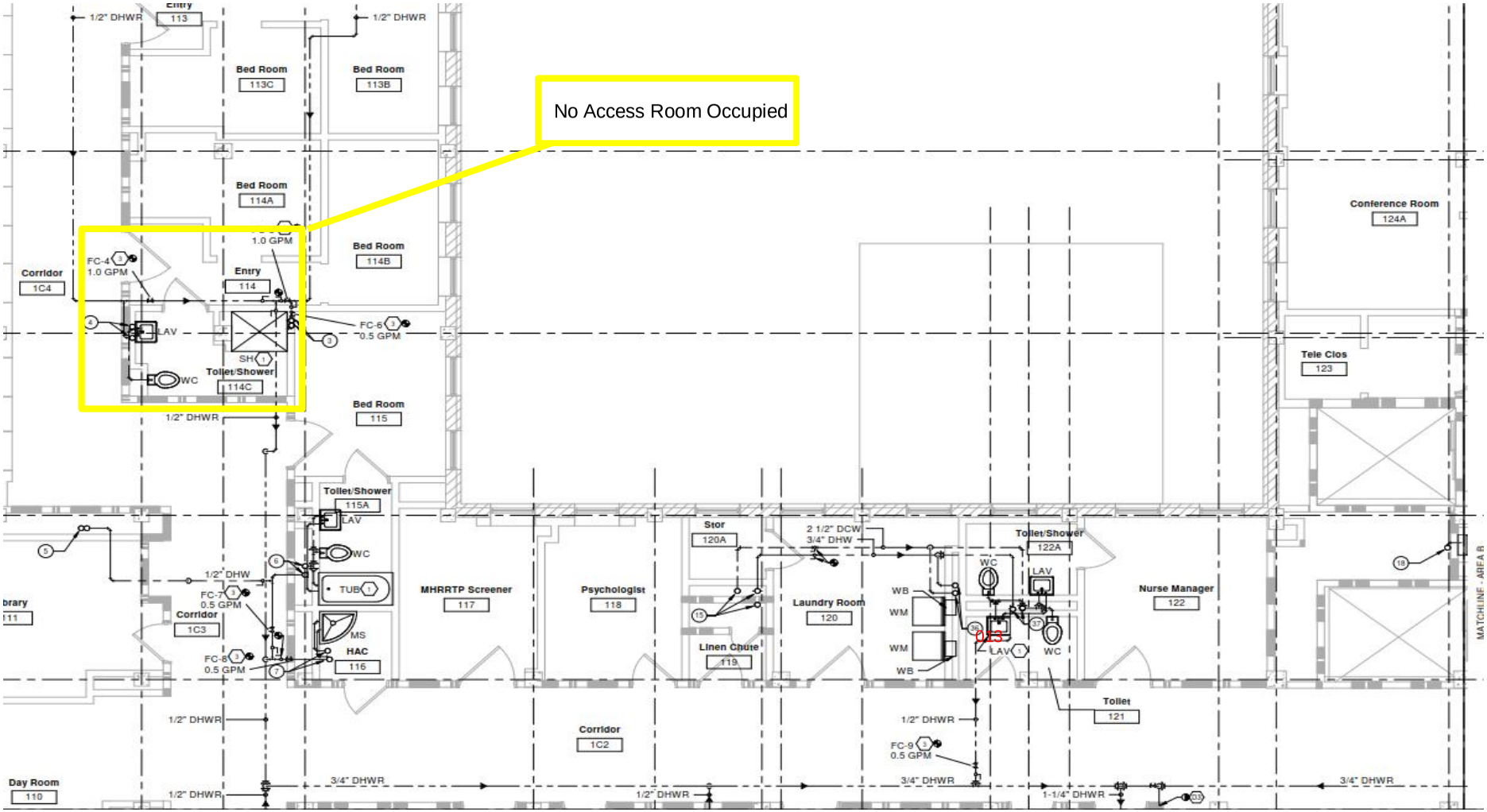
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 24 – Basement Plan Area C

Exhibit

4



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Project Manager:	JV
Drawn by:	GV
Checked by:	JV
Approved by:	JAT

Project No.	N1197373
Scale:	N.T.S.
Date:	09/18/19

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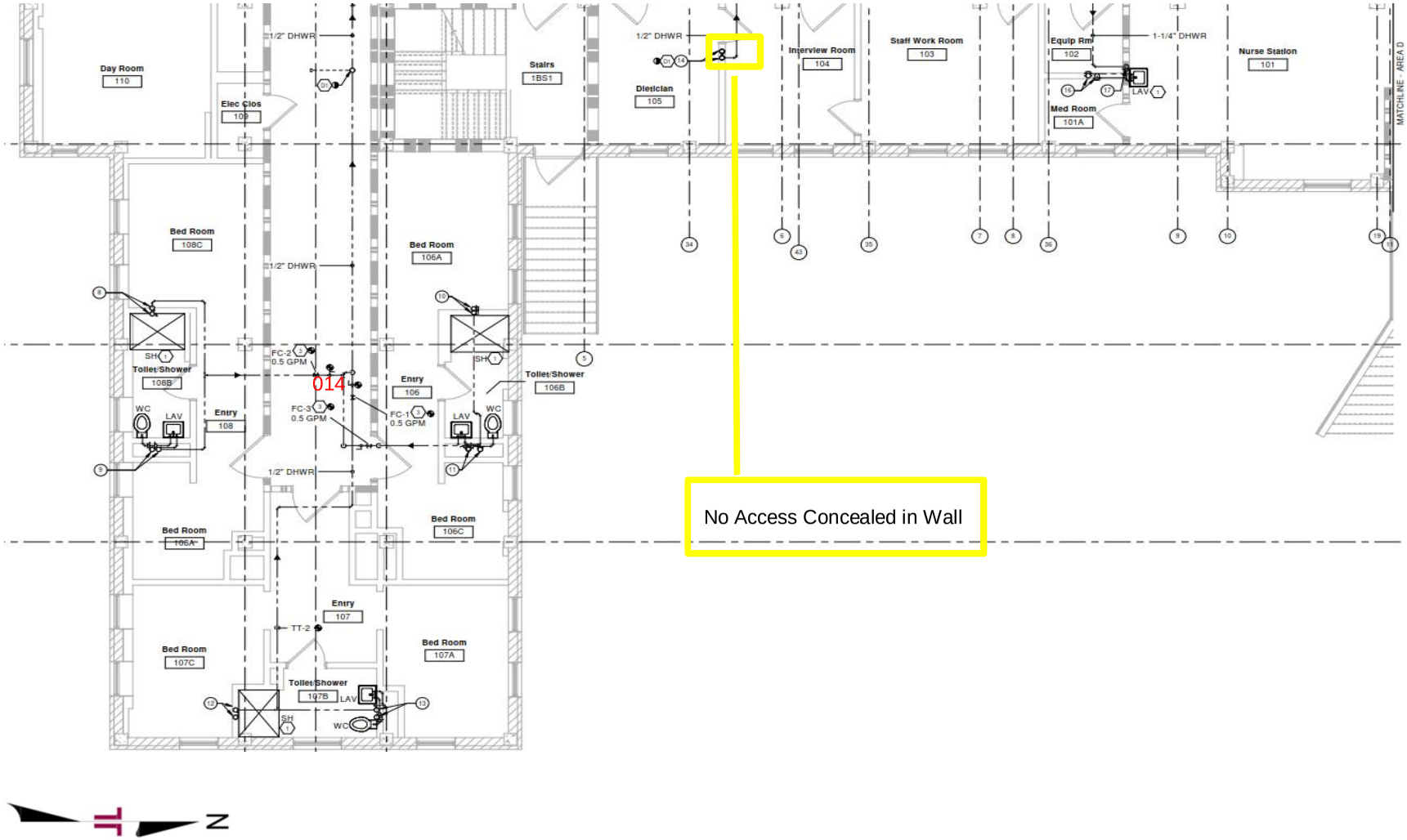
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 24 – First Floor Plan Area A

Exhibit

5



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ASBESTOS SAMPLE LOCATION DIAGRAM

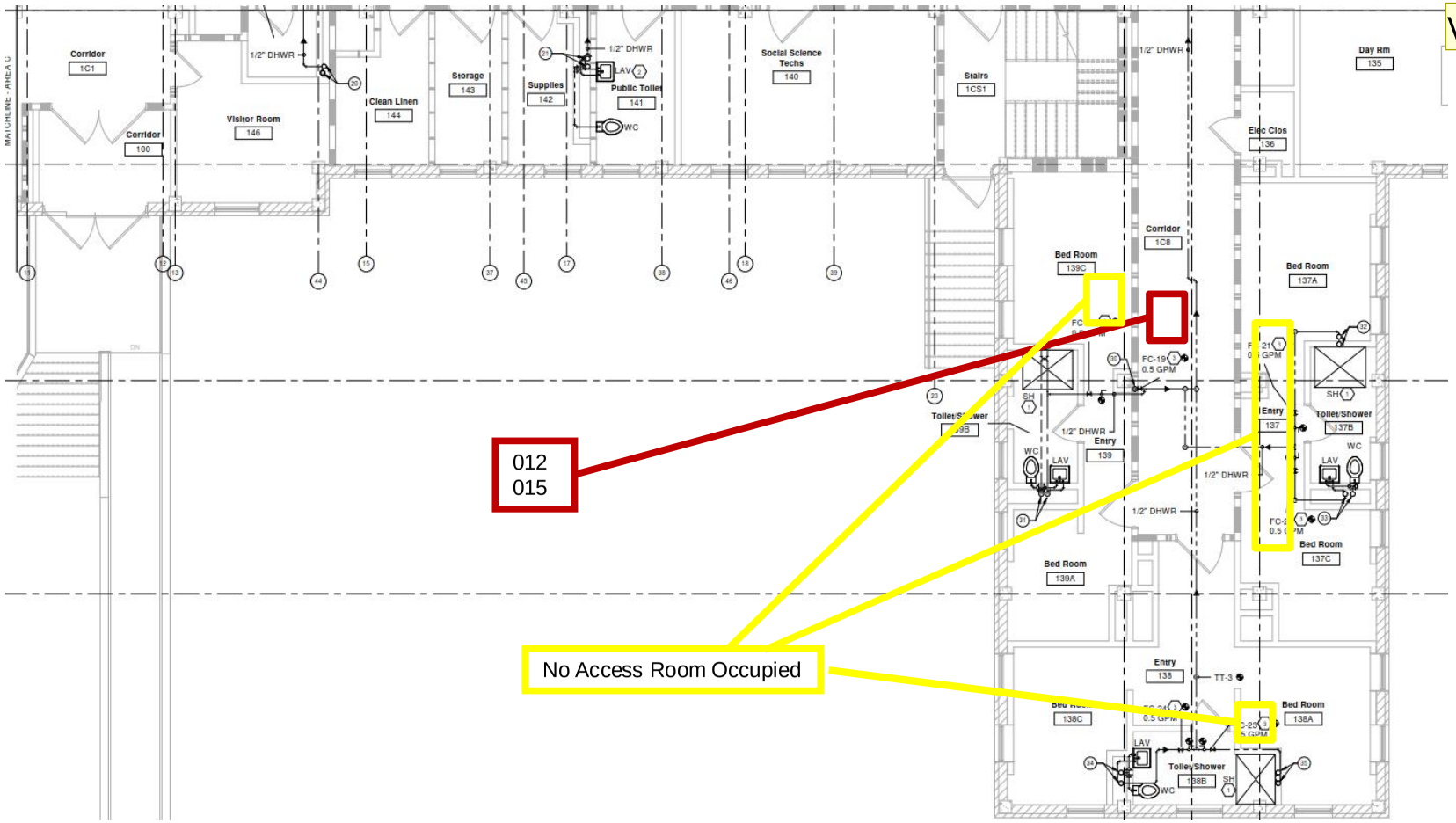
Chillicothe VAMC

Building 24 – First Floor Plan Area C

Exhibit

6

VGA1



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Drawn by: GV	Scale: N.T.S.	
Checked by: JV		
Approved by: JAT	Date: 09/18/19	

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ASBESTOS SAMPLE LOCATION DIAGRAM

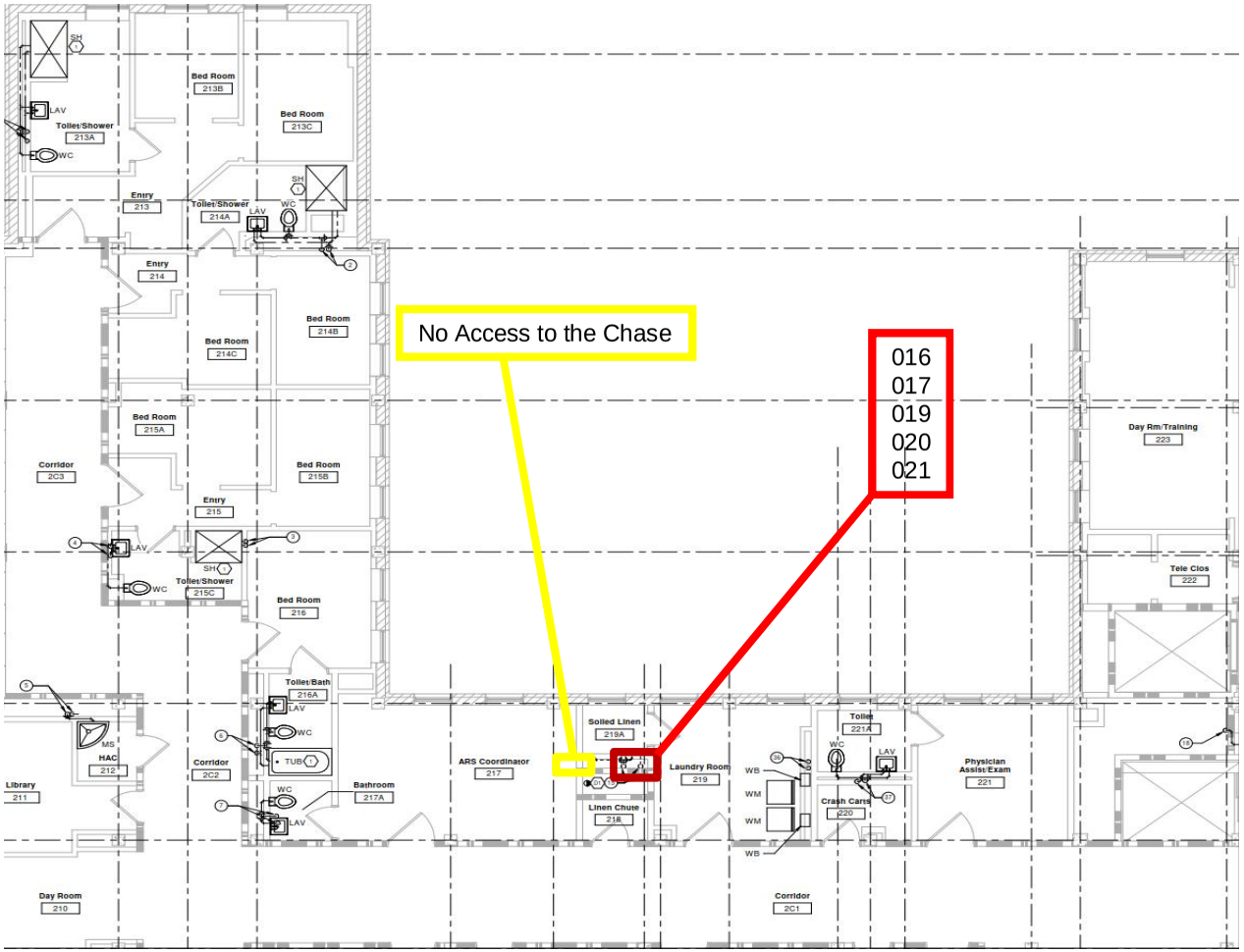
Chillicothe VAMC

Building 24 – First Floor Plan Area D

Exhibit

7

VGA1



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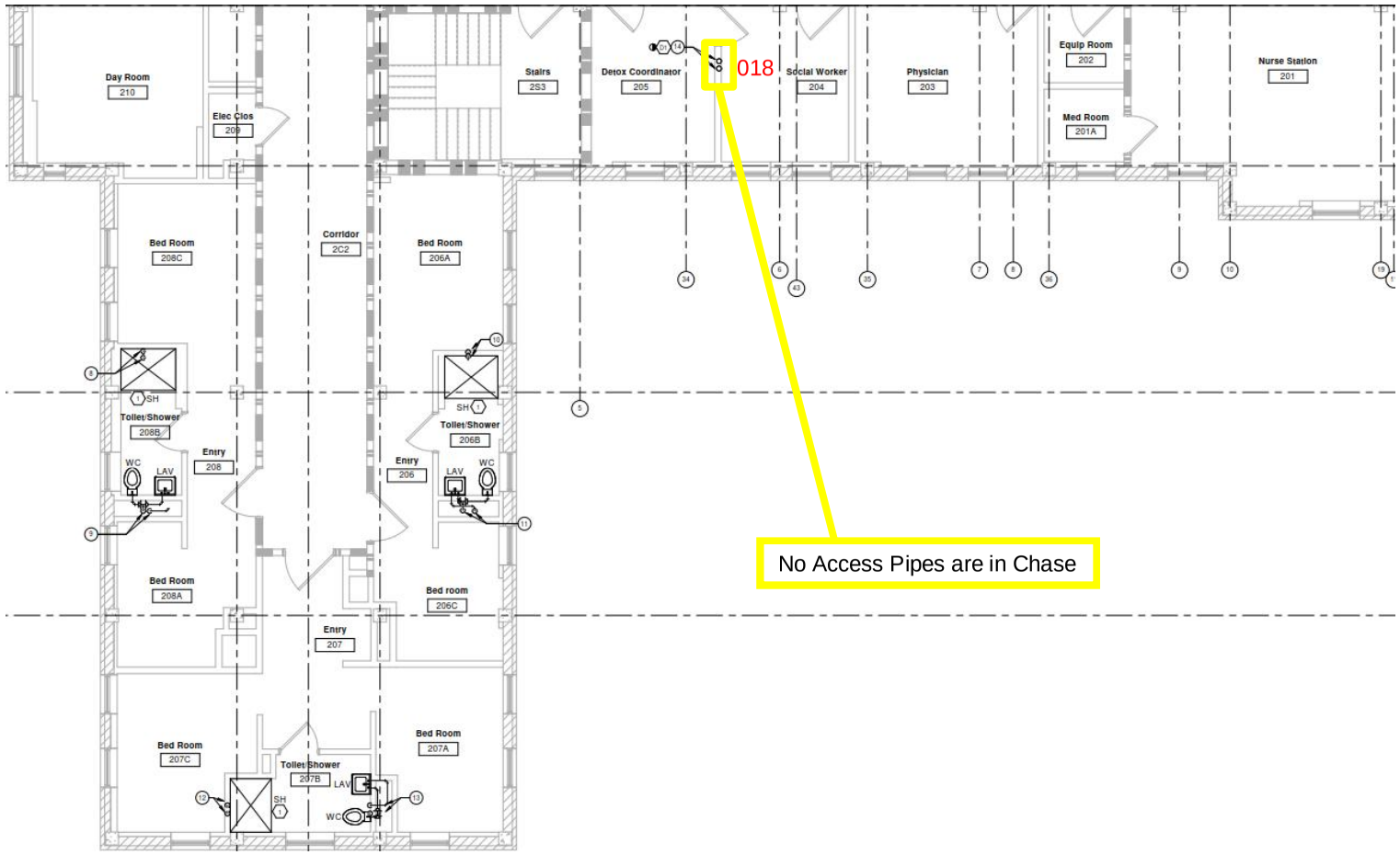
Drawn by: GV	Scale: N.T.S.	3601 Mojave Court, Suite A Columbia, Missouri 65202
Checked by: JV		PH. (573) 214-2677 FAX. (573) 214-2714
Approved by: JAT	Date: 09/18/19	

ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 24 – Second Floor Plan Area A

Exhibit 8



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Approved by: JAT	Date: 09/18/19	

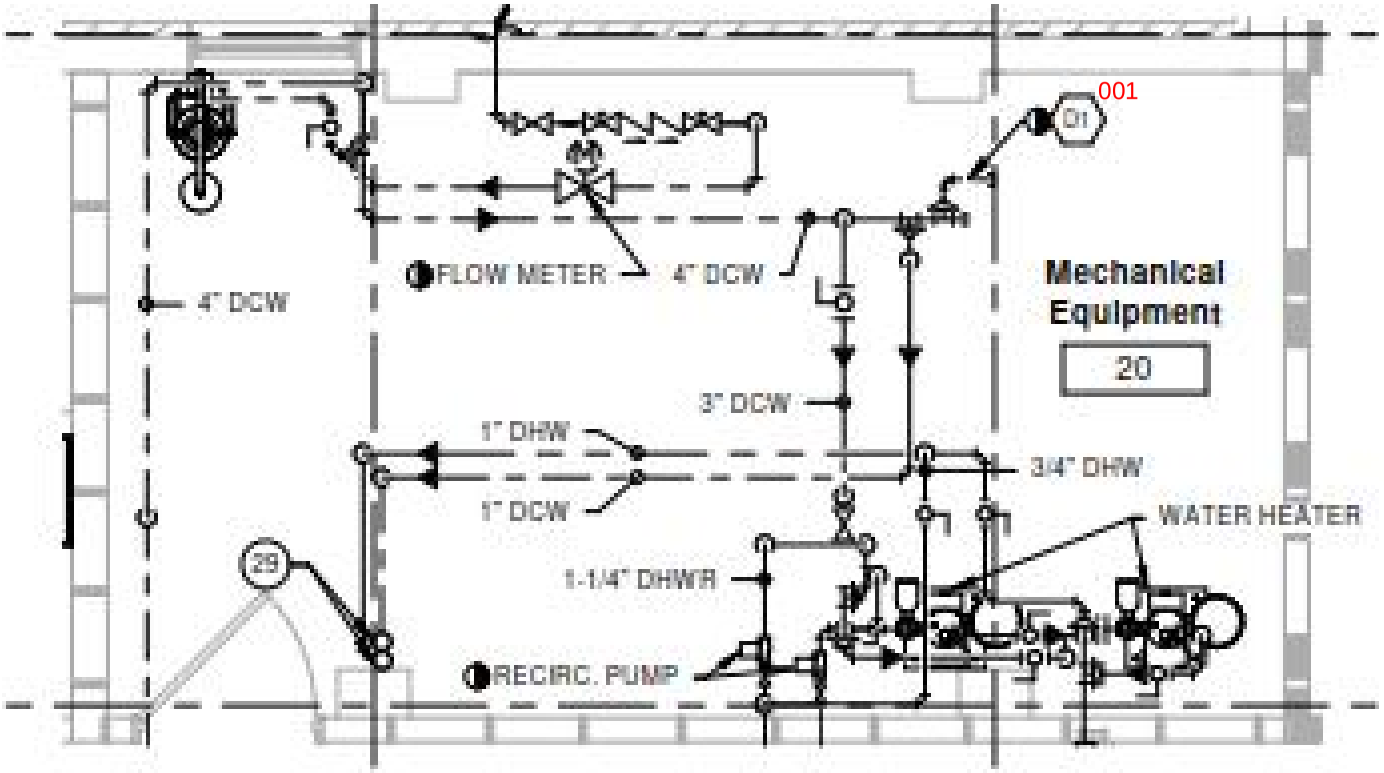
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 24 – Second Floor Plan Area C

Exhibit

9



N

All fiberglass pipe insulation to be impacted by the project has asbestos-containing white mastic associated

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Approved by: JAT	Date: 09/18/19	

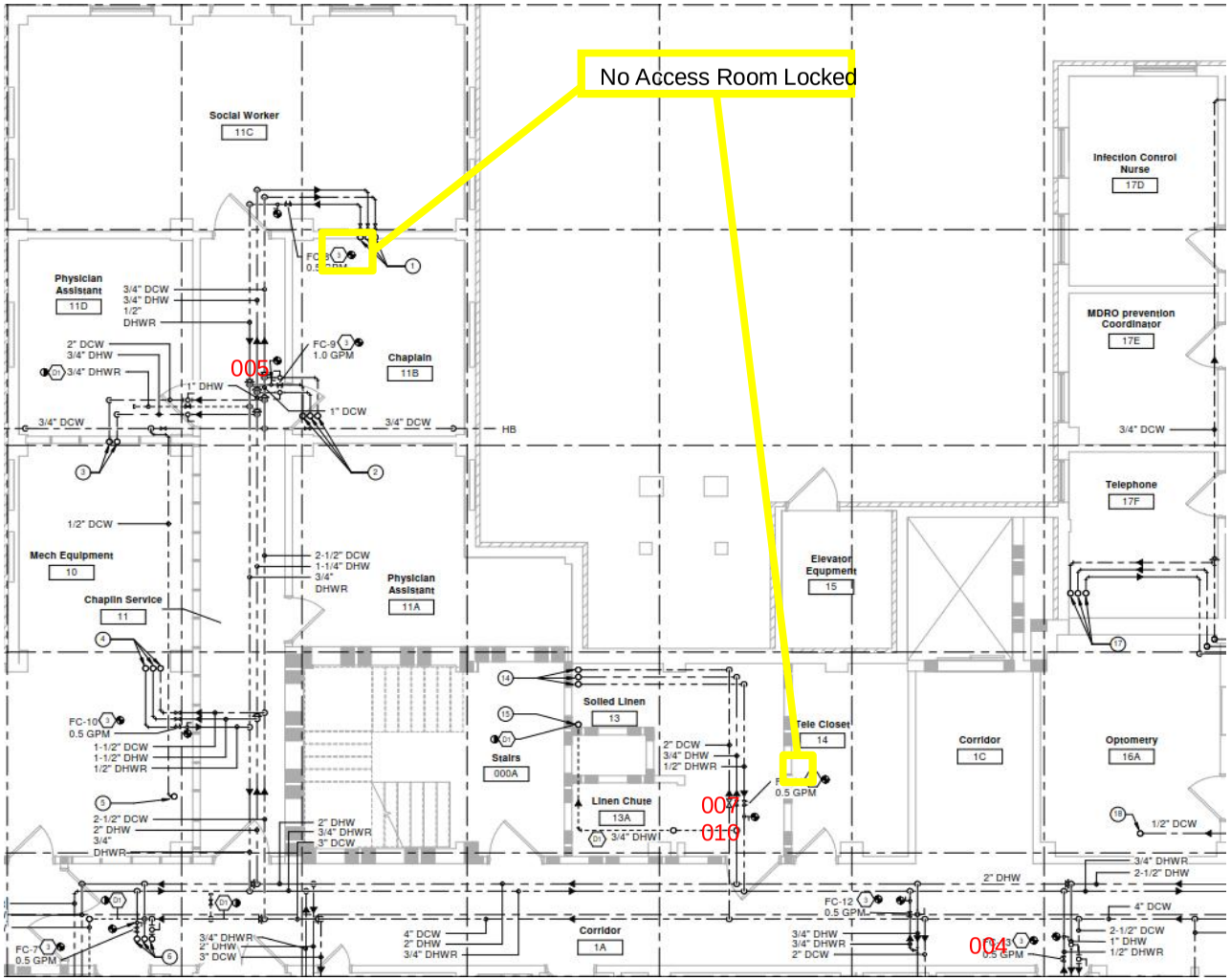
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 27 – Mechanical Room

Exhibit

10



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N

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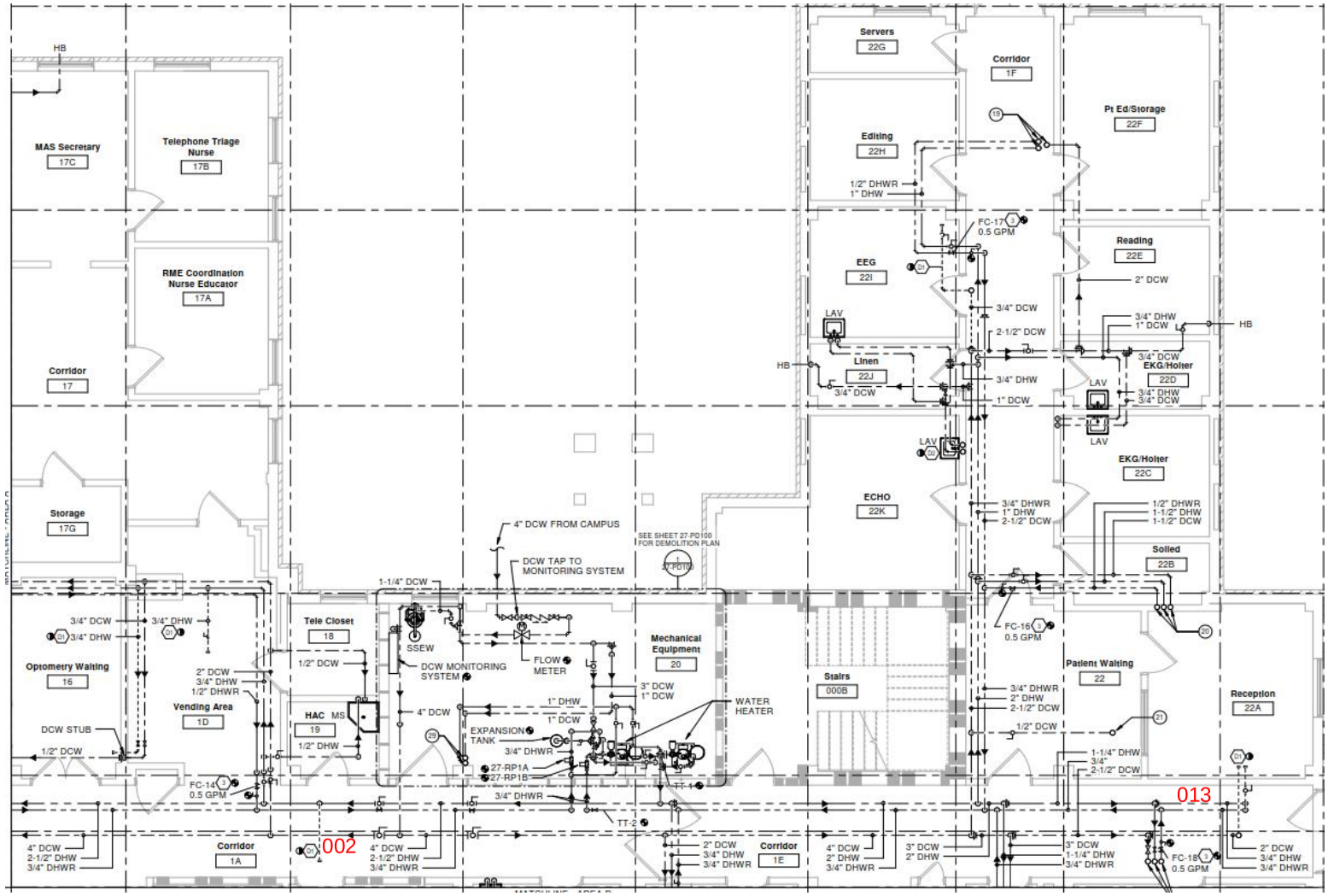
Checked by: JV		PH. (573) 214-2677 FAX. (573) 214-2714
Approved by: JAT	Date: 09/18/19	

ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 27 – Basement Plan Area A

Exhibit 11



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Project Manager: JV	Project No. N1197373
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Checked by: JV	
Approved by: JAT	Date: 09/18/19

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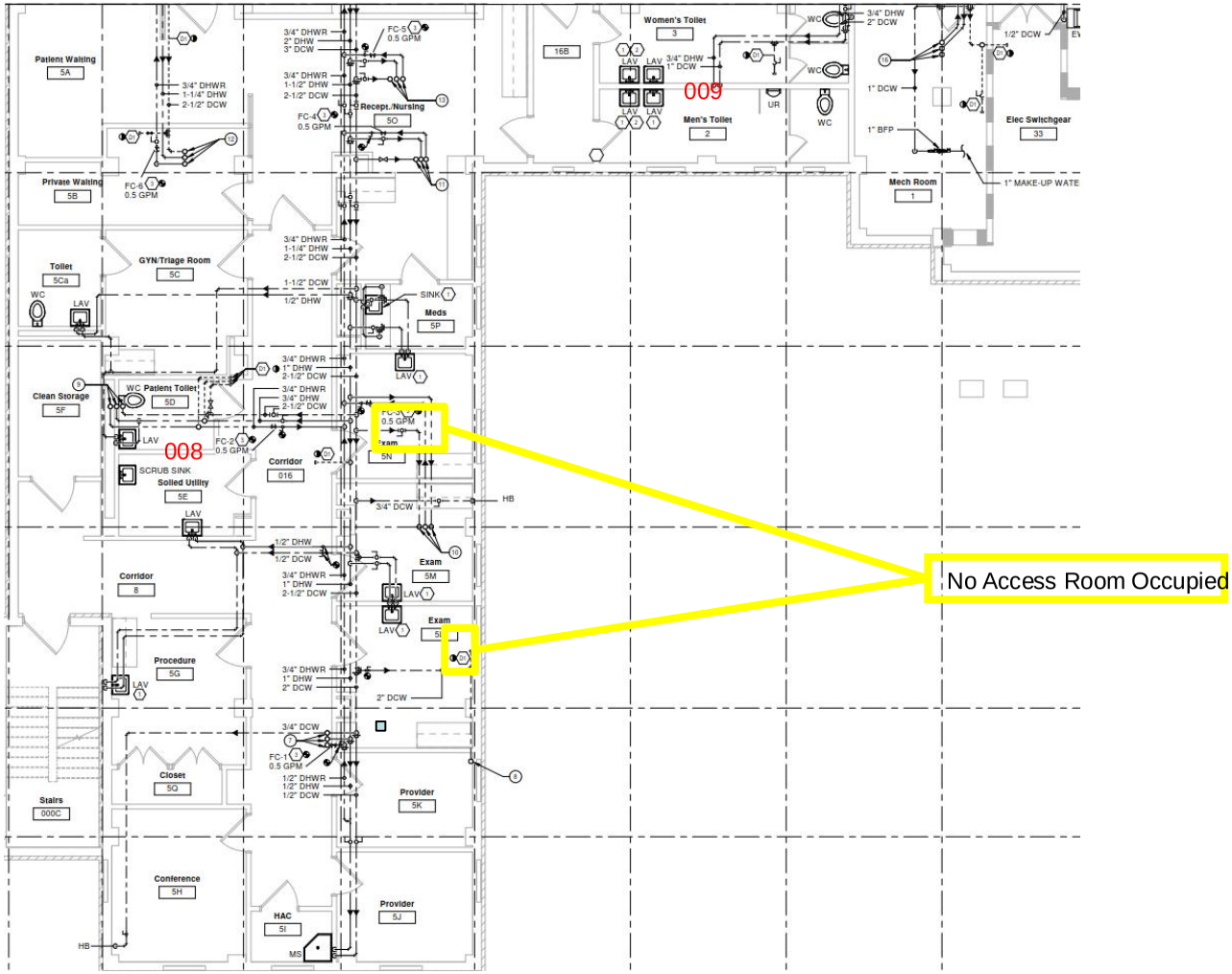
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 27 – Basement Plan Area B

Exhibit

12



N

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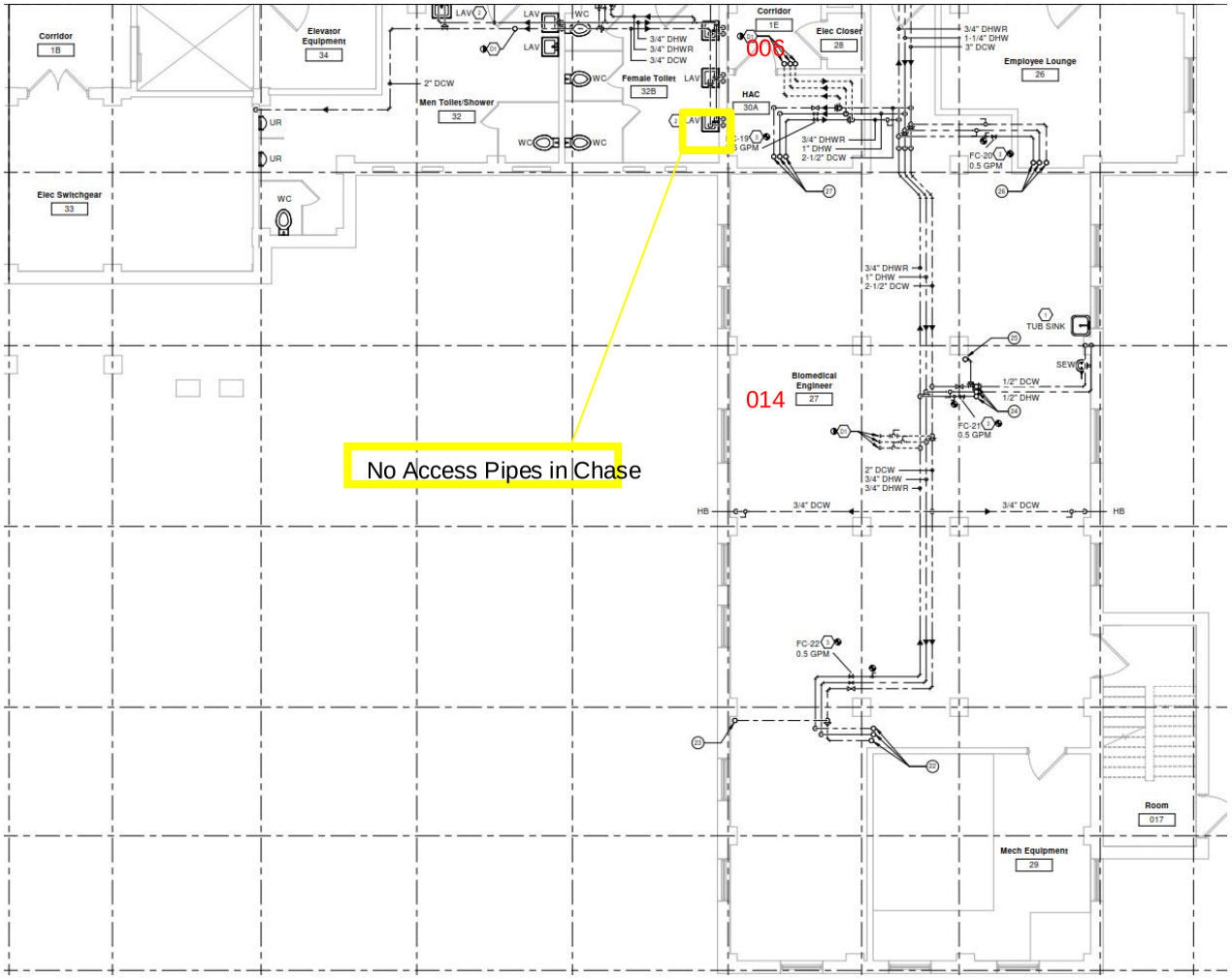
Project Manager: JV	Project No. N1197373	Terracon Consulting Engineers & Scientists	ASBESTOS SAMPLE LOCATION DIAGRAM
Drawn by: GV	Scale: N.T.S.	3601 Mojave Court, Suite A Columbia, Missouri 65202	Chillicothe VAMC
Checked by: JV		PH. (573) 214-2677 FAX. (573) 214-2714	Building 27 – Basement Plan Area C
Approved by: JAT	Date: 09/18/19		Exhibit 13



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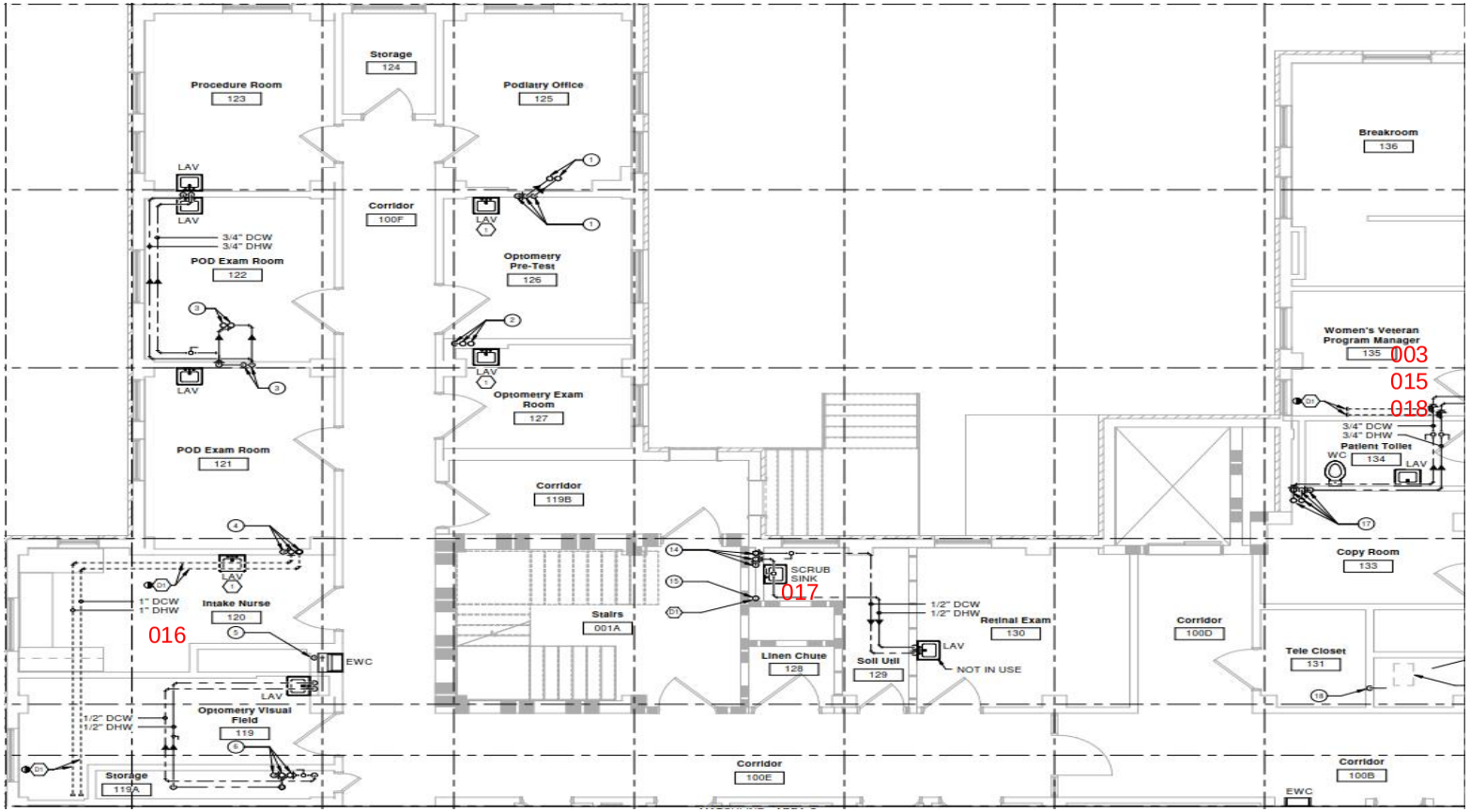
Drawn by: GV	Scale: N.T.S.	3601 Mojave Court, Suite A Columbia, Missouri 65202
Checked by: JV		PH. (573) 214-2677 FAX. (573) 214-2714
Approved by: JAT	Date: 09/18/19	

ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 27 – Basement Plan Area D

Exhibit 14



N

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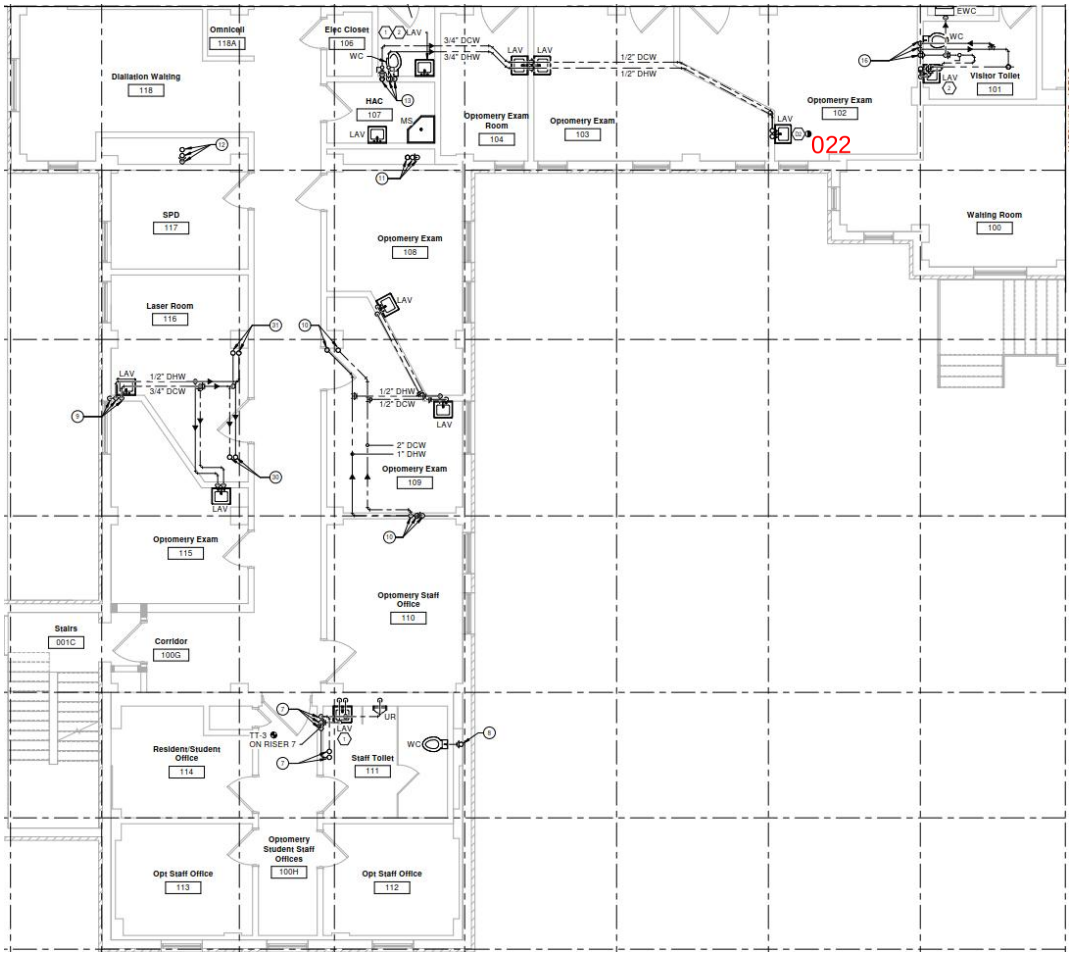
Project Manager: JV	Project No. N1197373	Terracon Consulting Engineers & Scientists	ASBESTOS SAMPLE LOCATION DIAGRAM
Drawn by: GV	Scale: N.T.S.	3601 Mojave Court, Suite A Columbia, Missouri 65202	Chillicothe VAMC
Checked by: JV		PH. (573) 214-2677 FAX. (573) 214-2714	Building 27 – First Floor Plan Area A
Approved by: JAT	Date: 09/18/19		Exhibit 15



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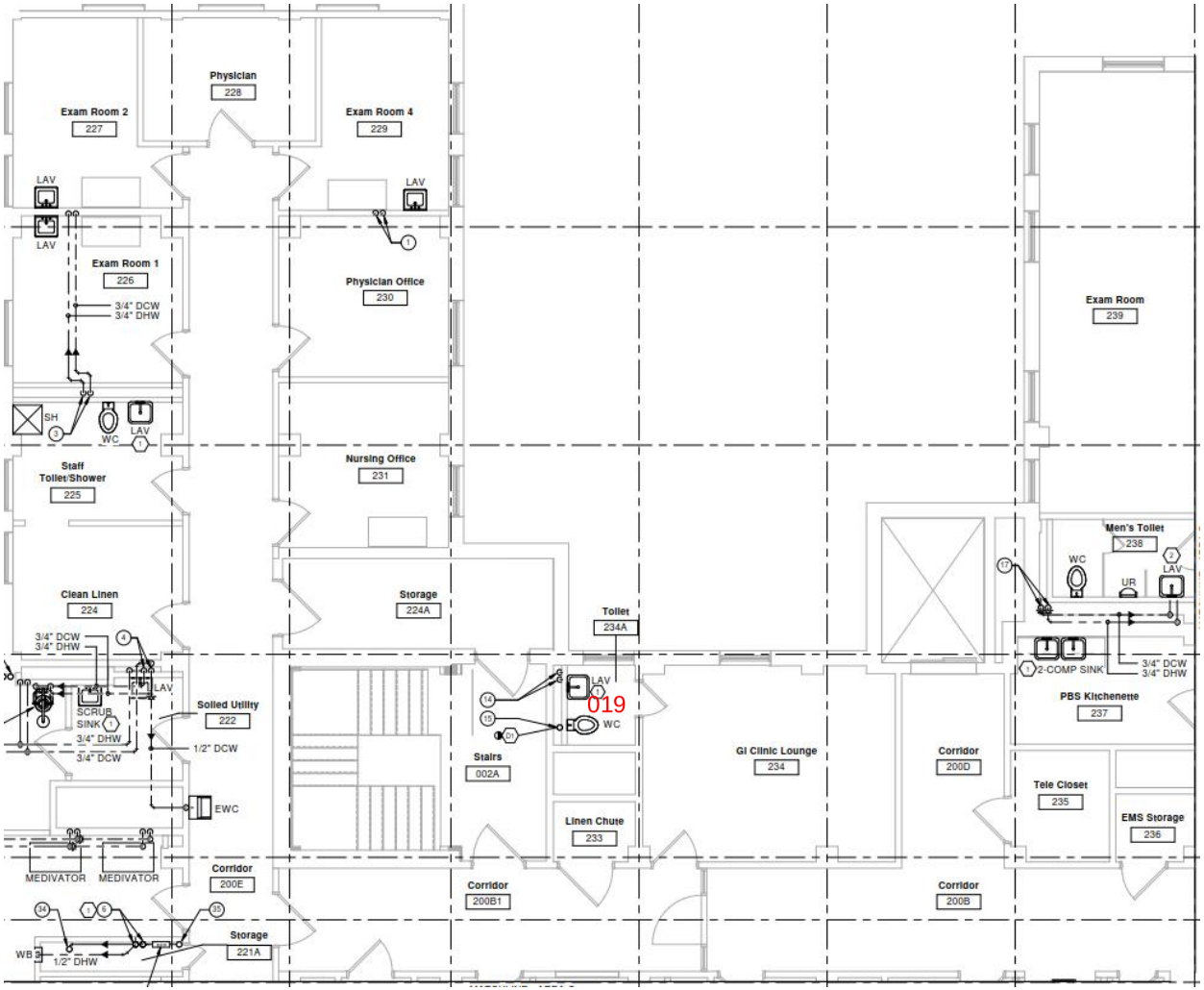
Checked by: JV		PH. (573) 214-2677 FAX. (573) 214-2714
Approved by: JAT	Date: 09/18/19	

ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 27 – First Floor Plan Area C

Exhibit 16



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Project Manager: JV	Project No. N1197373	Terracon Consulting Engineers & Scientists
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Checked by: JV		PH. (573) 214-2677 FAX. (573) 214-2714
Approved by: JAT	Date: 09/18/19	

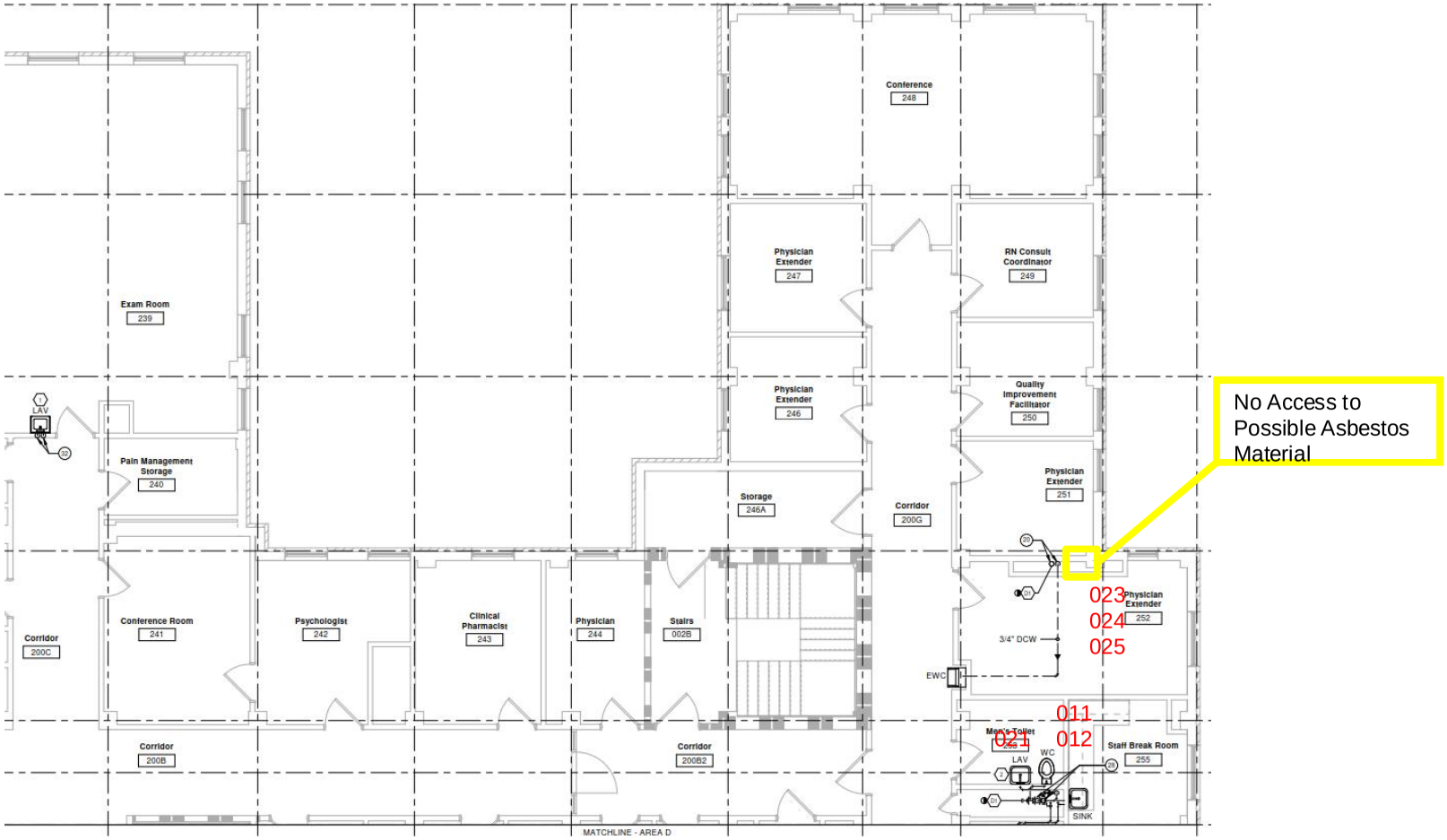
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 27 – Second Floor Plan Area A

Exhibit

17



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Approved by: JAT	Date: 09/18/19	

ASBESTOS SAMPLE LOCATION DIAGRAM

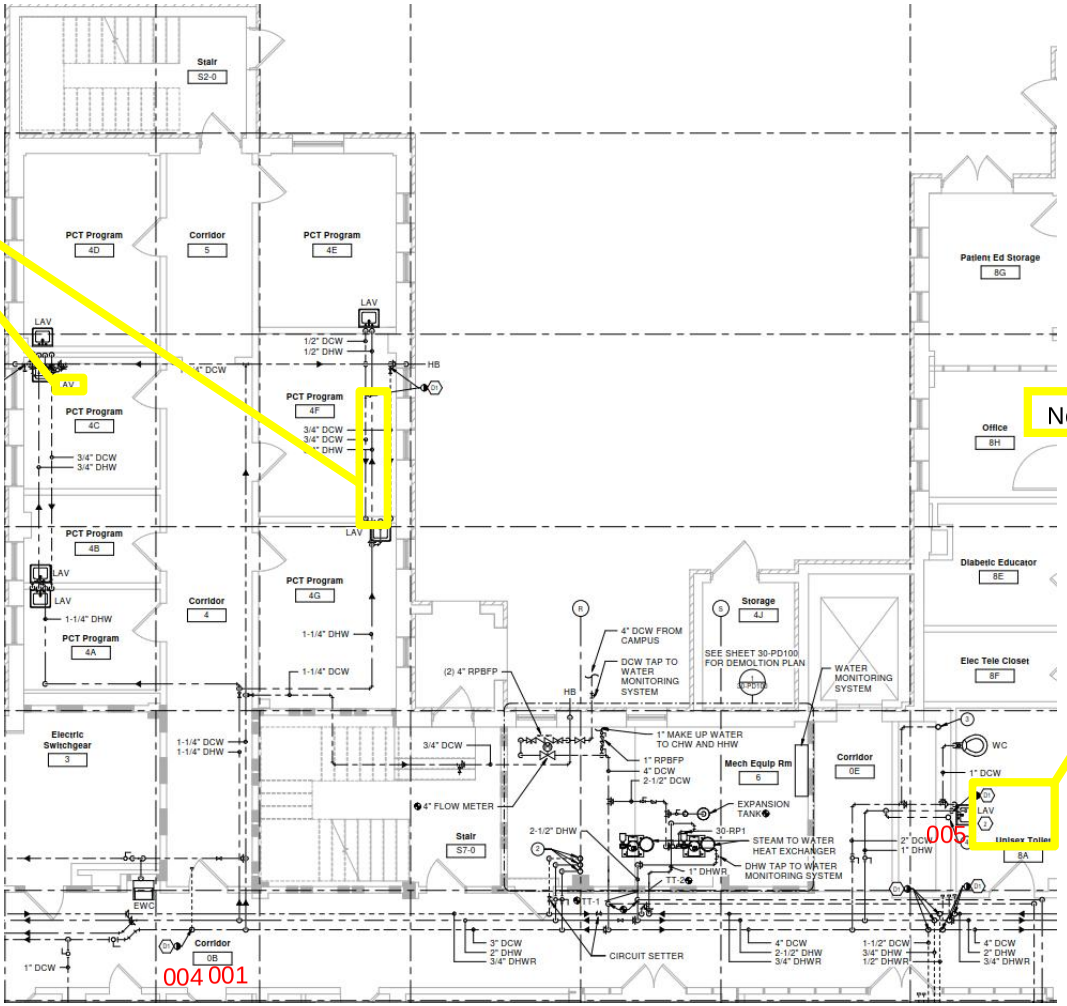
Chillicothe VAMC

Building 27 – Second Floor Plan Area B

Exhibit 18

No Access Locked

No Access in Pipe Chase



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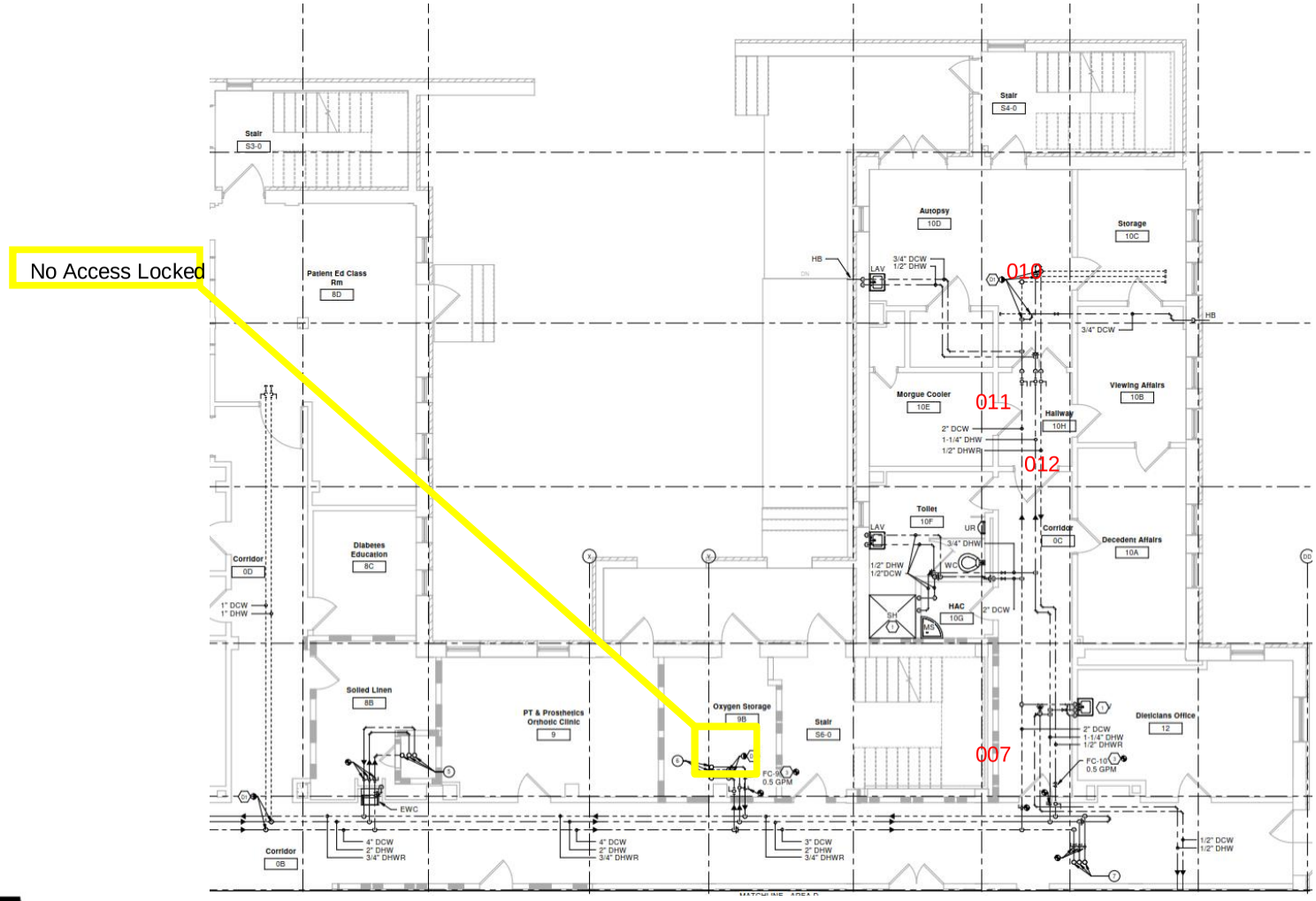
Project Manager: JV	Project No. N1197373	Terracon Consulting Engineers & Scientists	ASBESTOS SAMPLE LOCATION DIAGRAM
Drawn by: GV	Scale: N.T.S.	3601 Mojave Court, Suite A Columbia, Missouri 65202	Chillicothe VAMC
Checked by: JV		PH. (573) 214-2677 FAX. (573) 214-2714	Building 30 – Basement Plan Area A
Approved by: JAT	Date: 09/18/19		Exhibit 19



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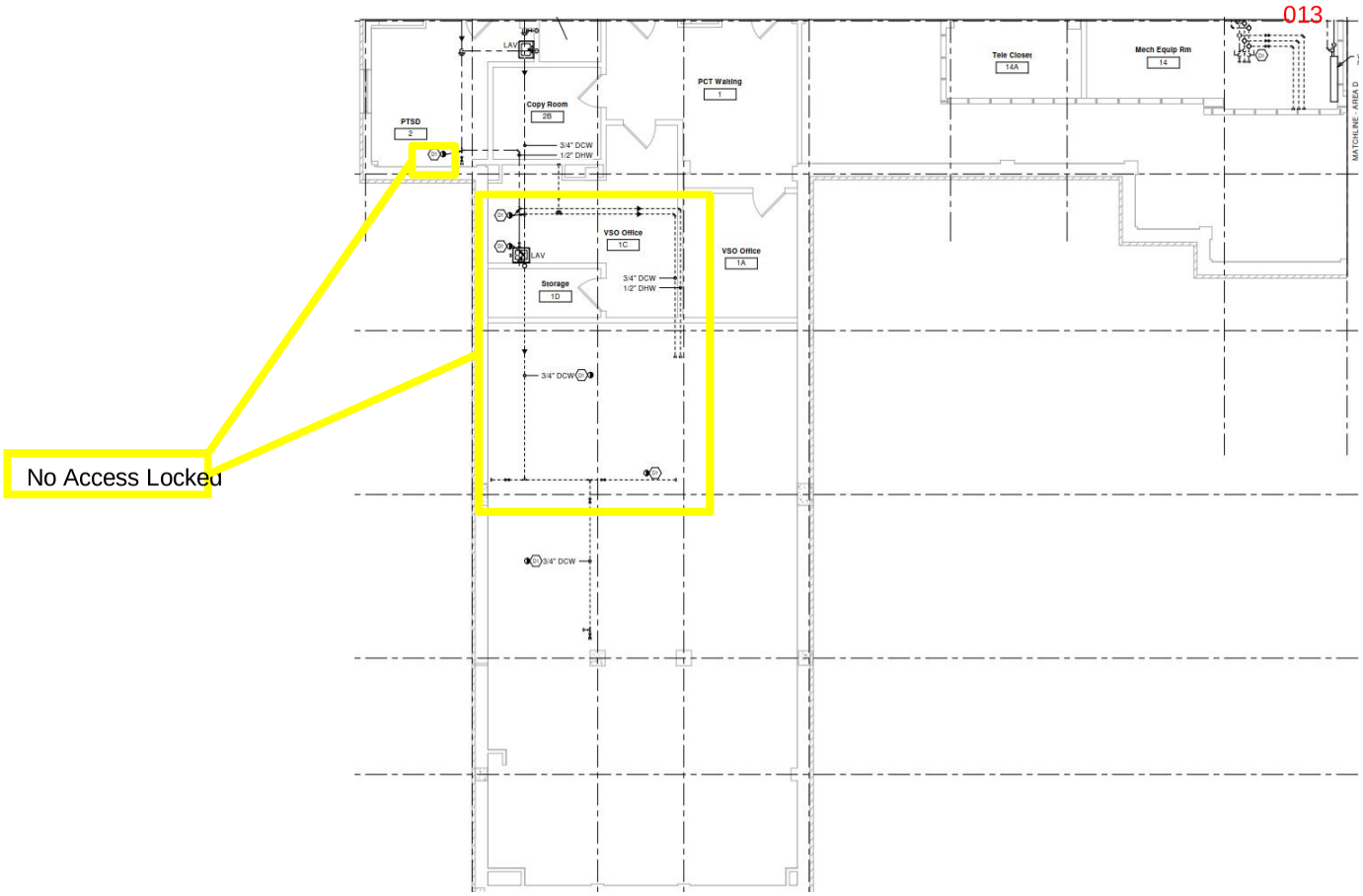
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 30 – Basement Plan Area B

Exhibit

20



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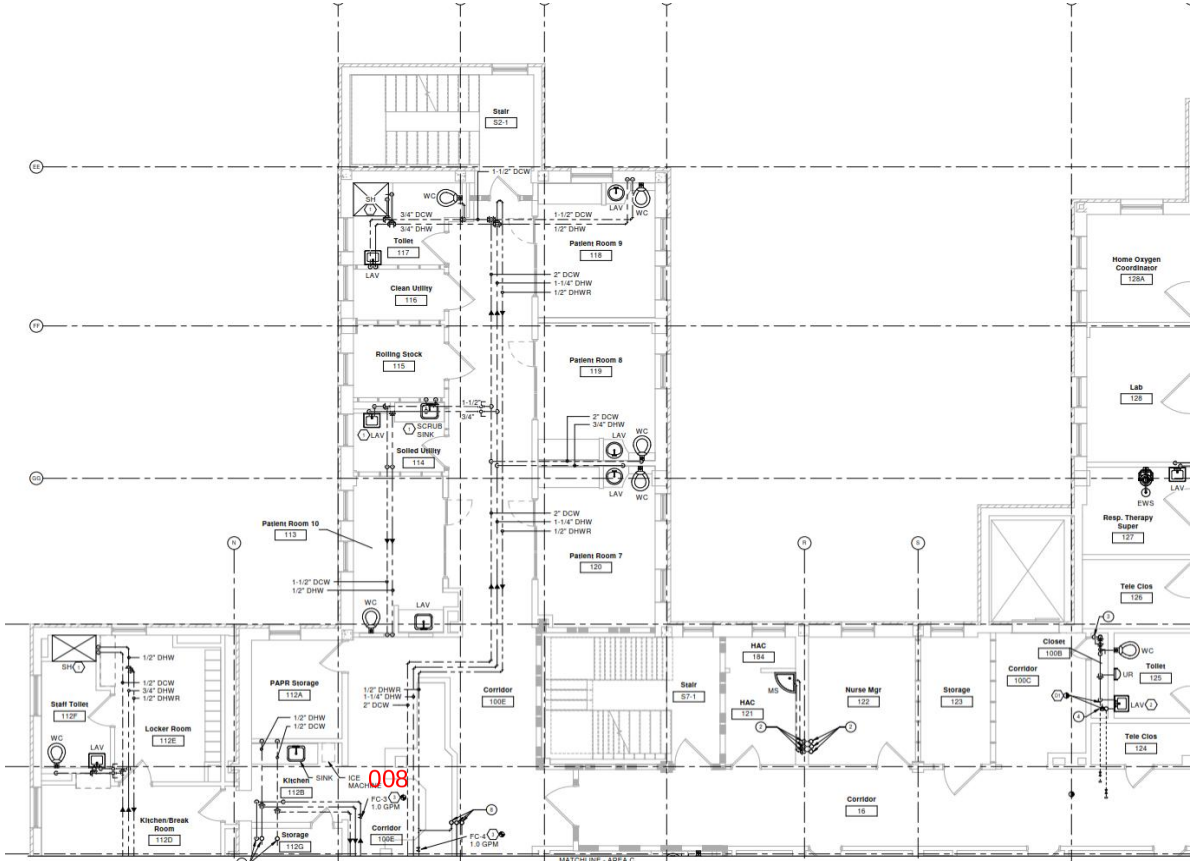
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 30 – Basement Plan Area C

Exhibit

21



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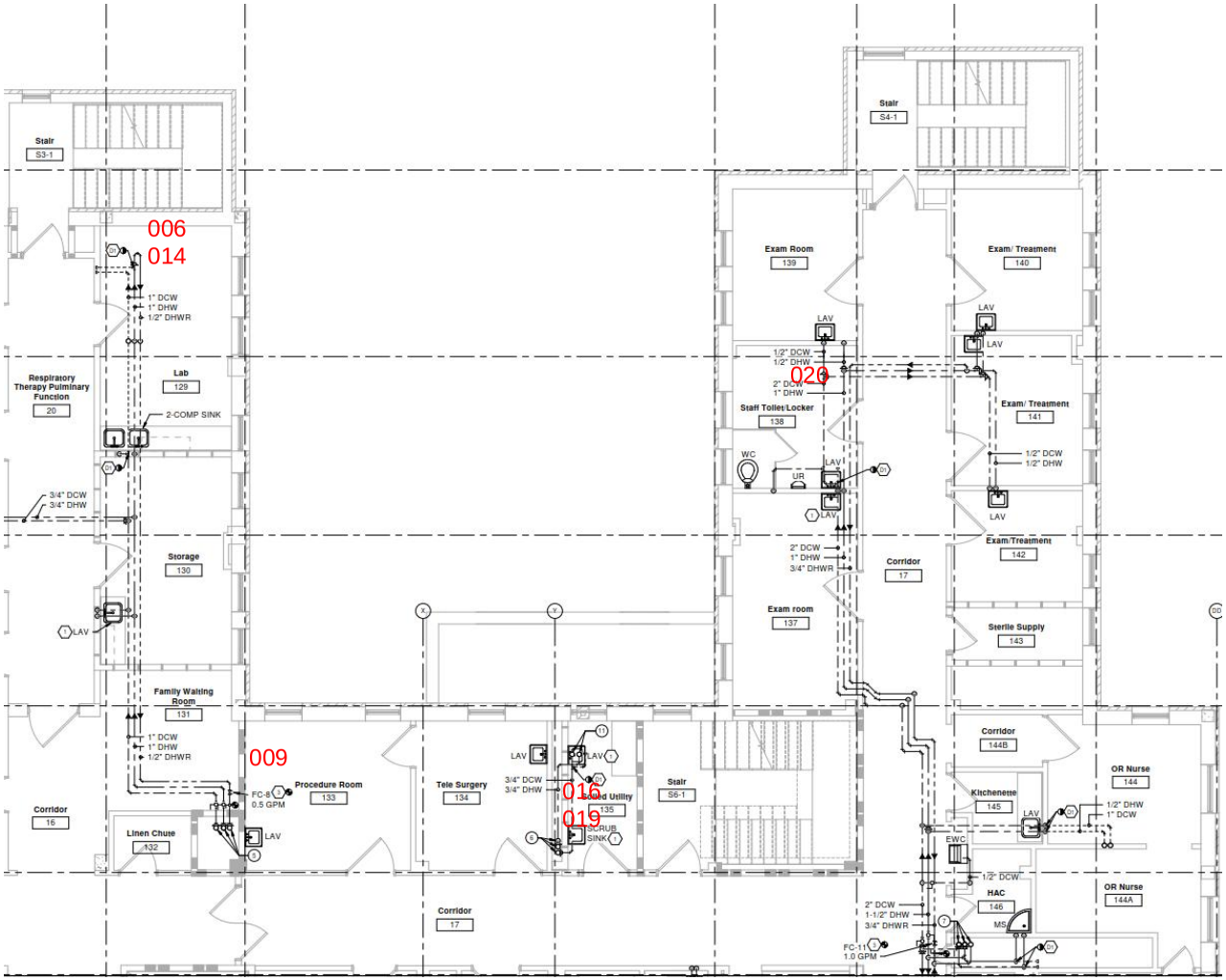
Approved by: JAT	Date: 09/18/19	

ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 30 – First Floor Plan Area A

Exhibit 22



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Approved by: JAT	Date: 09/18/19	

ASBESTOS SAMPLE LOCATION DIAGRAM

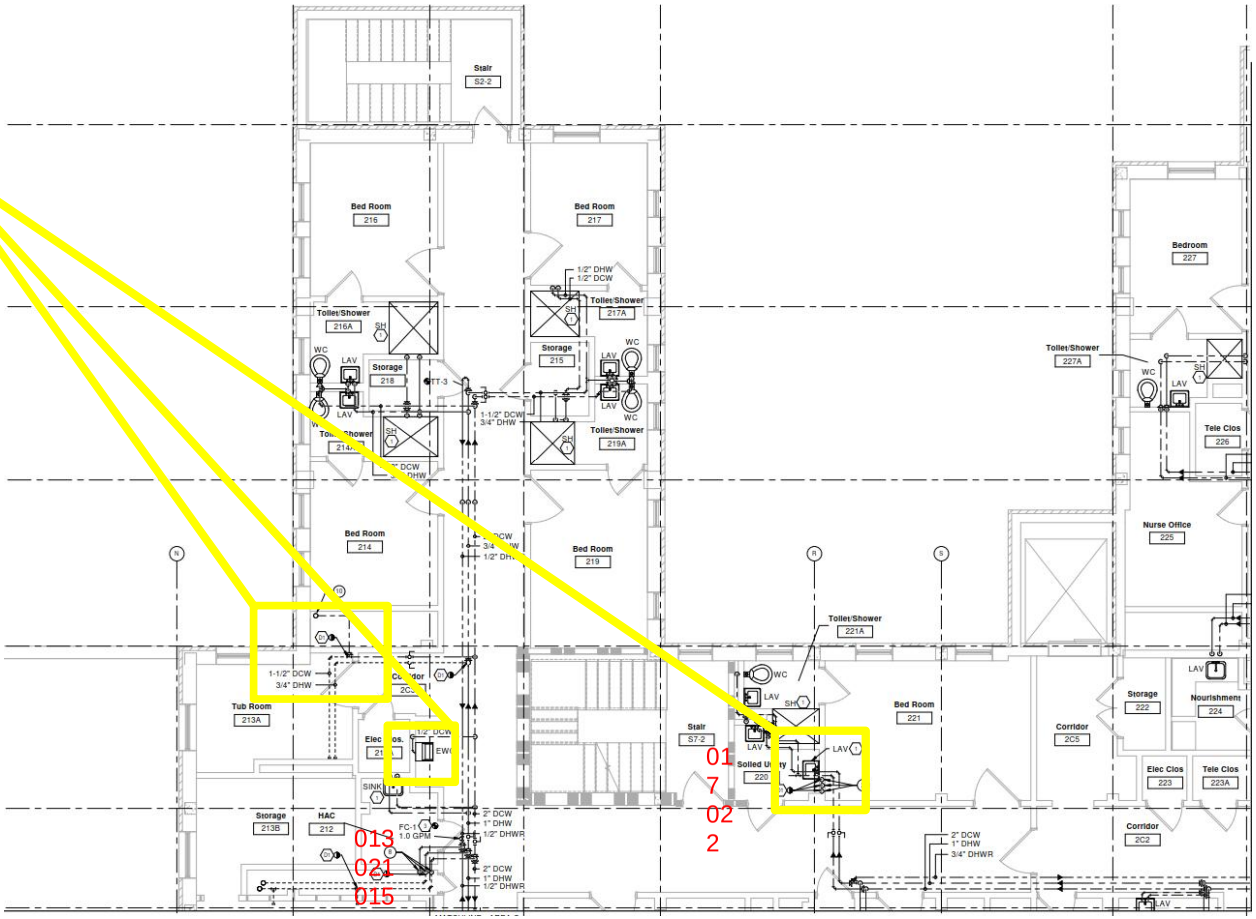
Chillicothe VAMC

Building 30 – First Floor Plan Area B

Exhibit

23

No Access Pipes
Hidden in Chase



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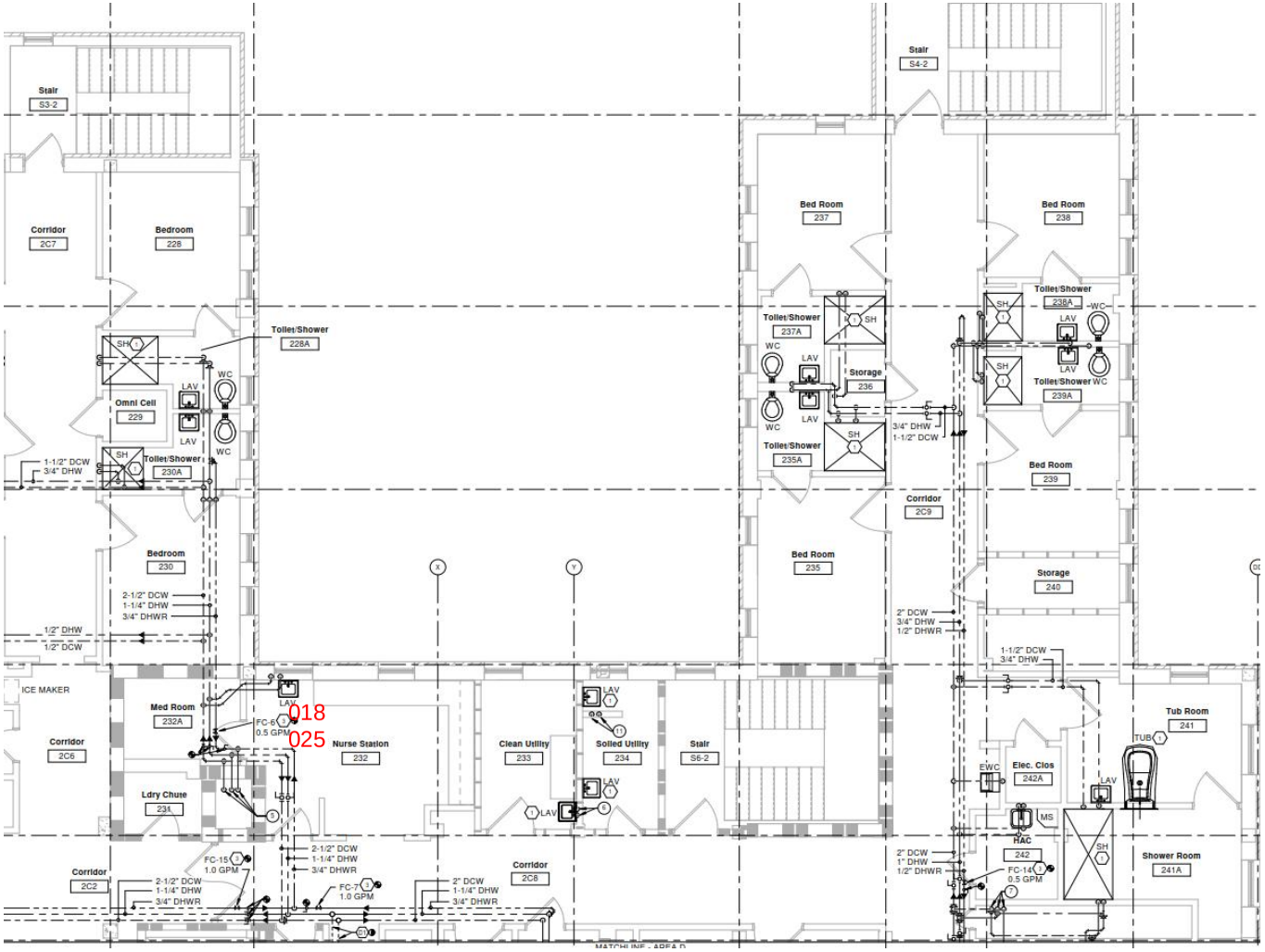
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 30 – Second Floor Plan Area A

Exhibit

24



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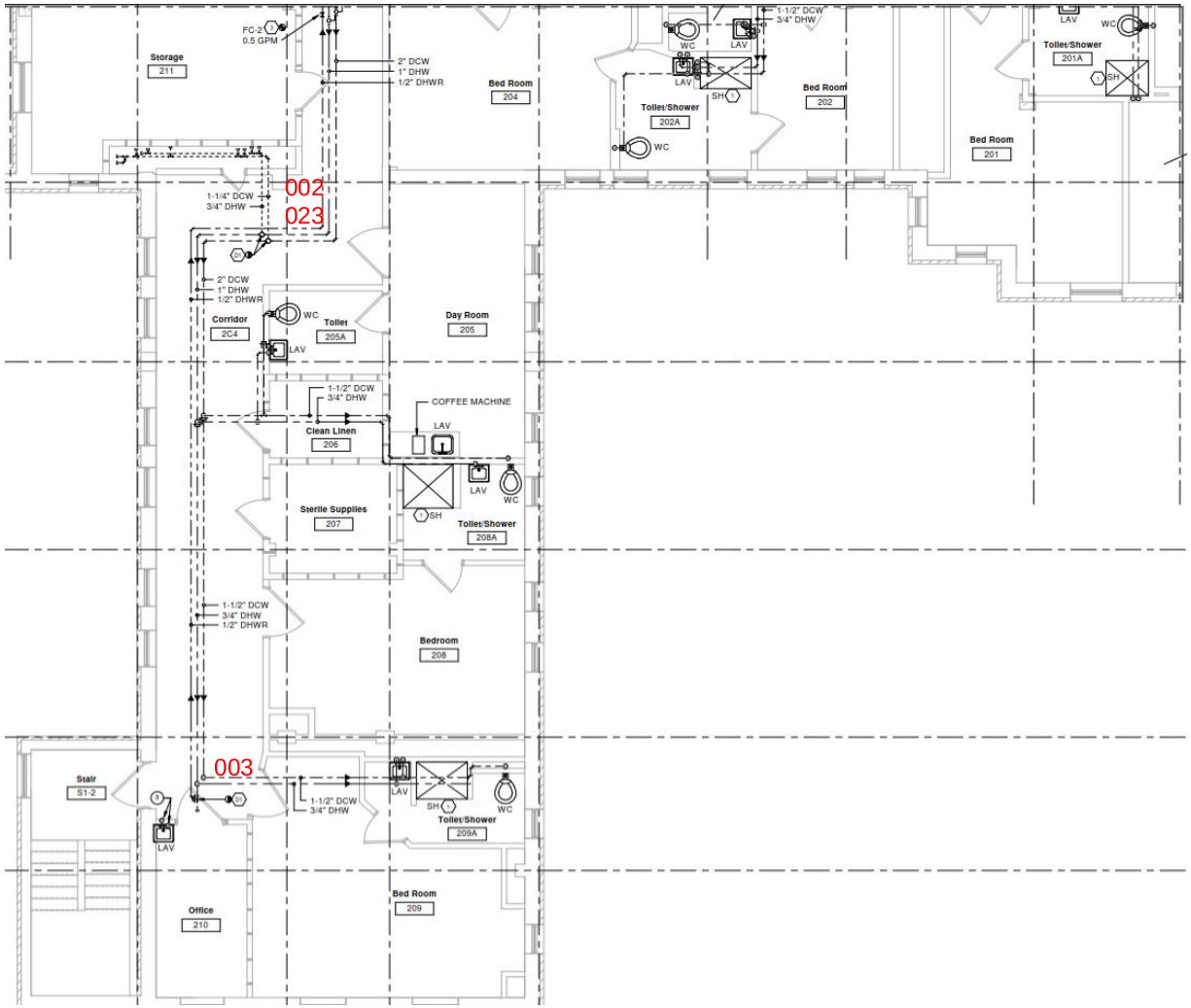
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 30 – Second Floor Plan Area B

Exhibit

25



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N

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Project Manager: JV	Project No. N1197373
Drawn by: GV	Scale: N.T.S.
Checked by: JV	
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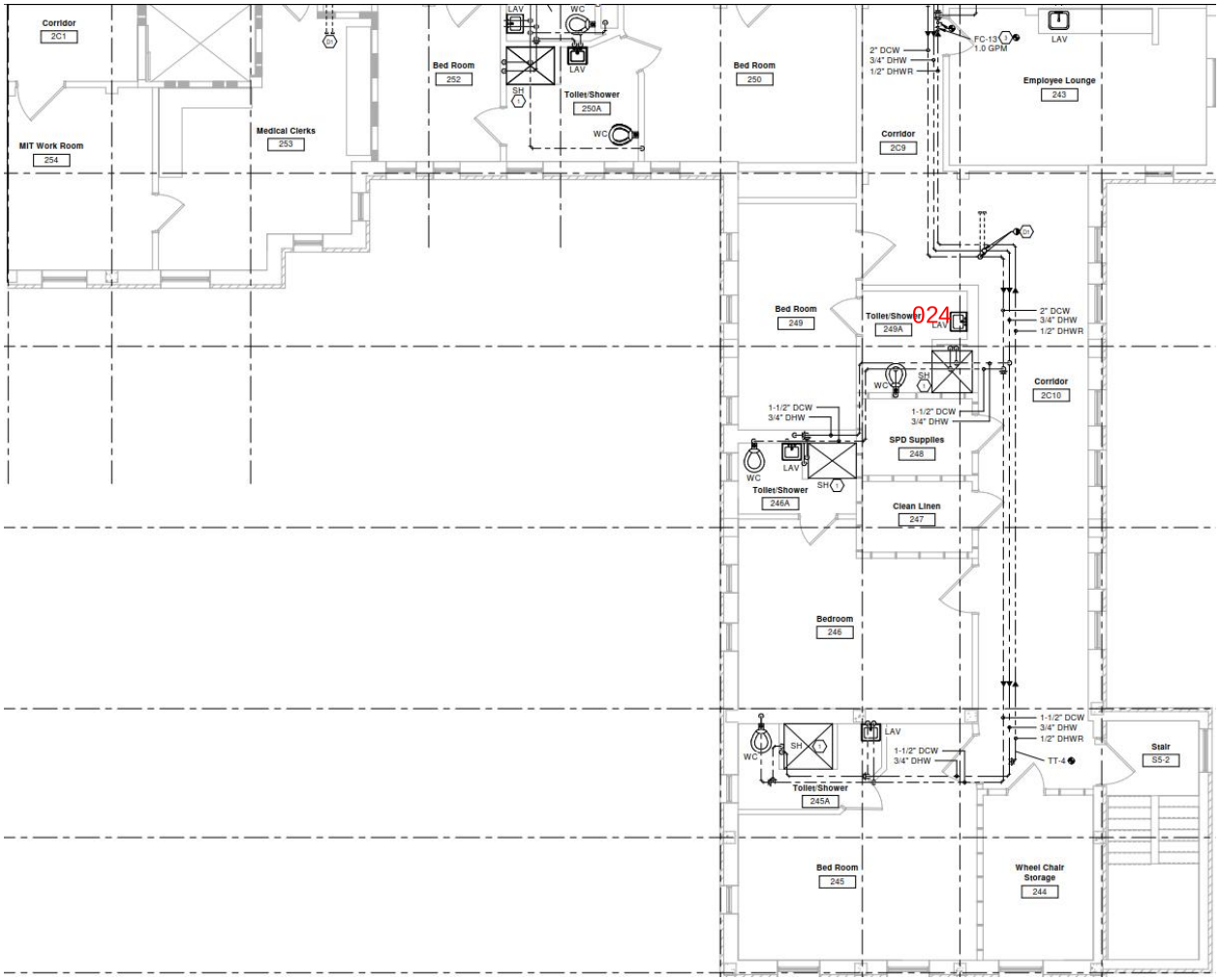
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 30 – Second Floor Plan Area C

Exhibit

26



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Approved by: JAT	Date: 09/18/19	

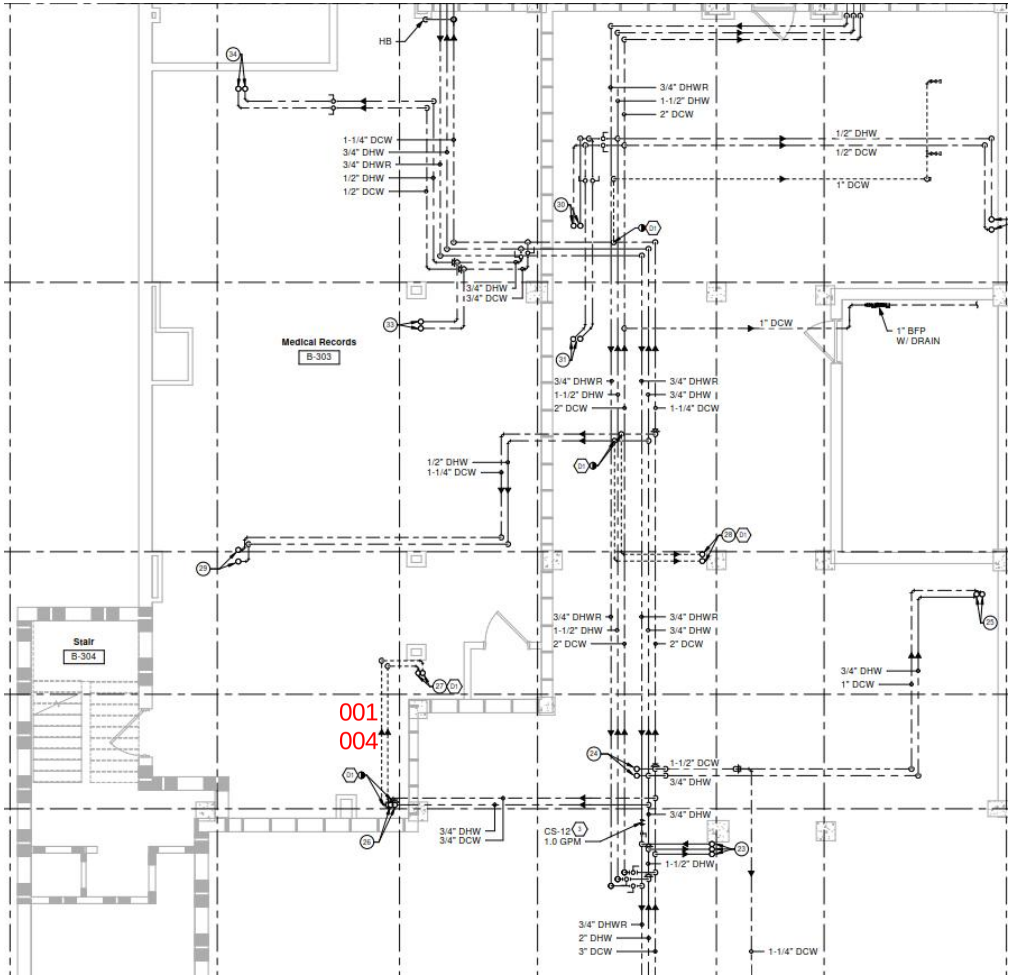
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 30 – Second Floor Plan Area D

Exhibit

27



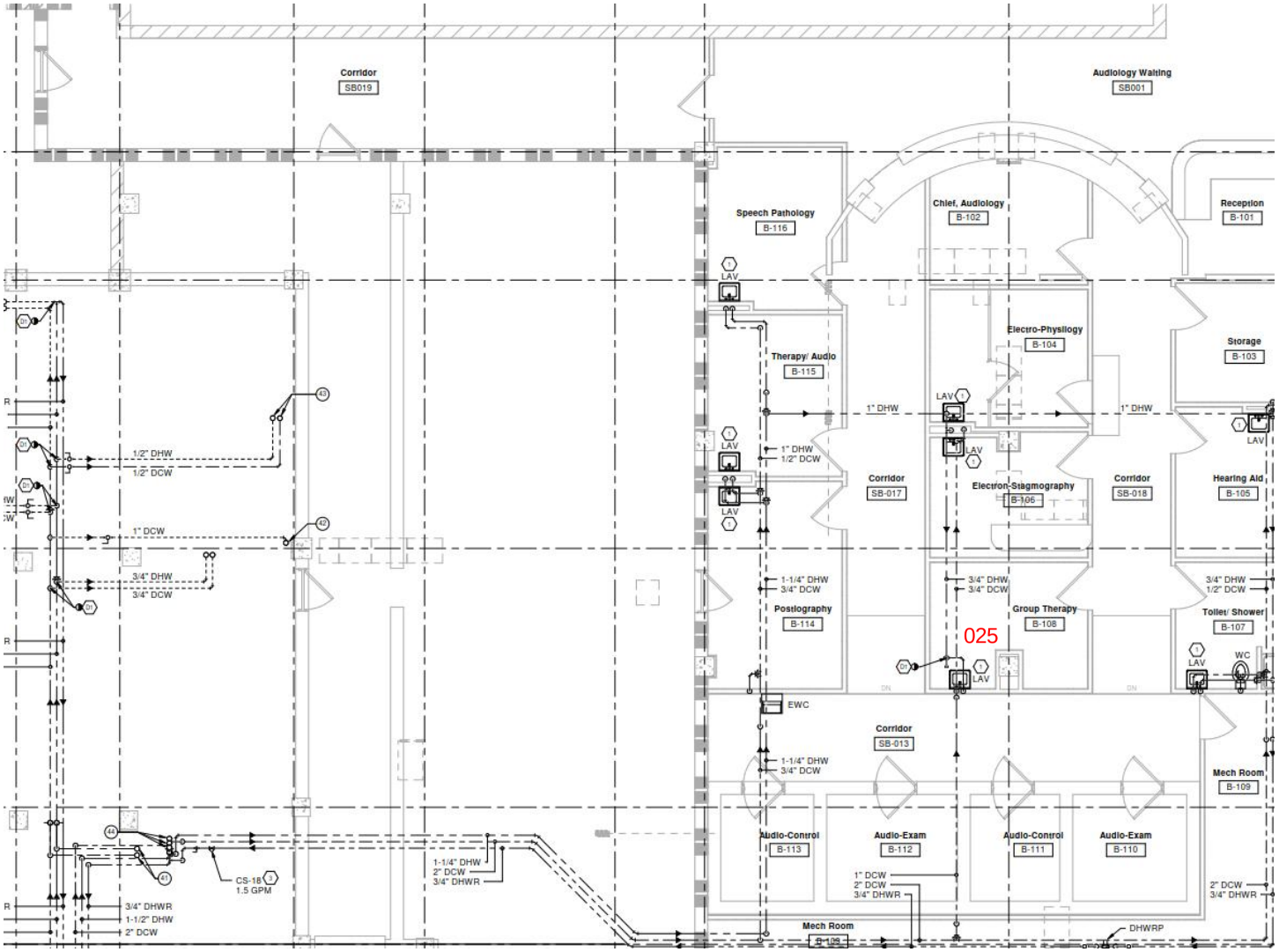
N

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: JV	Project No. N1197373	Terracon Consulting Engineers & Scientists	ASBESTOS SAMPLE LOCATION DIAGRAM
Drawn by: GV	Scale: N.T.S.	3601 Mojave Court, Suite A Columbia, Missouri 65202	Chillicothe VAMC
Checked by: JV		PH. (573) 214-2677 FAX. (573) 214-2714	Building 31 – Sub Basement Plan Area C
Approved by: JAT	Date: 09/18/19		

Exhibit

28



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Project Manager: JV	Project No.: N1197373	Terracon Consulting Engineers & Scientists	ASBESTOS SAMPLE LOCATION DIAGRAM
Drawn by: GV	Scale: N.T.S.	3601 Mojave Court, Suite A Columbia, Missouri 65202	Chillicothe VAMC
Checked by: JV		PH. (573) 214-2677 FAX. (573) 214-2714	Building 31 – Sub Basement Plan Area G
Approved by: JAT	Date: 09/18/19		

Exhibit

29

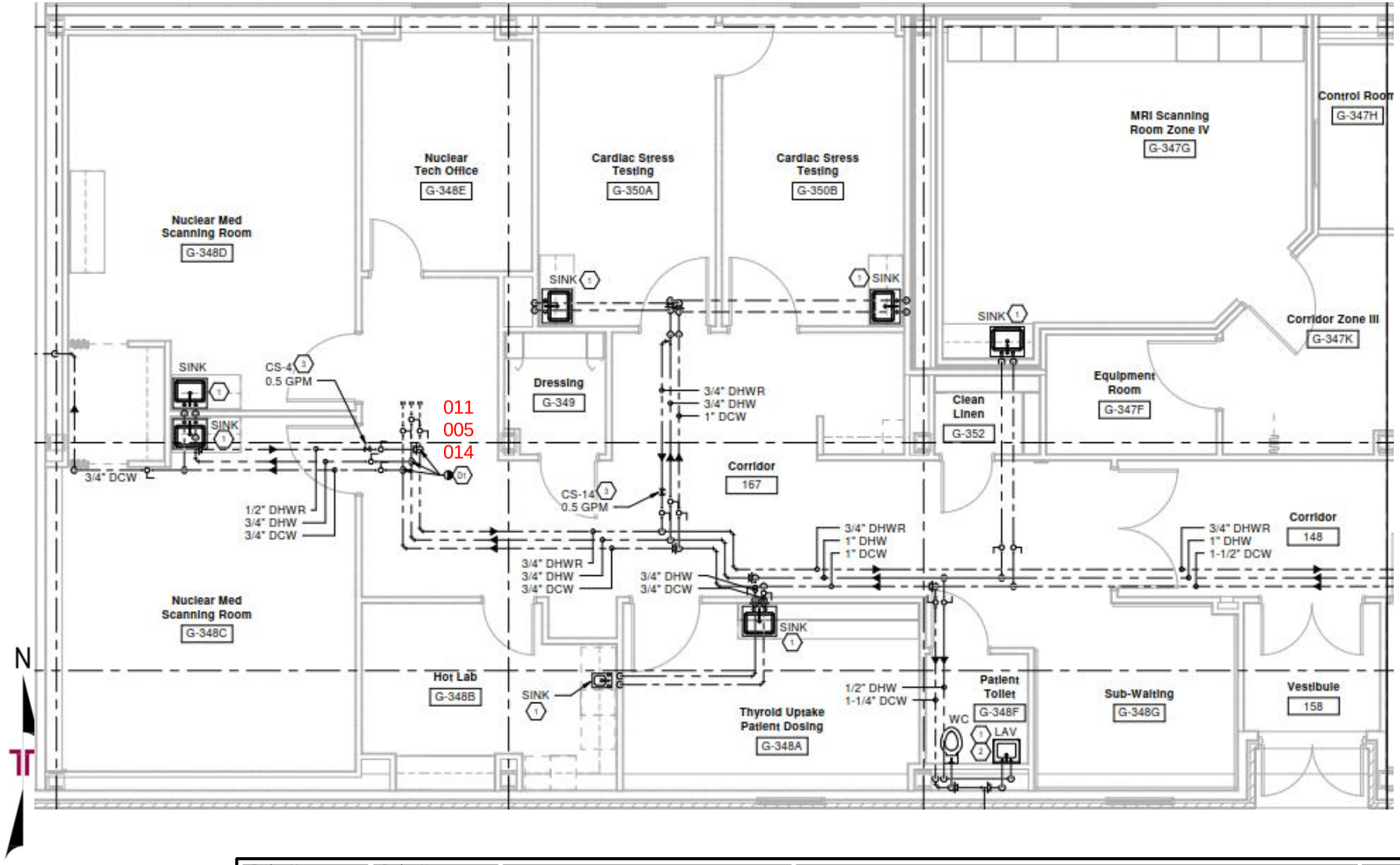

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: JV	Project No.: N1197373	Terracon Consulting Engineers & Scientists
Drawn by: GV	Scale: N.T.S.	3601 Mojave Court, Suite A Columbia, Missouri 65202
Checked by: JV		PH. (573) 214-2677 FAX. (573) 214-2714
Approved by: JAT	Date: 09/18/19	

ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 31 –Basement Plan Area A

Exhibit

30

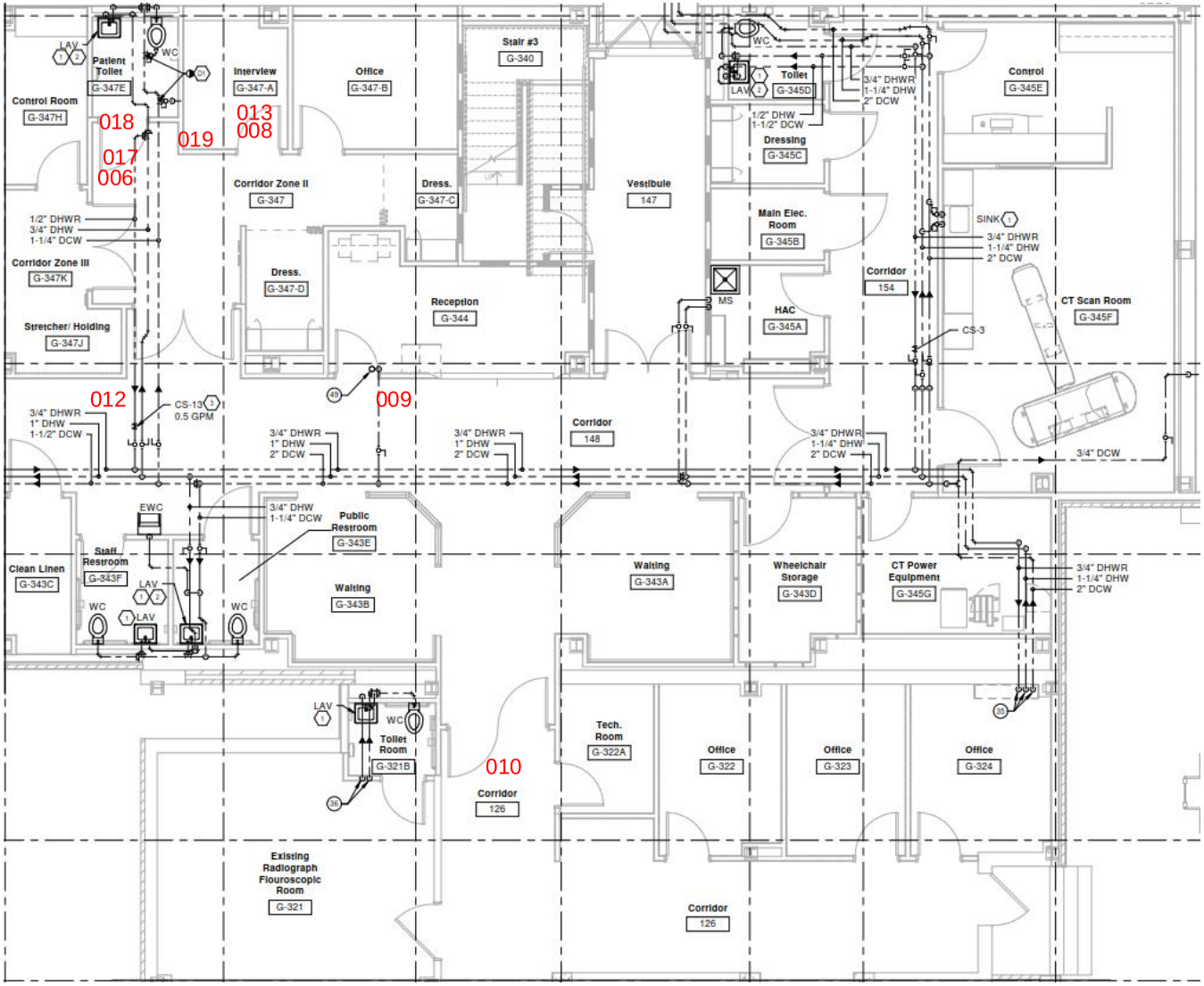

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: JV	Project No. N1197373	Terracon Consulting Engineers & Scientists
Drawn by: GV	Scale: N.T.S.	3601 Mojave Court, Suite A Columbia, Missouri 65202
Checked by: JV		PH. (573) 214-2677 FAX. (573) 214-2714
Approved by: JAT	Date: 09/18/19	

ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 31 –Basement Plan Area B

Exhibit

31

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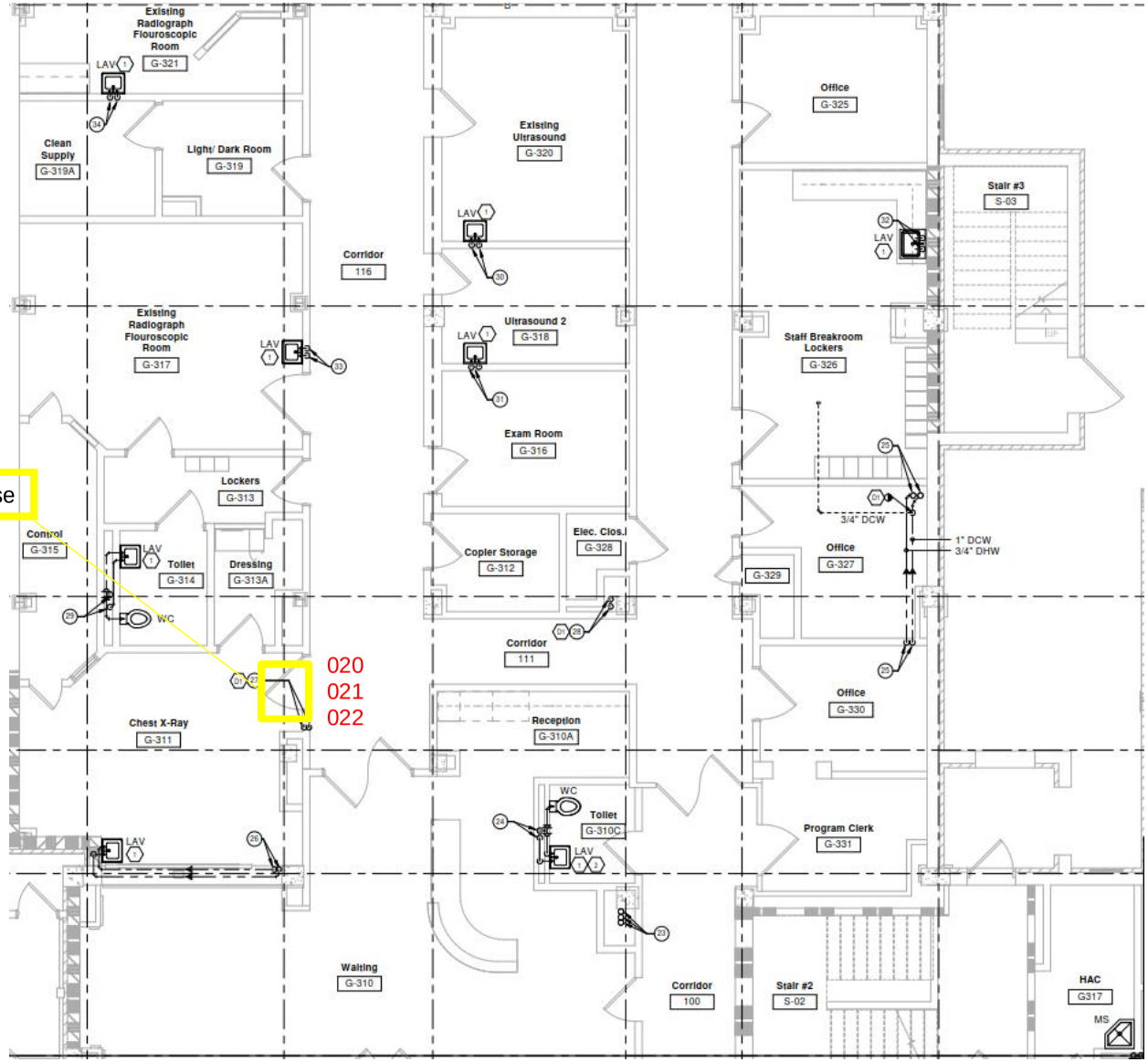


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: JV	Project No. N1197373	Terracon Consulting Engineers & Scientists
Drawn by: GV	Scale: N.T.S.	3601 Mojave Court, Suite A Columbia, Missouri 65202
Checked by: JV		PH. (573) 214-2677 FAX. (573) 214-2714
Approved by: JAT	Date: 09/18/19	

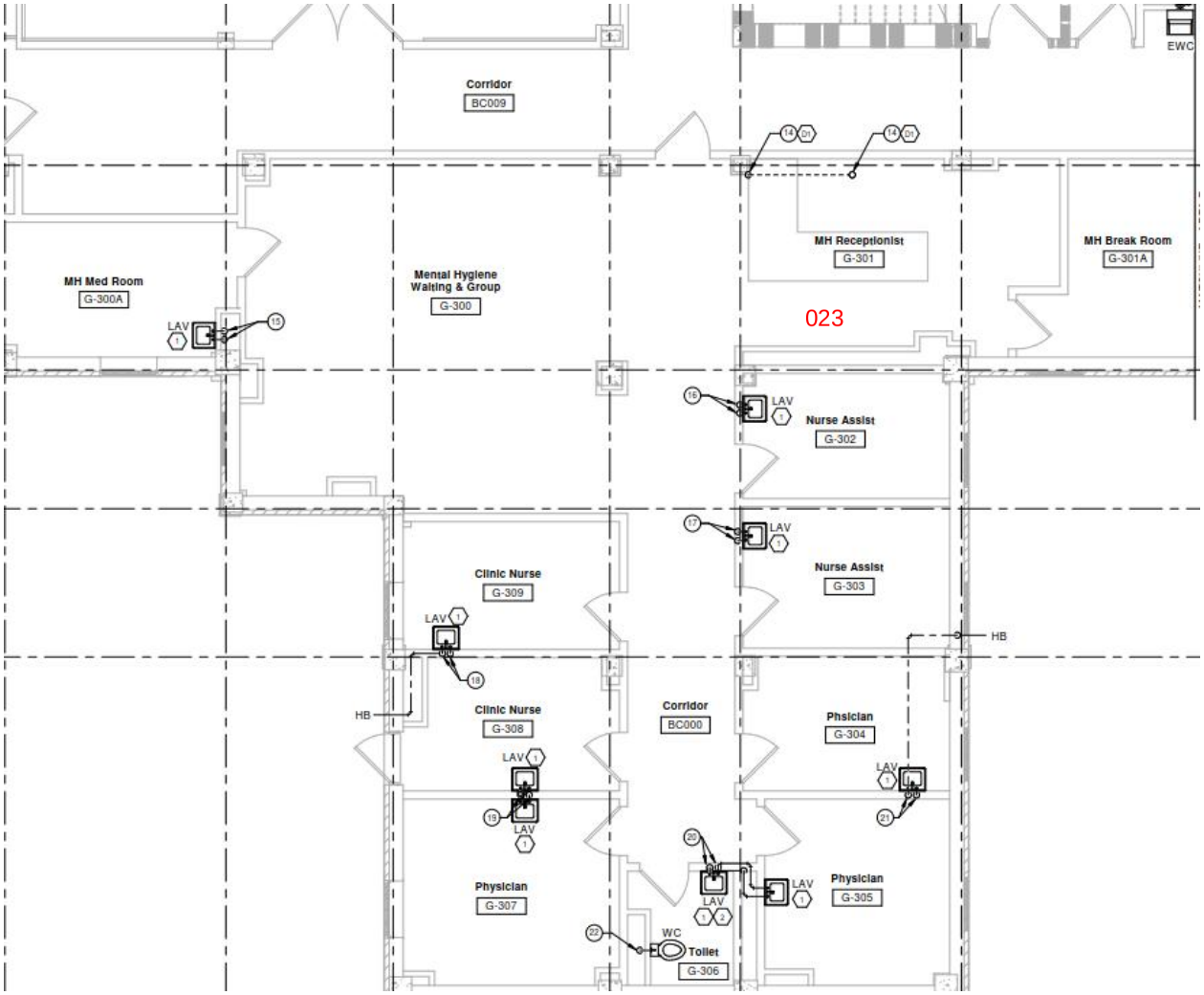
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 31 –Basement Plan Area C

Exhibit

32



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Project Manager: JV	Project No. N1197373	Terracon Consulting Engineers & Scientists	ASBESTOS SAMPLE LOCATION DIAGRAM
Drawn by: GV	Scale: N.T.S.	3601 Mojave Court, Suite A Columbia, Missouri 65202	Chillicothe VAMC
Checked by: JV		PH. (573) 214-2677 FAX. (573) 214-2714	Building 31 –Basement Plan Area D
Approved by: JAT	Date: 09/18/19		

Exhibit

33

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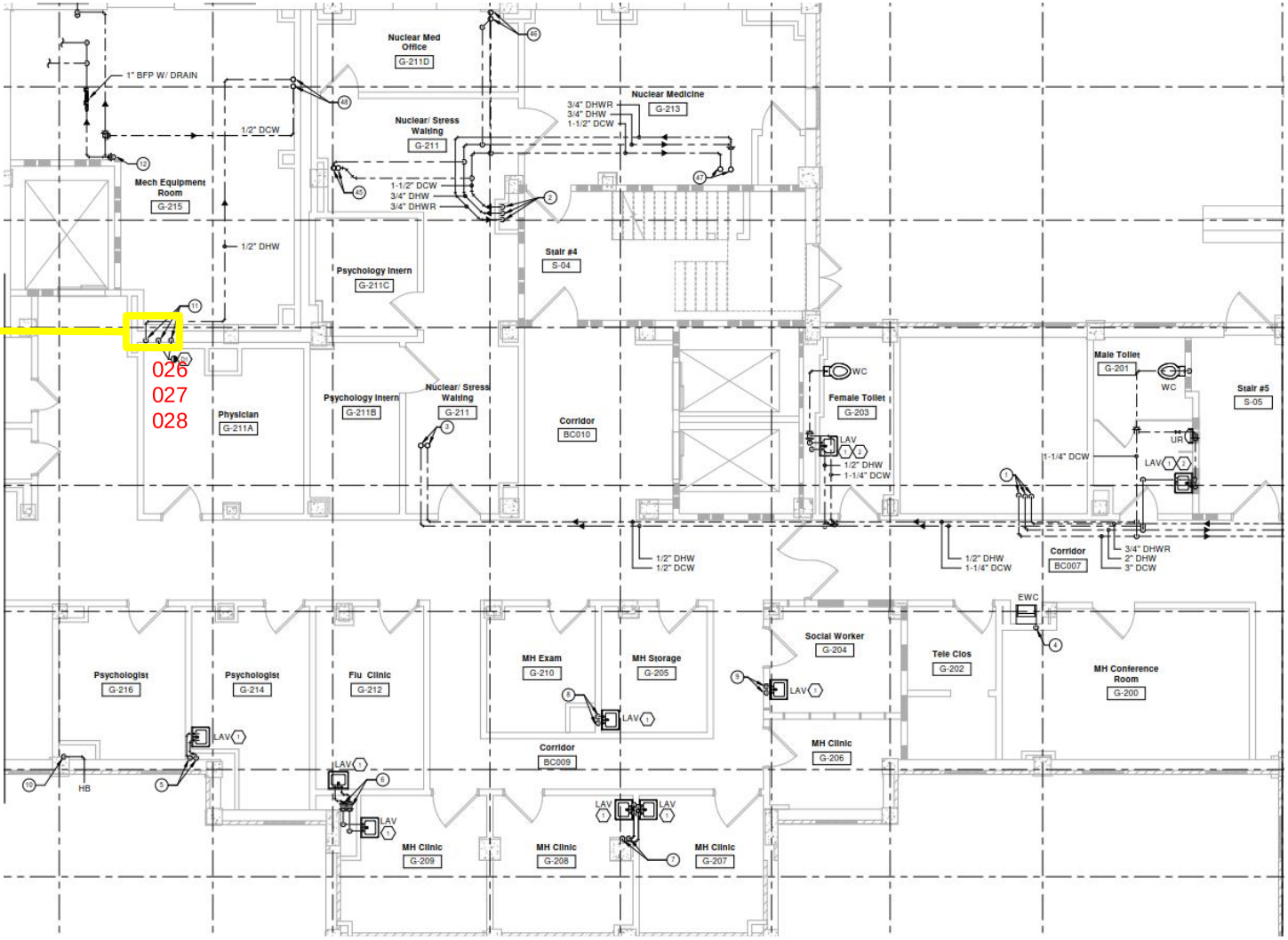

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Project Manager: JV	Project No.: N1197373	Terracon Consulting Engineers & Scientists
Drawn by: GV	Scale: N.T.S.	3601 Mojave Court, Suite A Columbia, Missouri 65202
Checked by: JV		PH. (573) 214-2677 FAX. (573) 214-2714
Approved by: JAT	Date: 09/18/19	

ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 31 –Basement Plan Area E

Exhibit

34

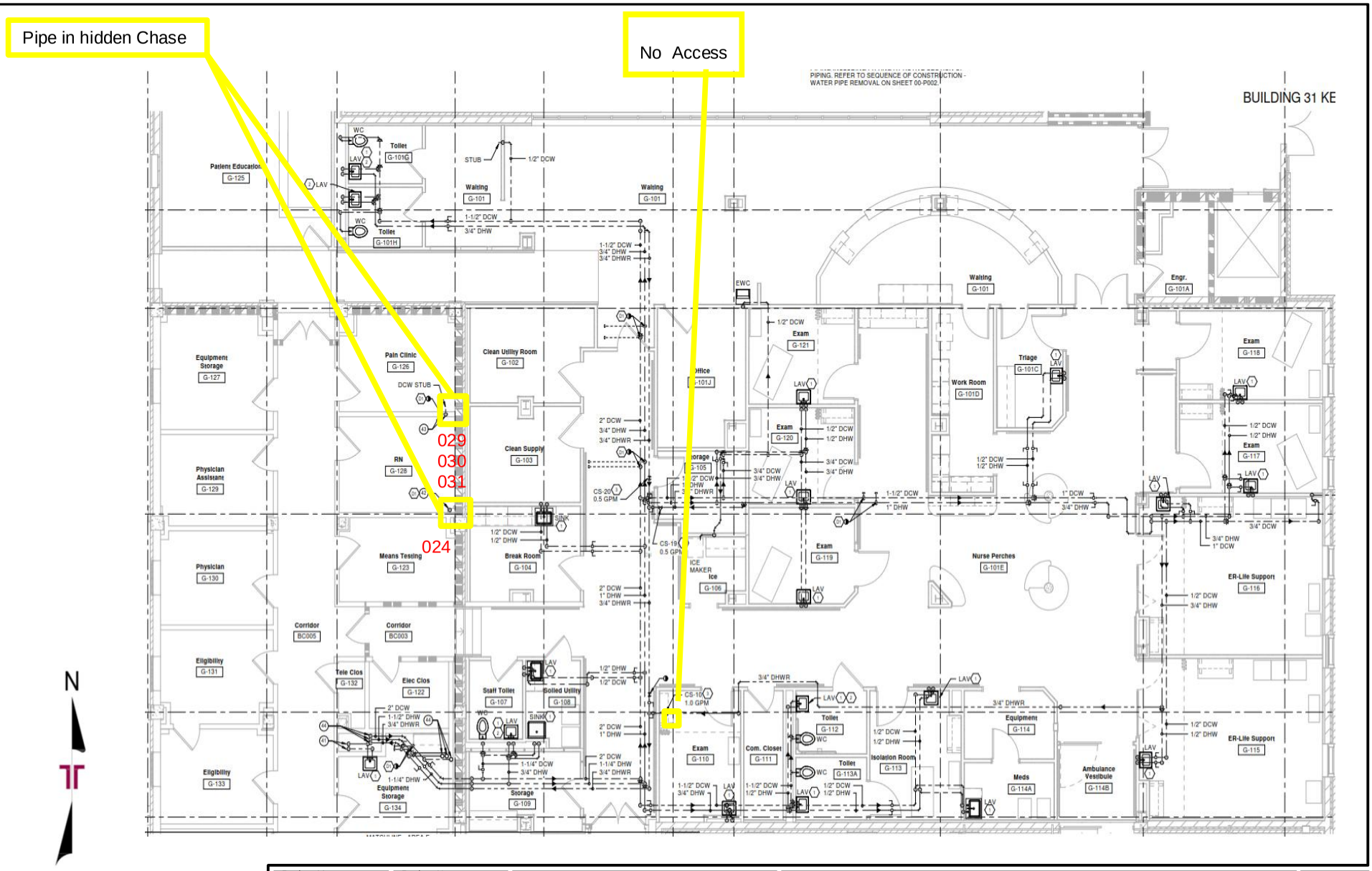

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: JV	Project No. N1197373	Terracon Consulting Engineers & Scientists
Drawn by: GV	Scale: N.T.S.	3601 Mojave Court, Suite A Columbia, Missouri 65202
Checked by: JV		PH. (573) 214-2677 FAX. (573) 214-2714
Approved by: JAT	Date: 09/18/19	

ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 31 –Basement Plan Area G

Exhibit

35

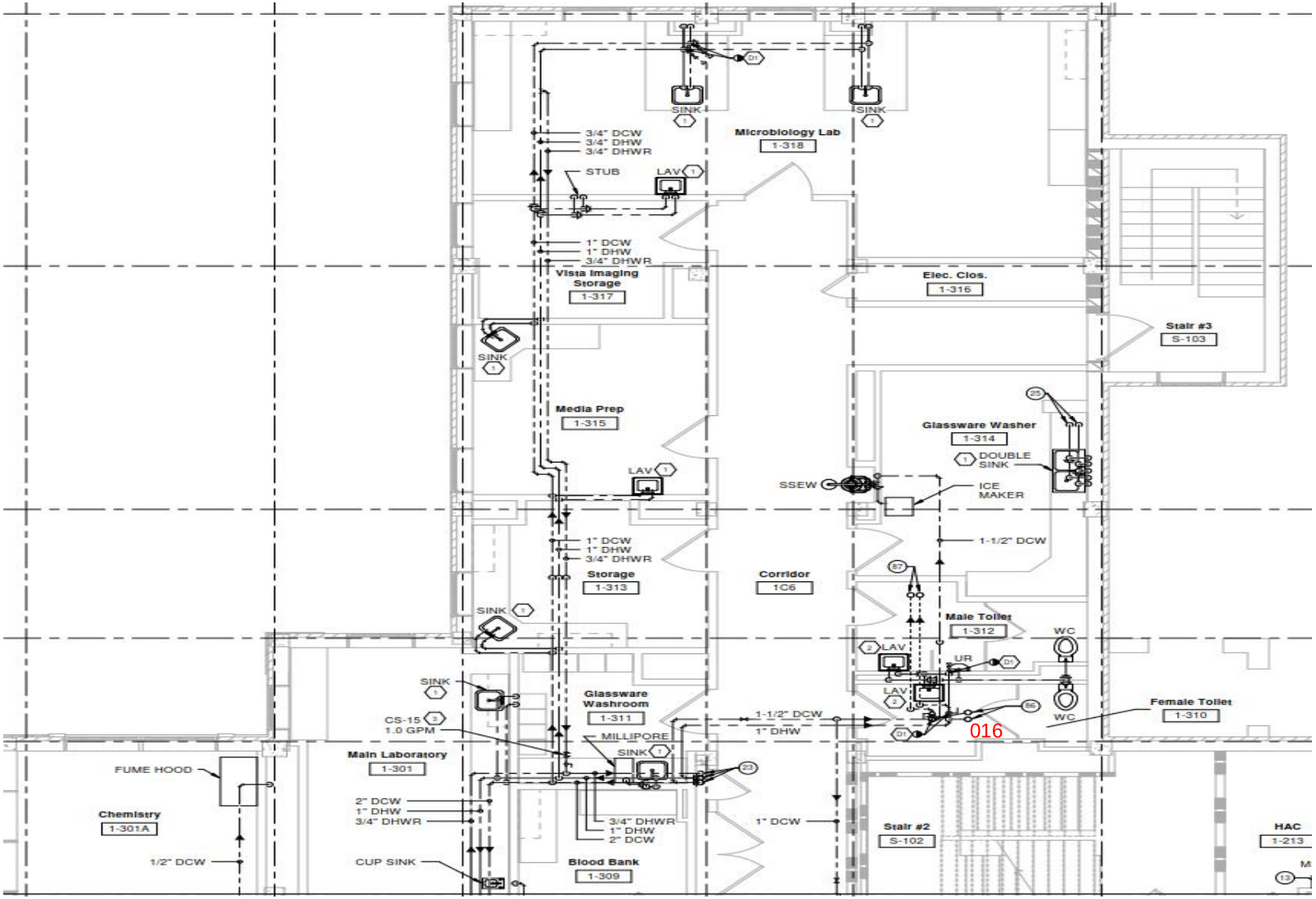

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: JV	Project No.: N1197373	
Drawn by: GV	Scale: N.T.S.	
Checked by: JV		
Approved by: JAT	Date: 09/18/19	

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ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 31 –First Floor Plan Area C

Exhibit

36

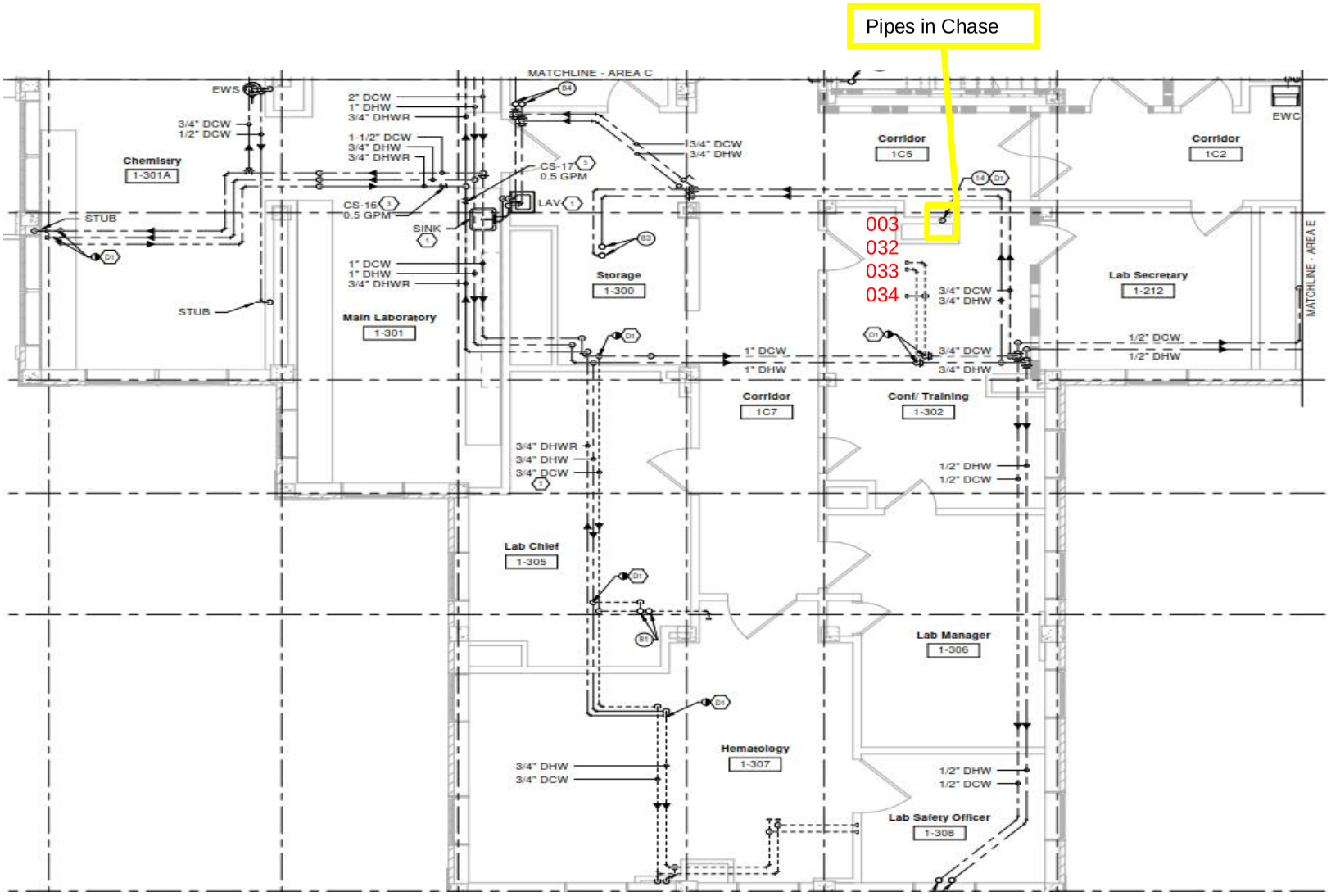
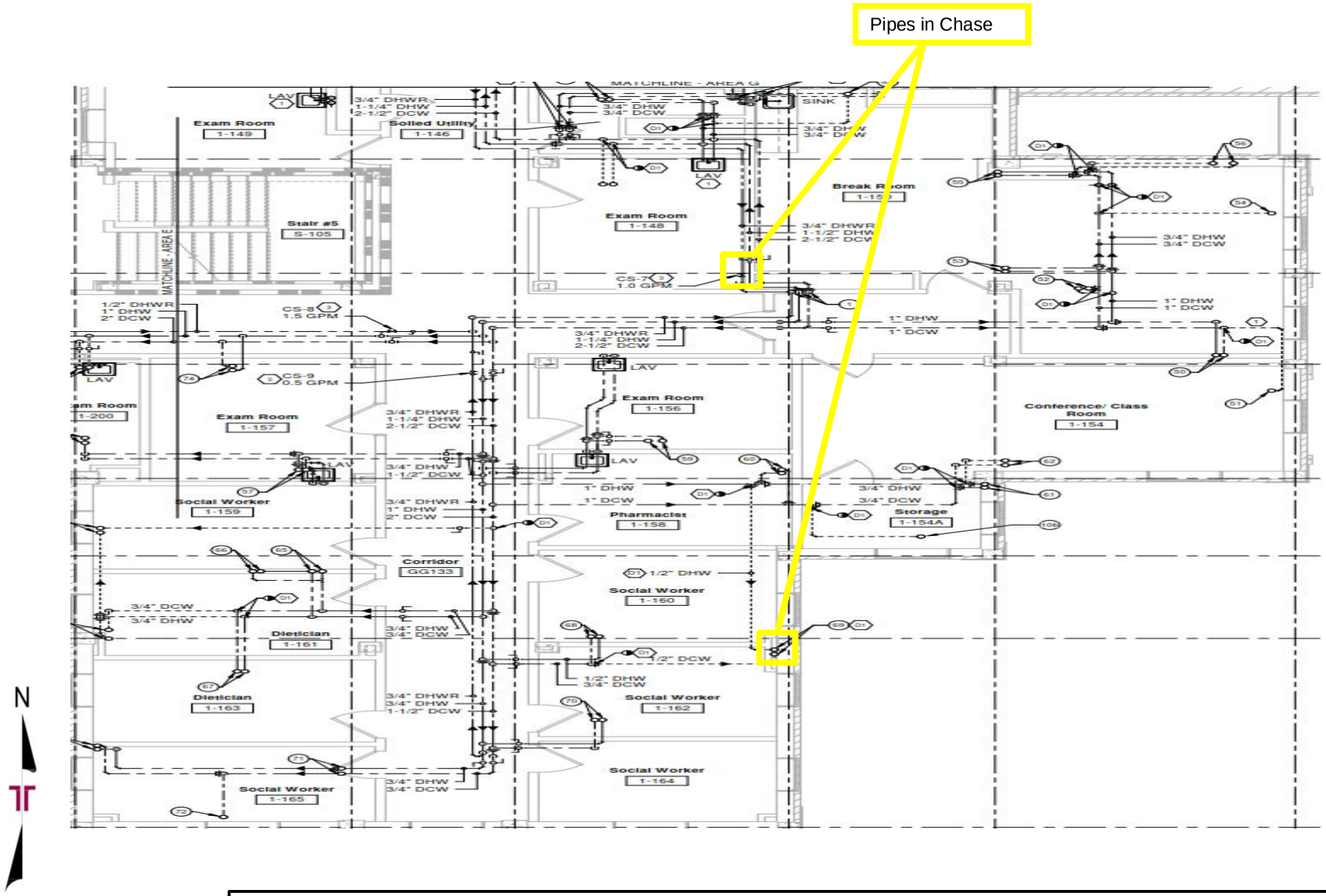


DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: JV	Project No. N1197373	Terracon Consulting Engineers & Scientists	ASBESTOS SAMPLE LOCATION DIAGRAM
Drawn by: GV	Scale: N.T.S.	3601 Mojave Court, Suite A Columbia, Missouri 65202	Chillicothe VAMC
Checked by: JV		PH. (573) 214-2677 FAX. (573) 214-2714	Building 31 –First Floor Plan Area D
Approved by: JAT	Date: 09/18/19		

Exhibit

37



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Project Manager: JV	Project No. N1197373	Terracon Consulting Engineers & Scientists	ASBESTOS SAMPLE LOCATION DIAGRAM
Drawn by: GV	Scale: N.T.S.	3601 Mojave Court, Suite A Columbia, Missouri 65202	Chillicothe VAMC
Checked by: JV		PH. (573) 214-2677 FAX. (573) 214-2714	Building 31 –First Floor Plan Area F
Approved by: JAT	Date: 09/18/19		

Exhibit

38

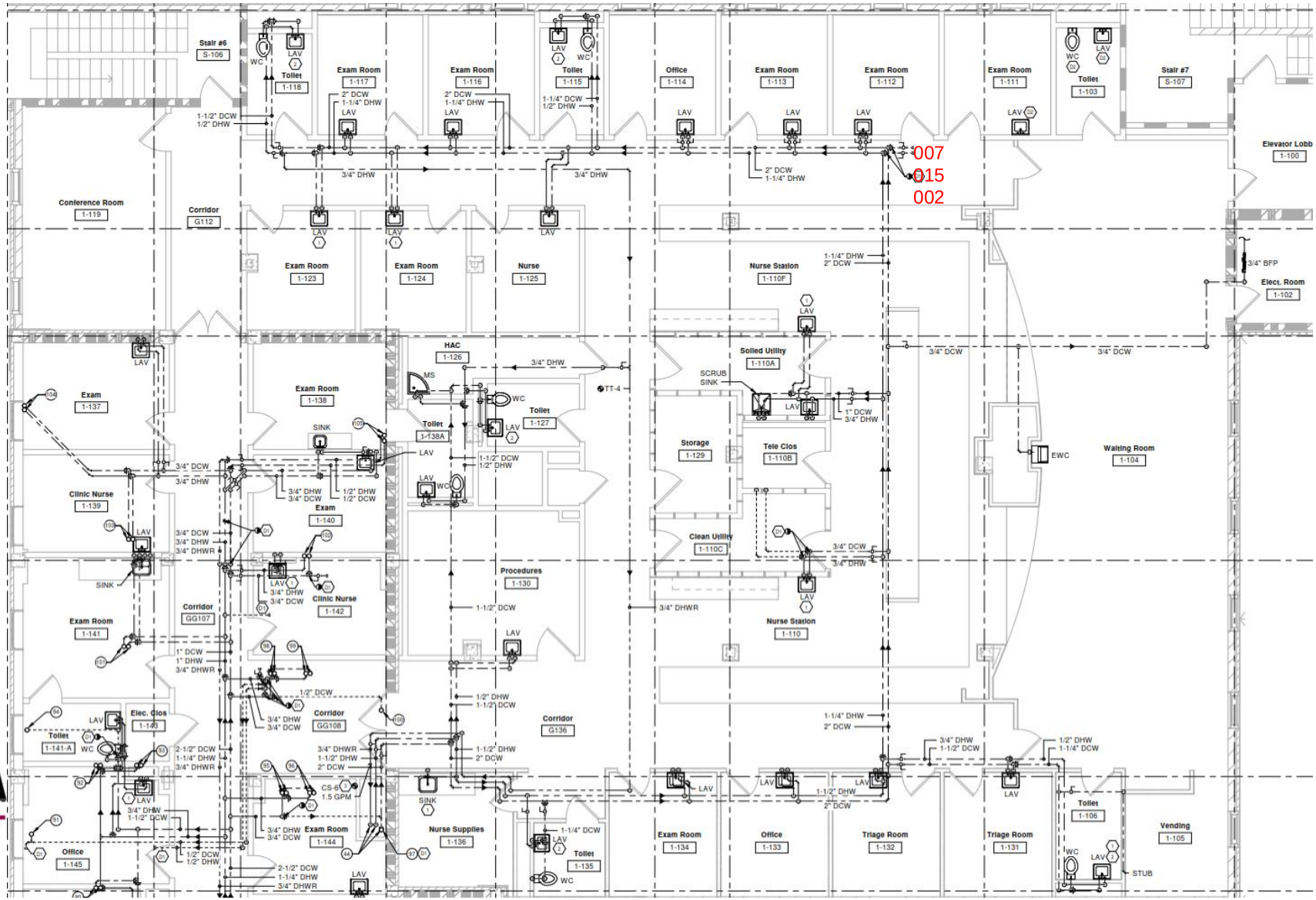

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: JV	Project No. N1197373	Terracon Consulting Engineers & Scientists	ASBESTOS SAMPLE LOCATION DIAGRAM
Drawn by: GV	Scale: N.T.S.	3601 Mojave Court, Suite A Columbia, Missouri 65202	Chillicothe VAMC
Checked by: JV		PH. (573) 214-2677 FAX. (573) 214-2714	Building 31 –First Floor Plan Area G
Approved by: JAT	Date: 09/18/19		Exhibit 39

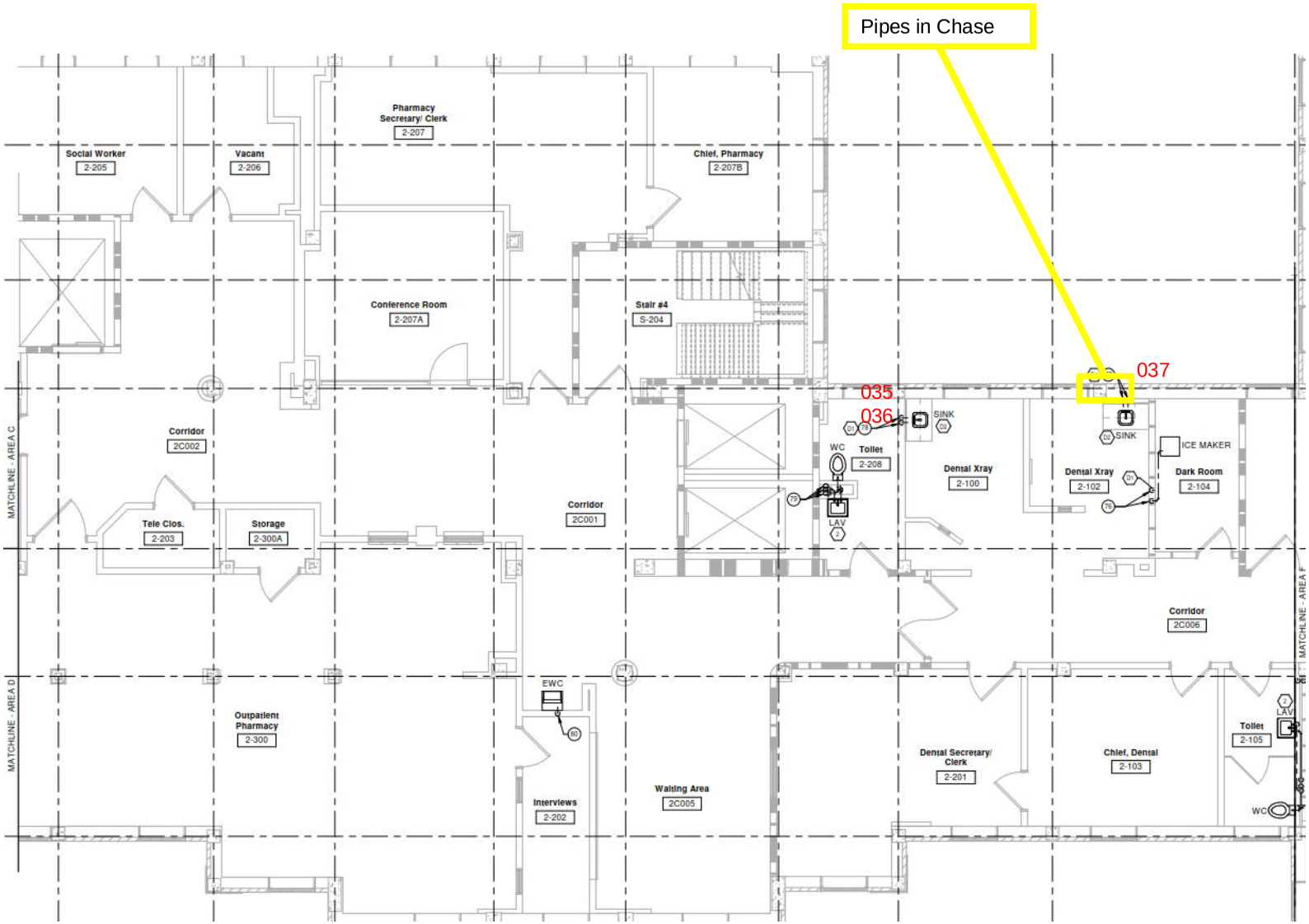

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: JV	Project No. N1197373	
Drawn by: GV	Scale: N.T.S.	
Checked by: JV		
Approved by: JAT	Date: 09/18/19	

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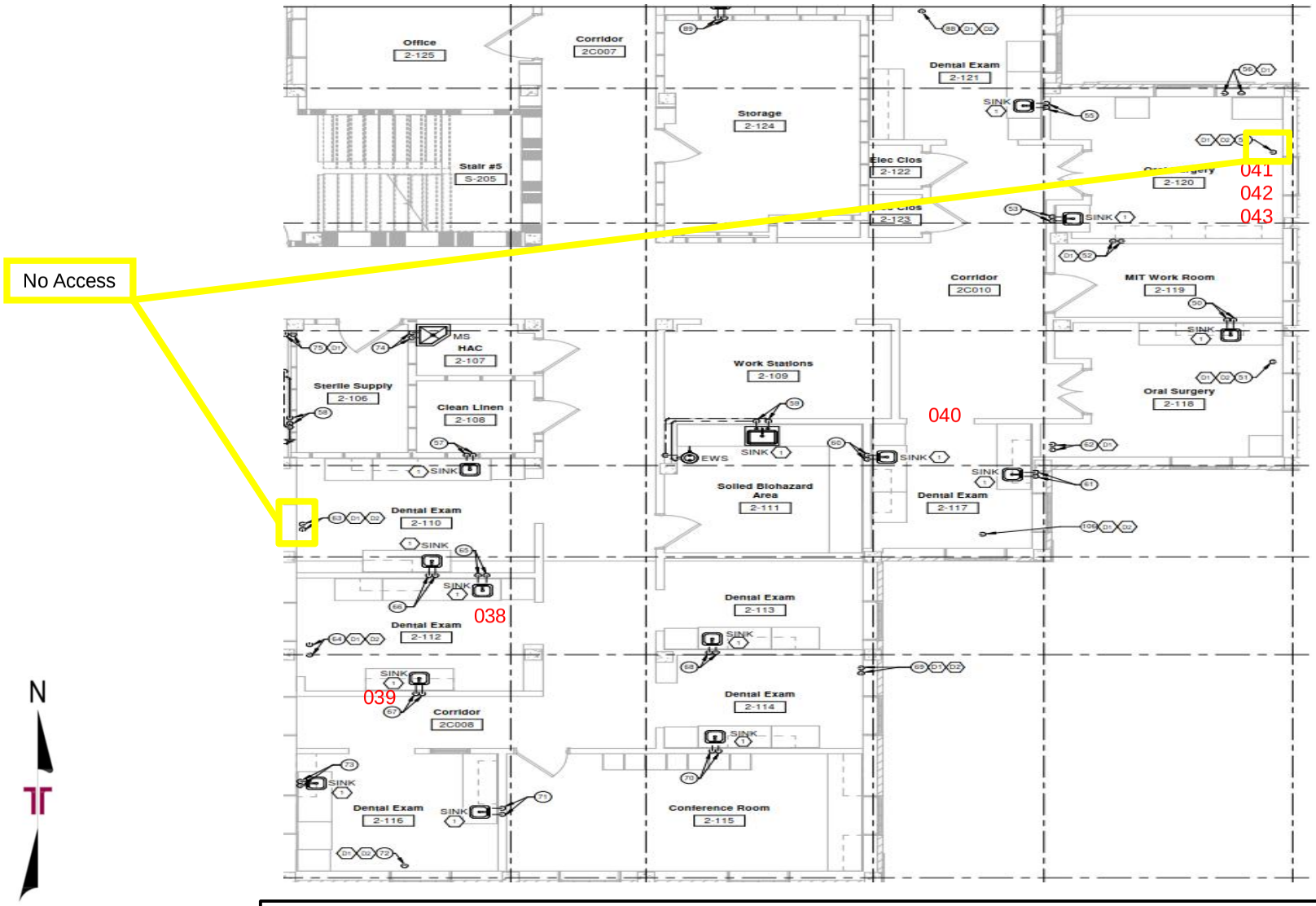
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 31 –Second Floor Plan Area E

Exhibit

40



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Project Manager: JV	Project No. N1197373	Terracon Consulting Engineers & Scientists
Drawn by: GV	Scale: N.T.S.	3601 Mojave Court, Suite A Columbia, Missouri 65202
Checked by: JV		PH. (573) 214-2677 FAX. (573) 214-2714
Approved by: JAT	Date: 09/18/19	

ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 31 –Second Floor Plan Area F

Exhibit

41

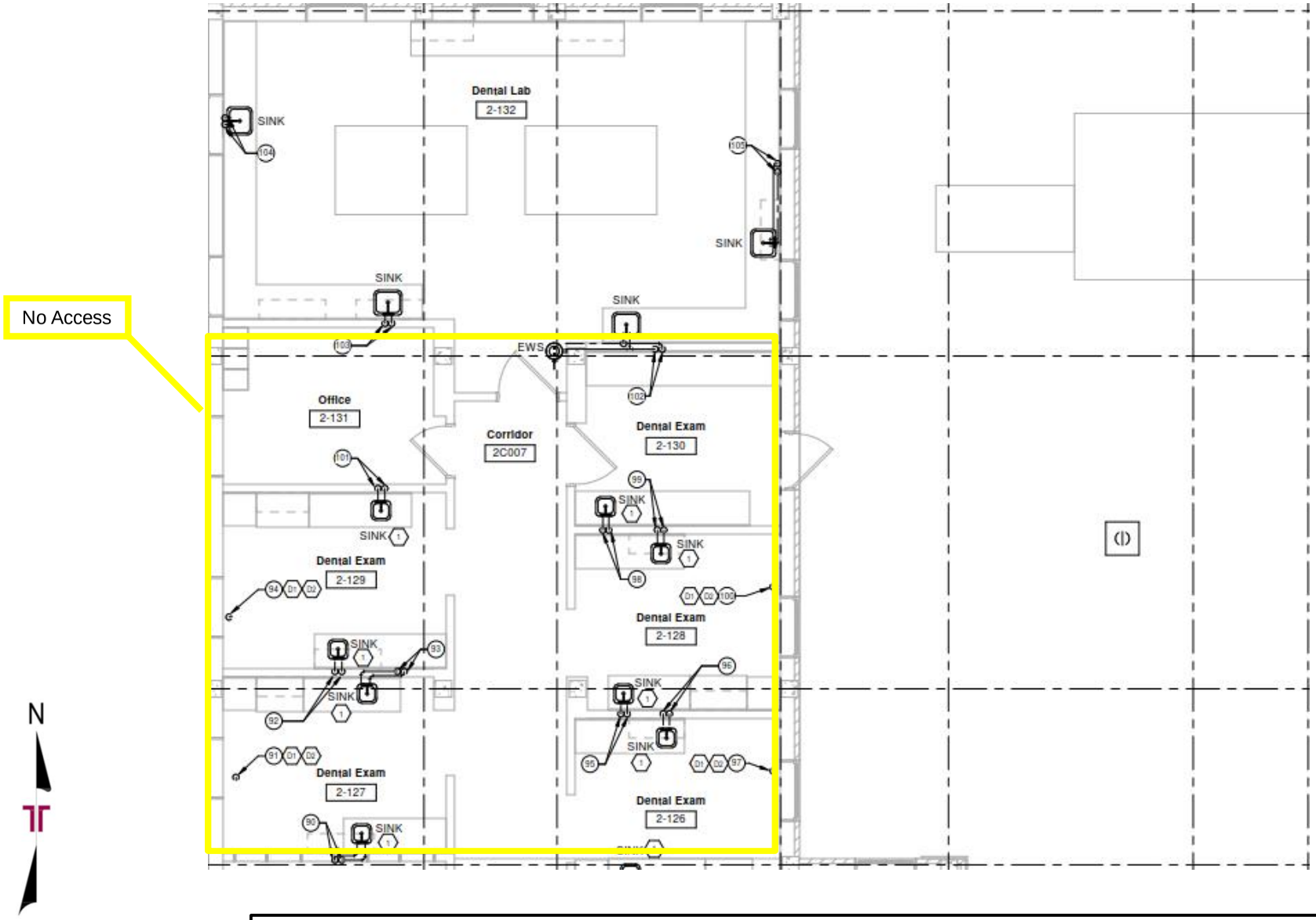

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: JV	Project No.: N1197373	
Drawn by: GV	Scale: N.T.S.	
Checked by: JV		
Approved by: JAT	Date: 09/18/19	

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ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 31 –Second Floor Plan Area G

Exhibit

42

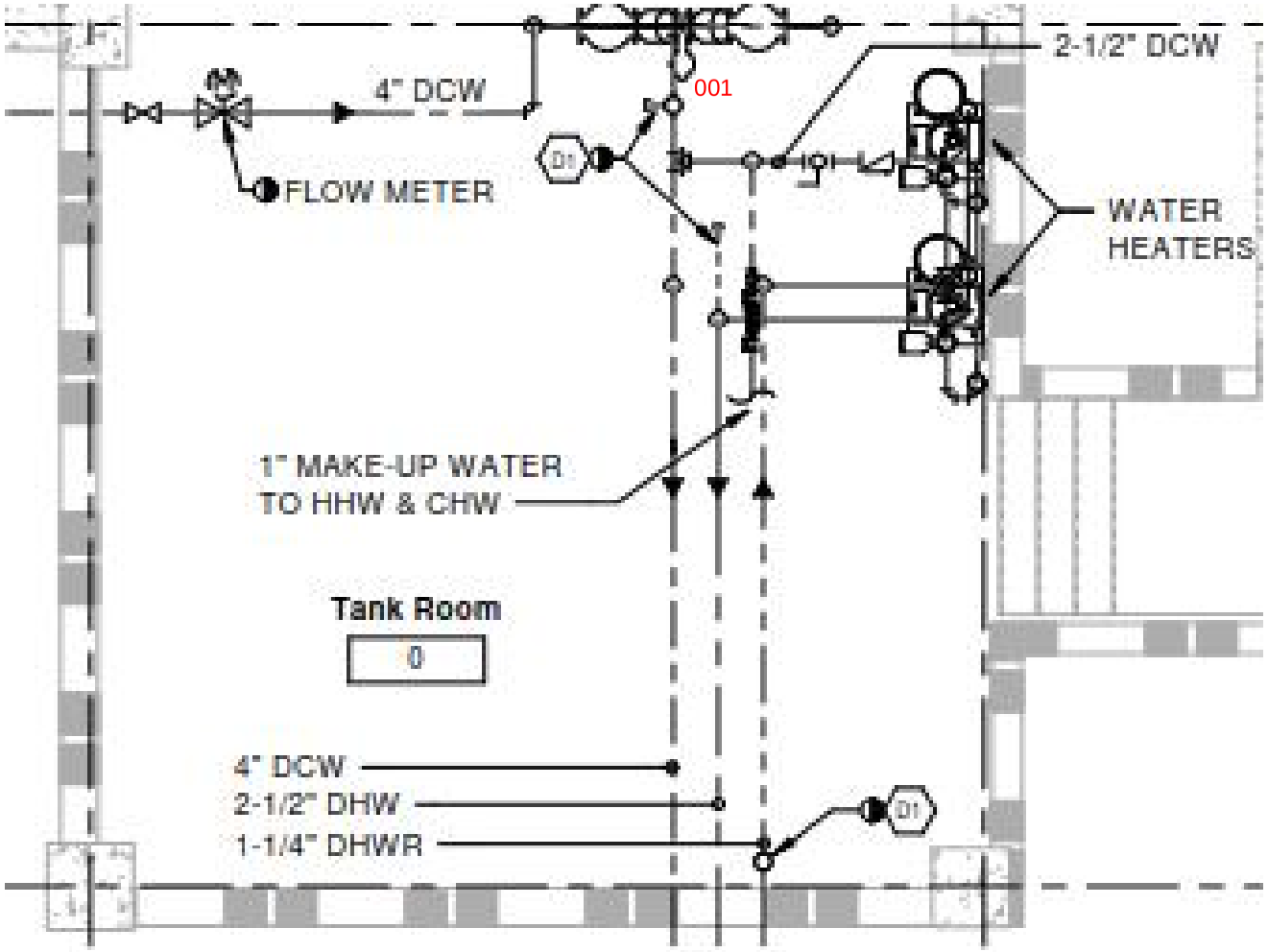

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DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager:	JV
Drawn by:	GV
Checked by:	JV
Approved by:	JAT

Project No.	N1197373
Scale:	N.T.S.
Date:	09/18/19

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ASBESTOS SAMPLE LOCATION DIAGRAM

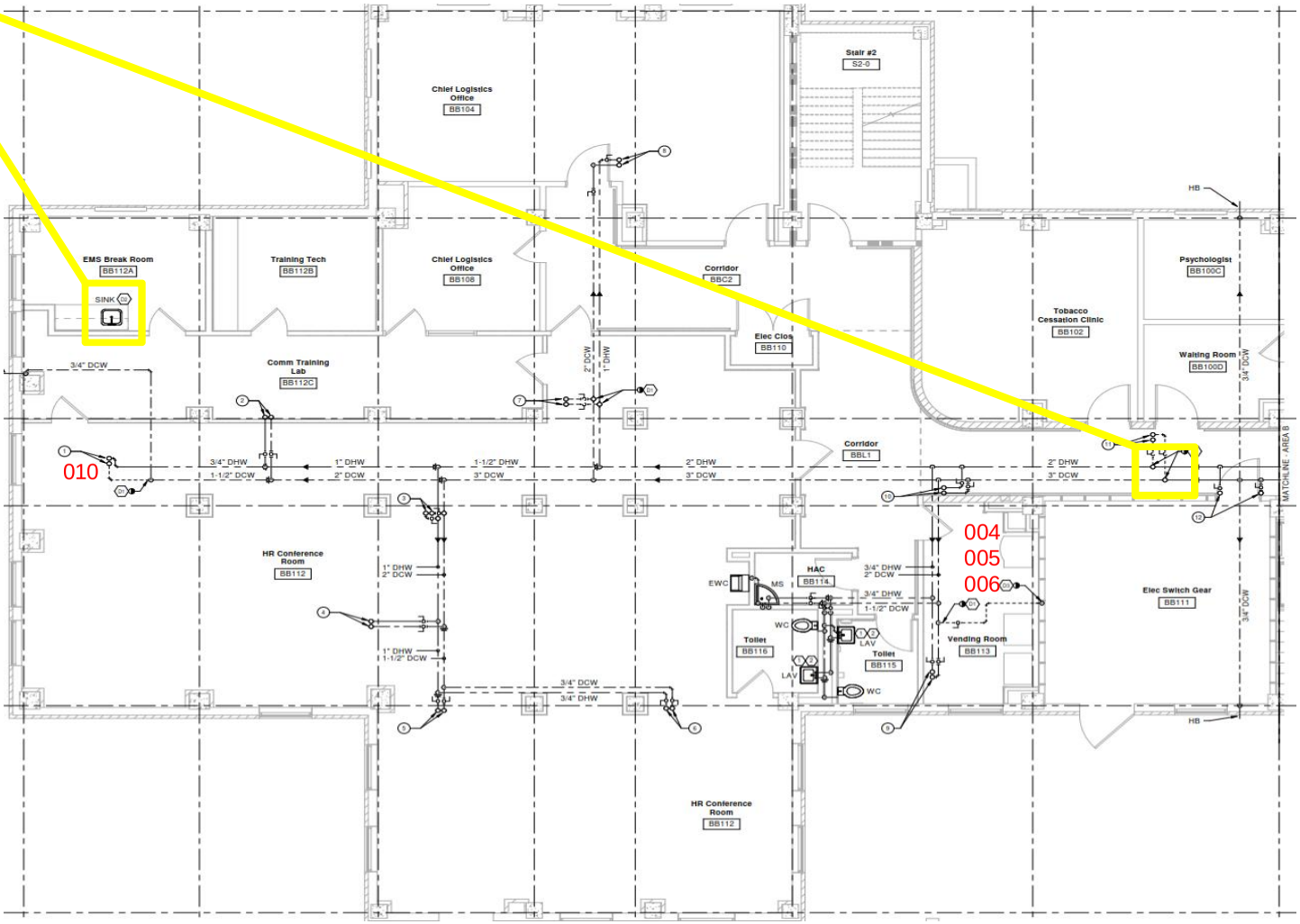
Chillicothe VAMC

Building 35 – Mechanical Room

Exhibit

43

No Access Pipes In Chase



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Project Manager: JV	Project No. N1197373	Terracon Consulting Engineers & Scientists
Drawn by: GV	Scale: N.T.S.	3601 Mojave Court, Suite A Columbia, Missouri 65202
Checked by: JV		PH. (573) 214-2677 FAX. (573) 214-2714
Approved by: JAT	Date: 09/18/19	

ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 35 – Basement Plan Area A

Exhibit

44

No Access Pipes In Chase

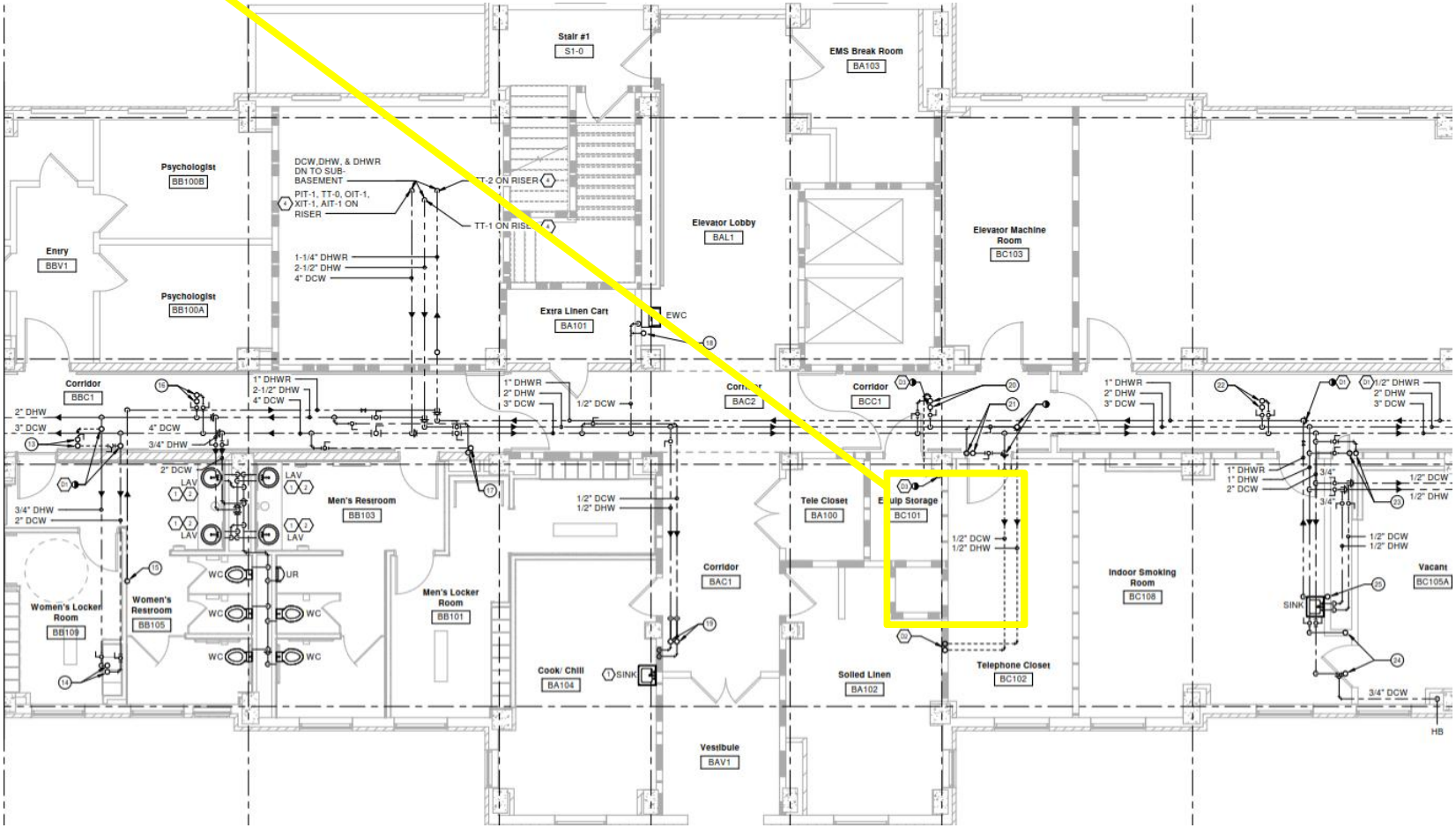

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: JV	Project No. N1197373	Terracon Consulting Engineers & Scientists
Drawn by: GV	Scale: N.T.S.	3601 Mojave Court, Suite A Columbia, Missouri 65202
Checked by: JV		PH. (573) 214-2677 FAX. (573) 214-2714
Approved by: JAT	Date: 09/18/19	

ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 35 – Basement Plan Area B

Exhibit

45

No Access Pipes In Chase

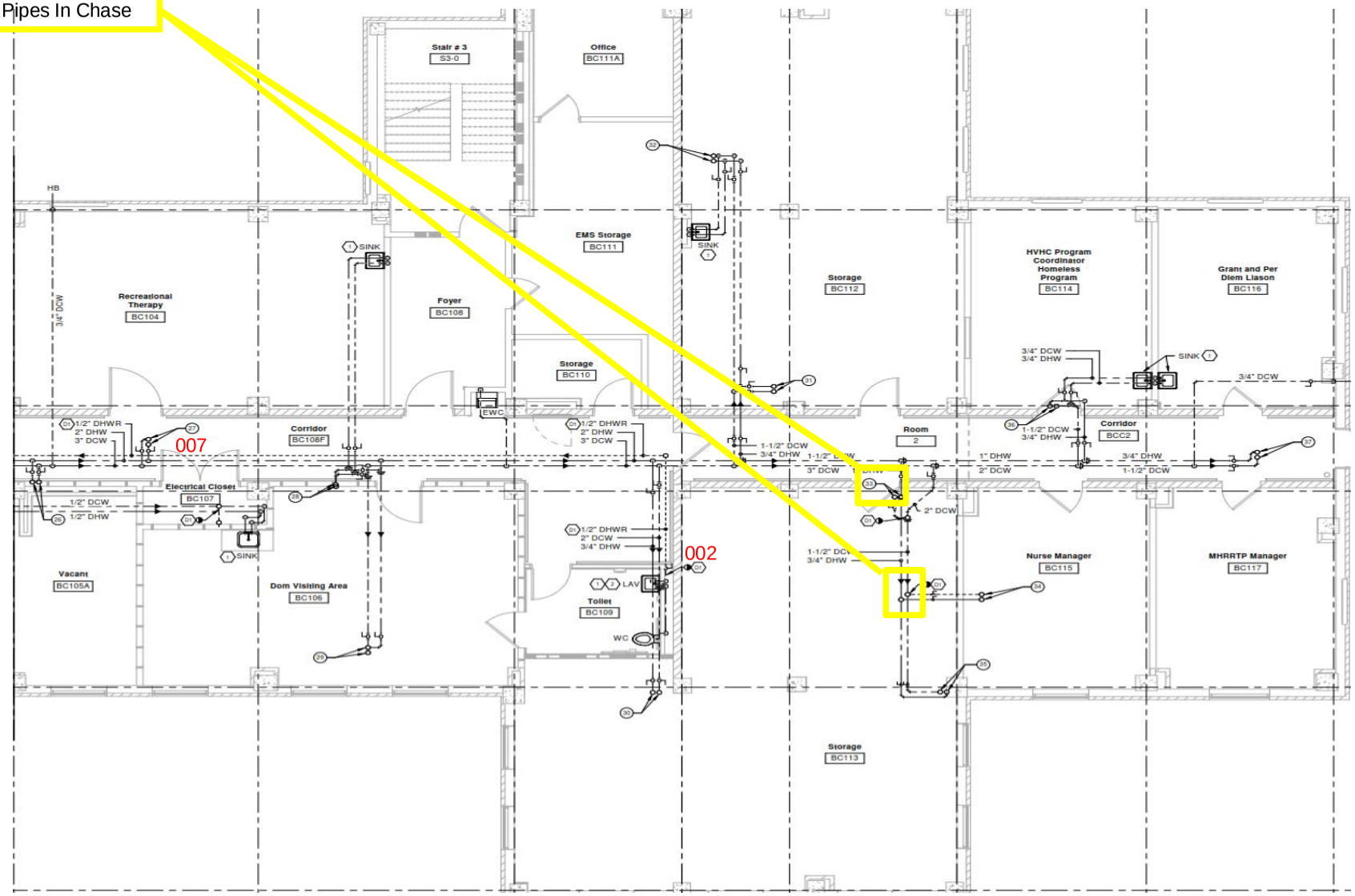

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: JV	Project No. N1197373
Drawn by: GV	Scale: N.T.S.
Checked by: JV	
Approved by: JAT	Date: 09/18/19

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ASBESTOS SAMPLE LOCATION DIAGRAM

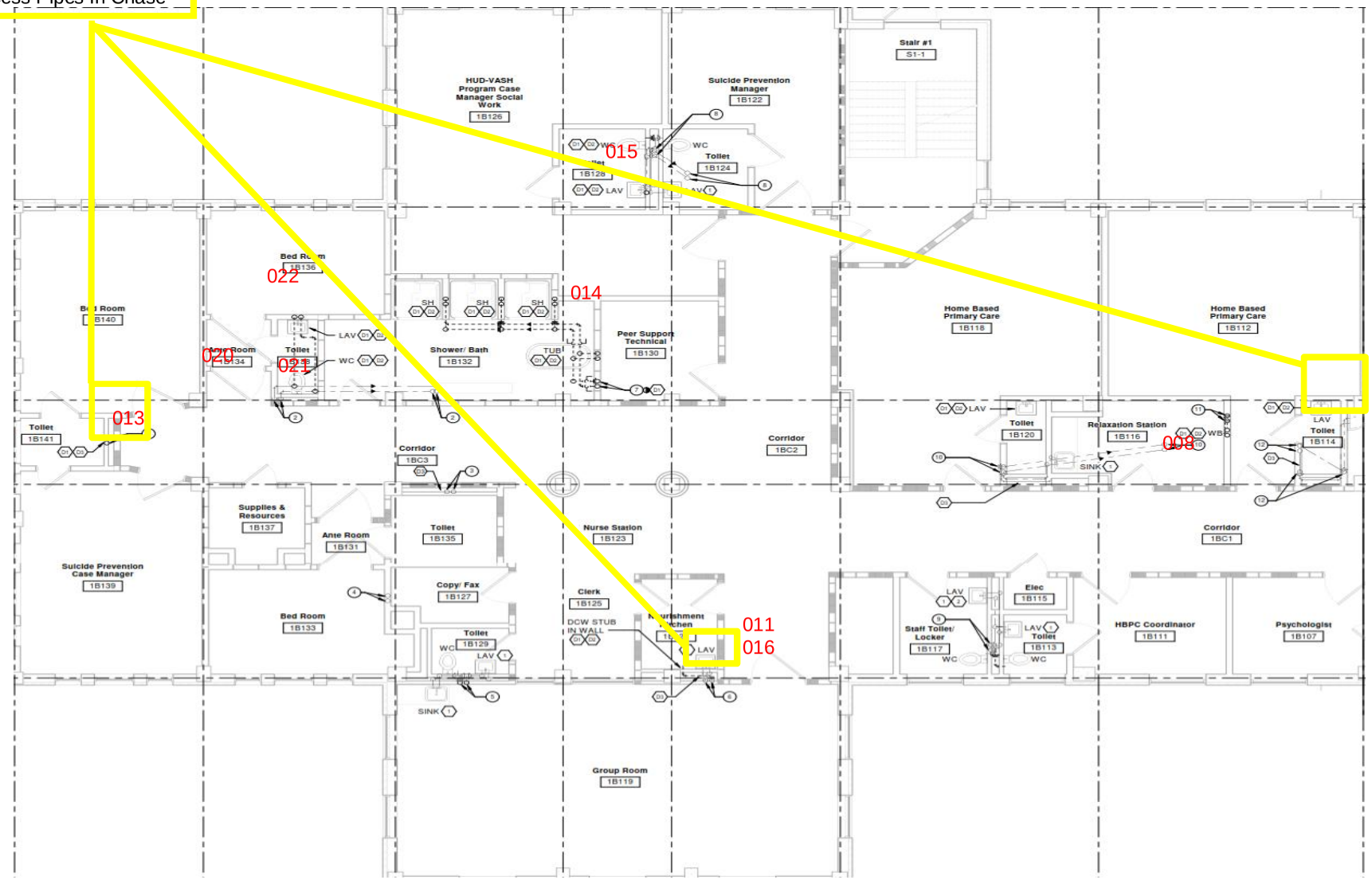
Chillicothe VAMC

Building 35 – Basement Plan Area C

Exhibit

46

No Access Pipes In Chase



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Project Manager: JV	Project No. N1197373	Terracon Consulting Engineers & Scientists	ASBESTOS SAMPLE LOCATION DIAGRAM
Drawn by: GV	Scale: N.T.S.	3601 Mojave Court, Suite A Columbia, Missouri 65202	Chillicothe VAMC
Checked by: JV		PH. (573) 214-2677 FAX. (573) 214-2714	Building 35 – First Floor Plan Area A
Approved by: JAT	Date: 09/18/19		Exhibit 47

No Access Pipes In Chase

N

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: JV	Project No. N1197373	
Drawn by: GV	Scale: N.T.S.	
Checked by: JV		
Approved by: JAT	Date: 09/18/19	

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ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 35 – First Floor Plan Area B

Exhibit

48

No Access Pipes In Chase

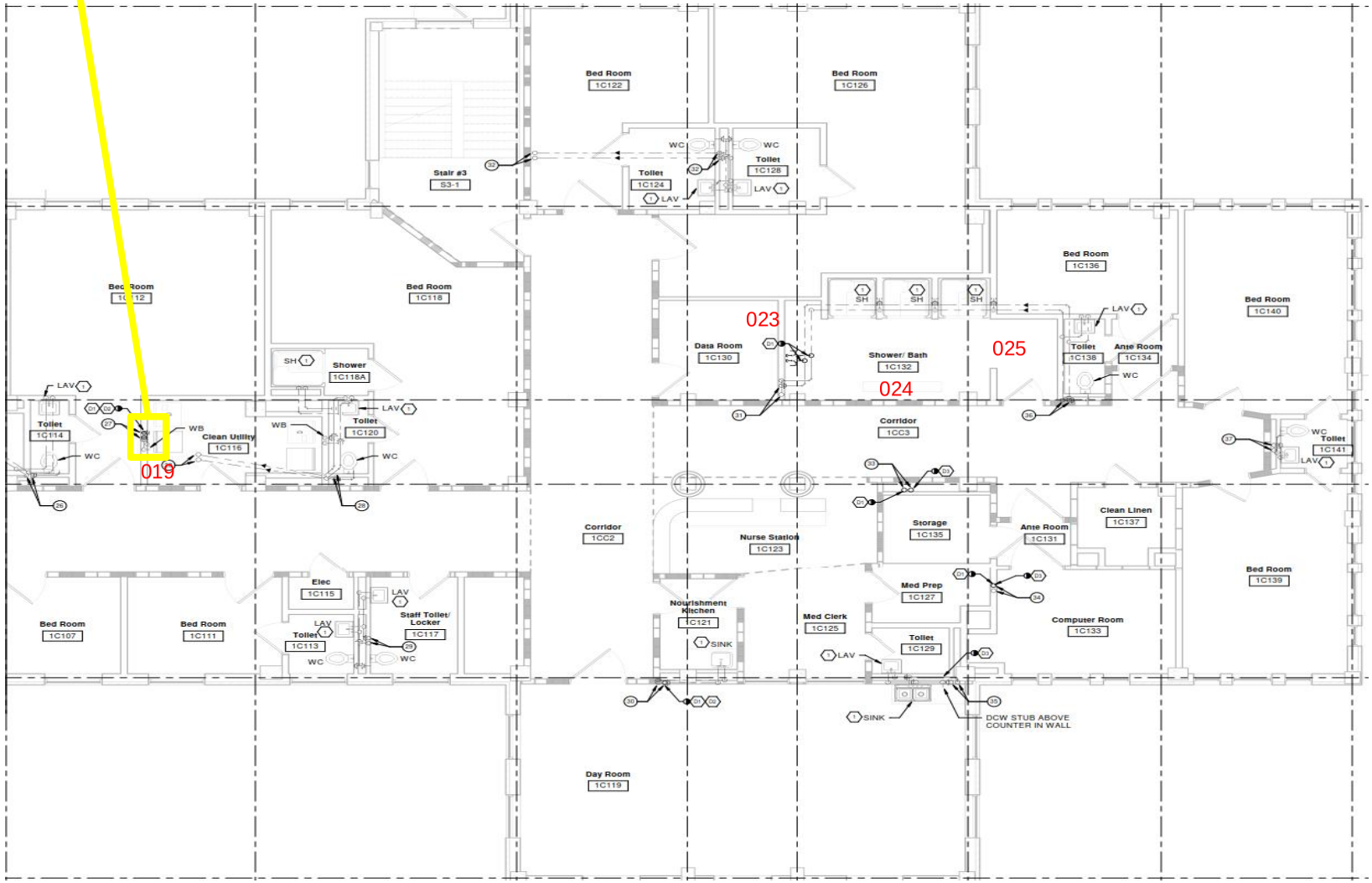

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DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: JV	Project No. N1197373
Drawn by: GV	Scale: N.T.S.
Checked by: JV	
Approved by: JAT	Date: 09/18/19

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ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 35 – First Floor Plan Area C

Exhibit

49

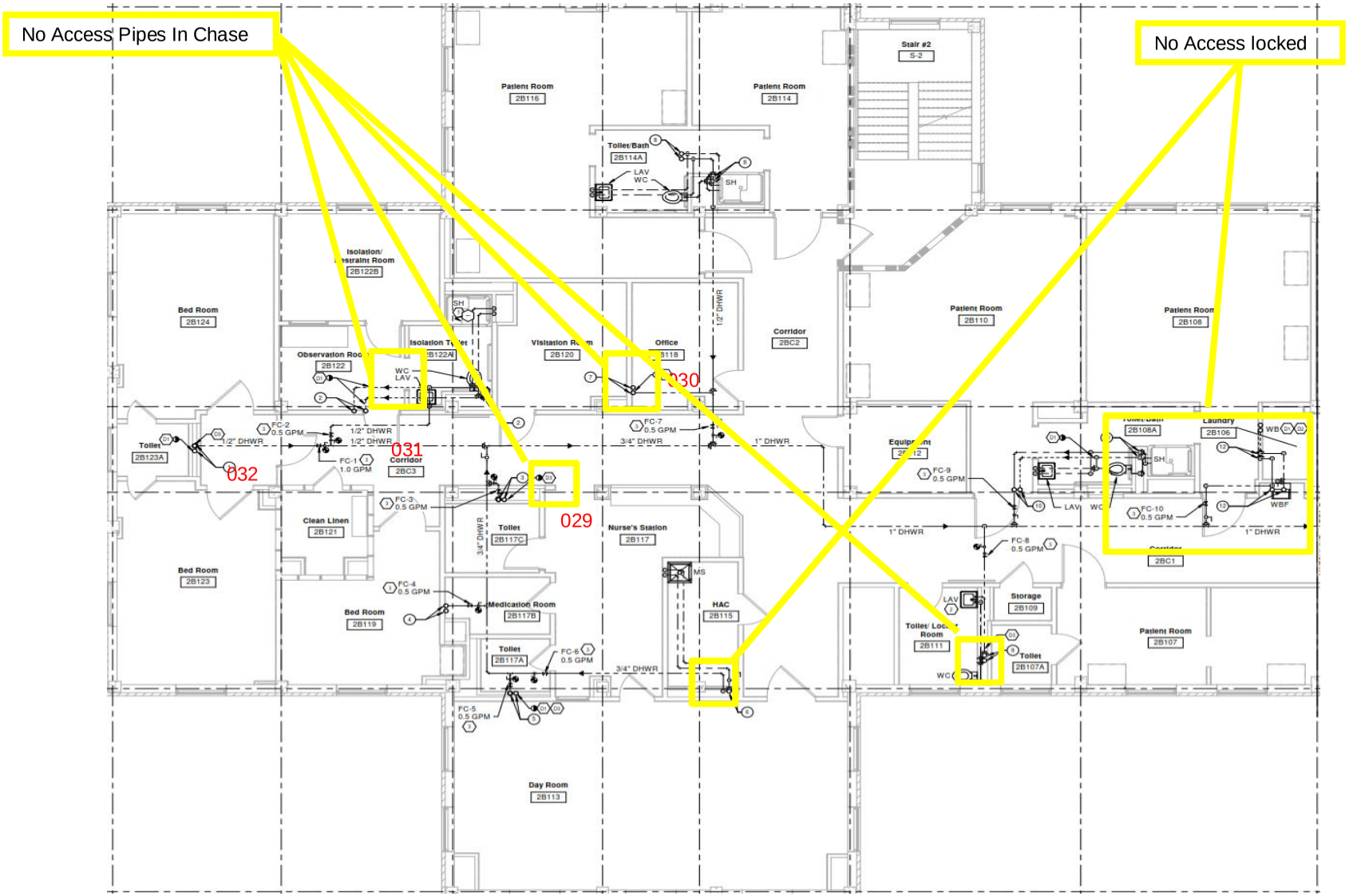

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: JV	Project No. N1197373
Drawn by: GV	Scale: N.T.S.
Checked by: JV	
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ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 35 – Second Floor Plan Area A

Exhibit

50

No Access Pipes In Chase

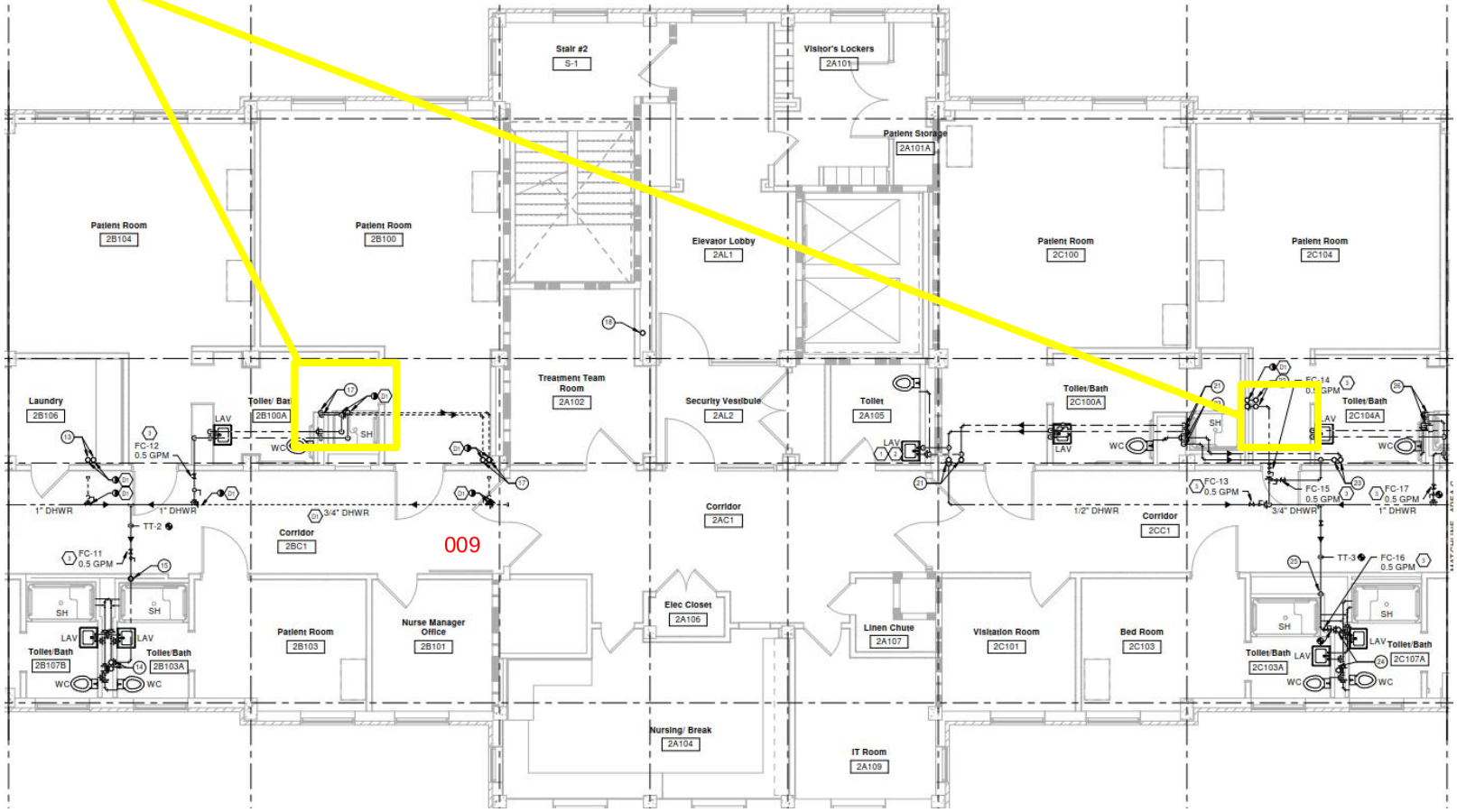

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: JV	Project No. N1197373	
Drawn by: GV	Scale: N.T.S.	
Checked by: JV		
Approved by: JAT	Date: 09/18/19	

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ASBESTOS SAMPLE LOCATION DIAGRAM

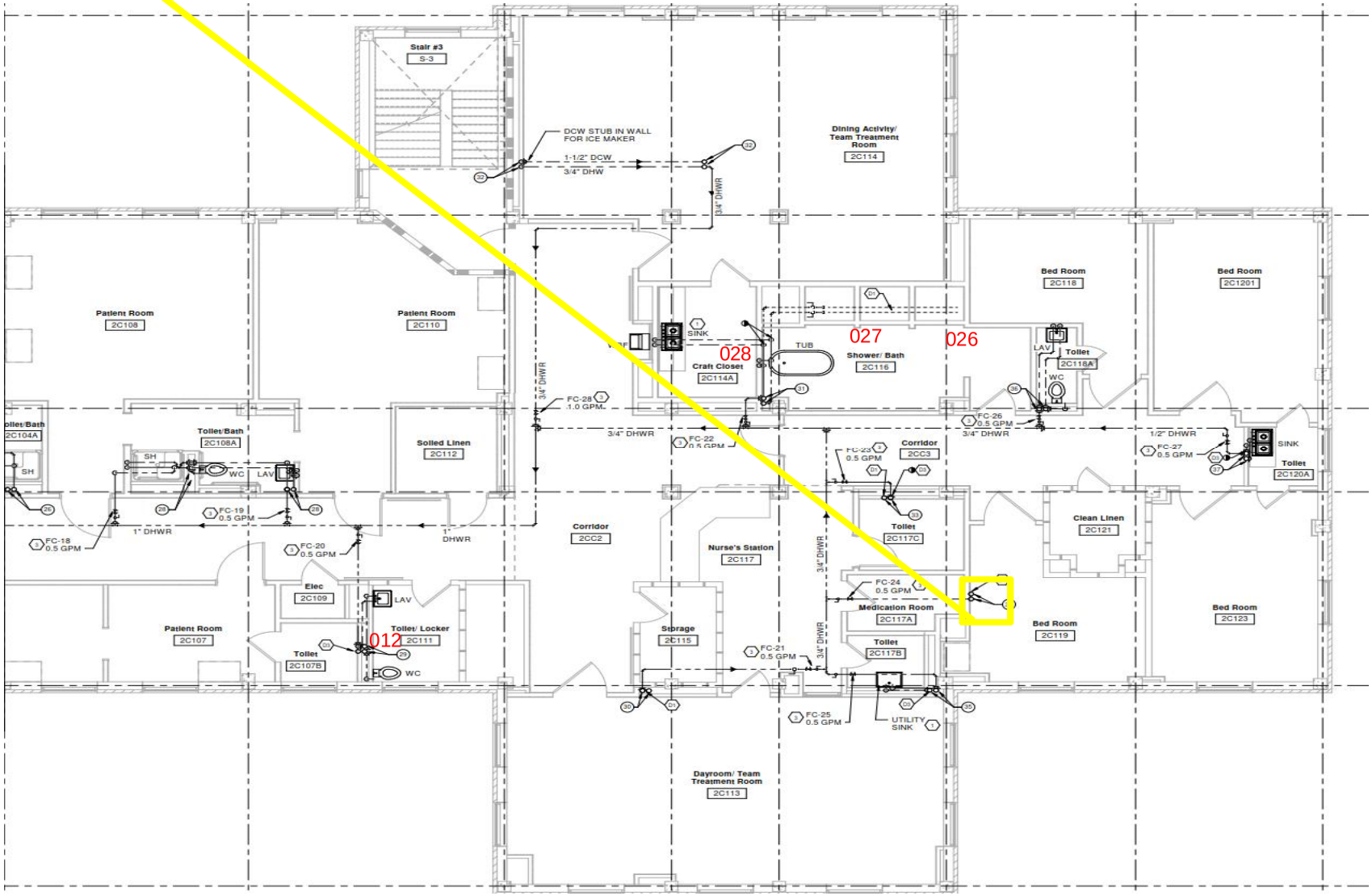
Chillicothe VAMC

Building 35 – Second Floor Plan Area B

Exhibit

51

No Access Pipes In Chase



N

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Project Manager: JV	Project No. N1197373
Drawn by: GV	Scale: N.T.S.
Checked by: JV	
Approved by: JAT	Date: 09/18/19

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ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 35 – Second Floor Plan Area C

Exhibit

52

No Access Pipes In Chase

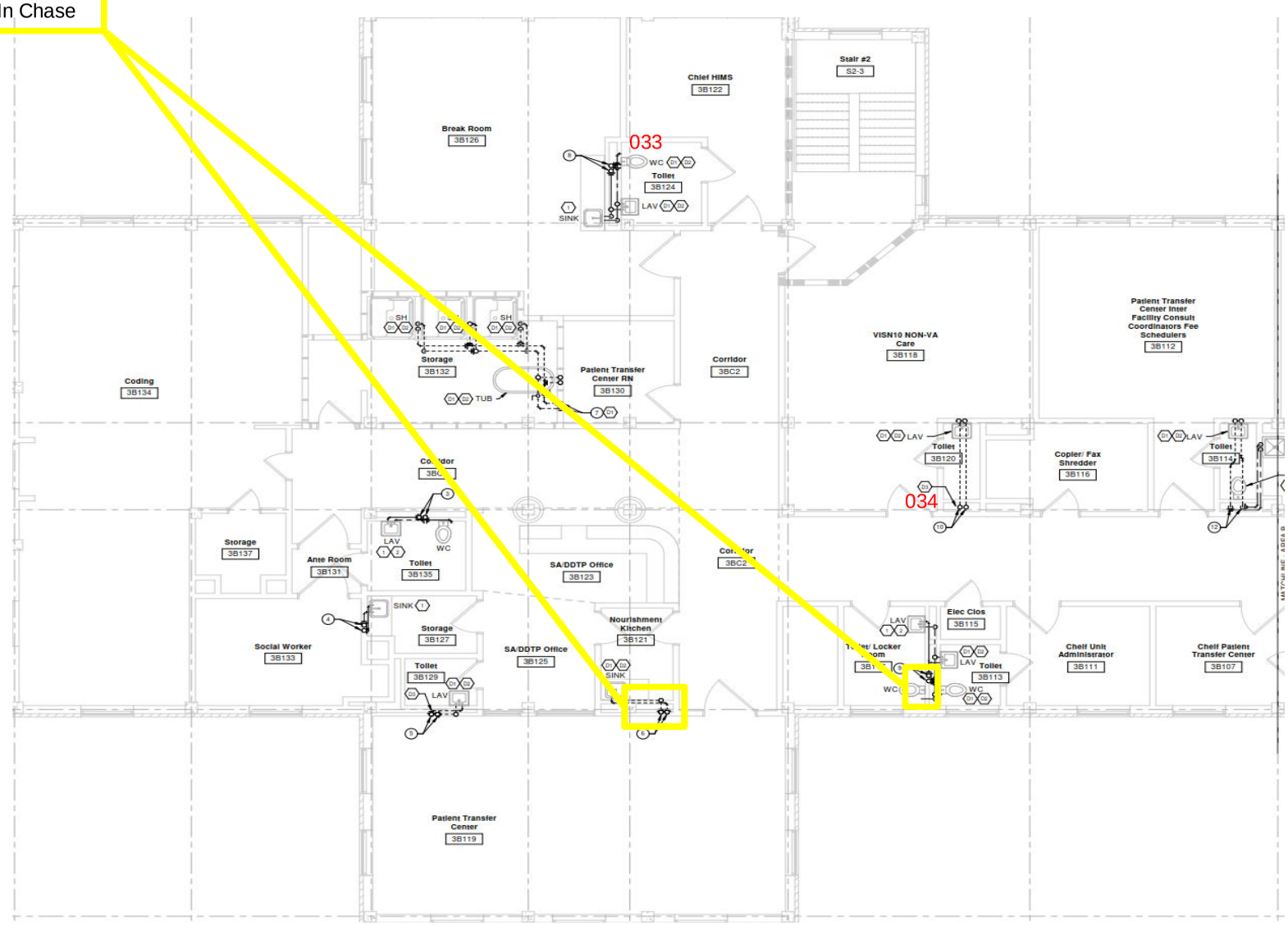

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: JV	Project No. N1197373
Drawn by: GV	Scale: N.T.S.
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ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 35 – Third Floor Plan Area A

Exhibit

53

No Access Pipes In Chase

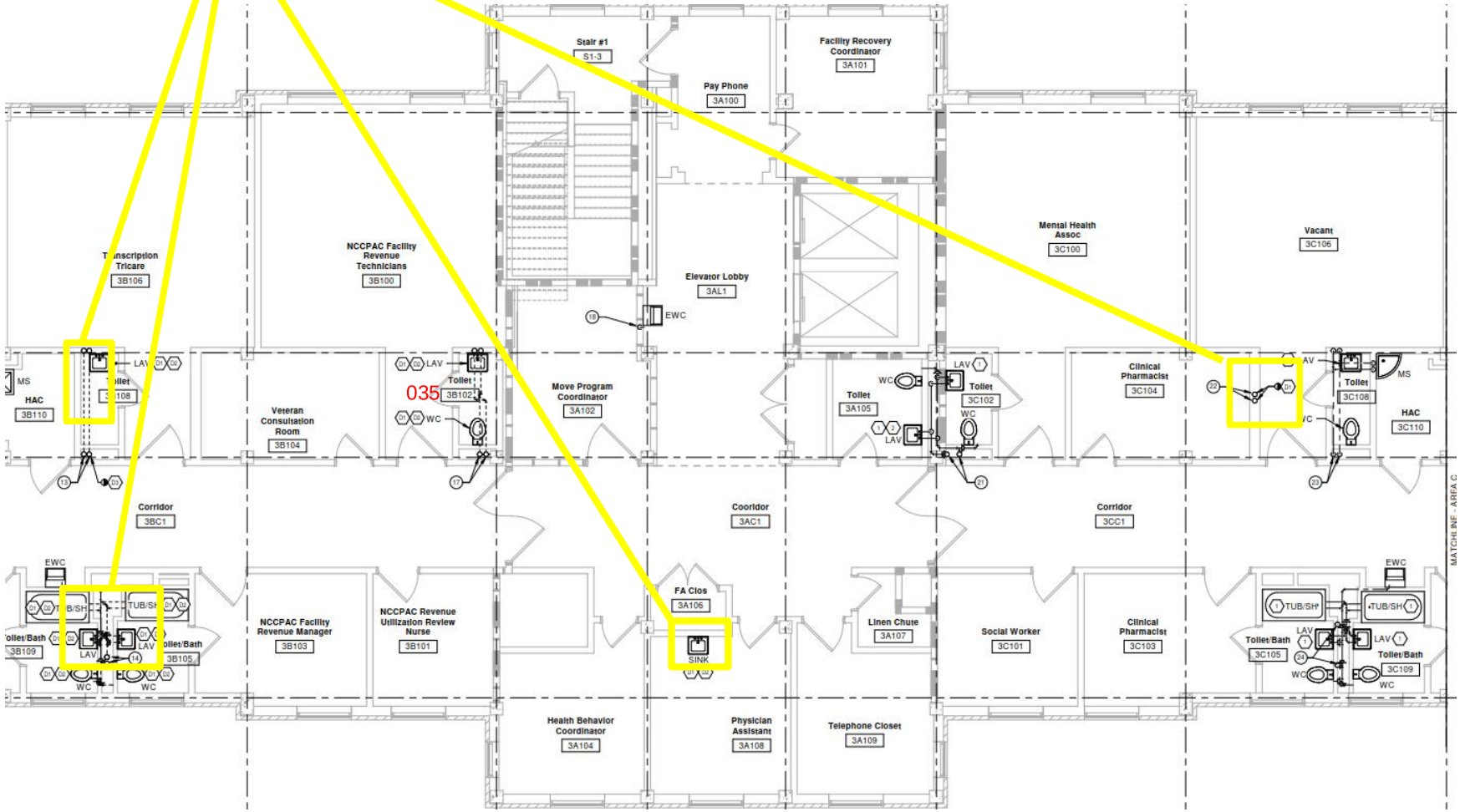

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DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager: JV	Project No. N1197373	
Drawn by: GV	Scale: N.T.S.	
Checked by: JV		
Approved by: JAT	Date: 09/18/19	

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ASBESTOS SAMPLE LOCATION DIAGRAM

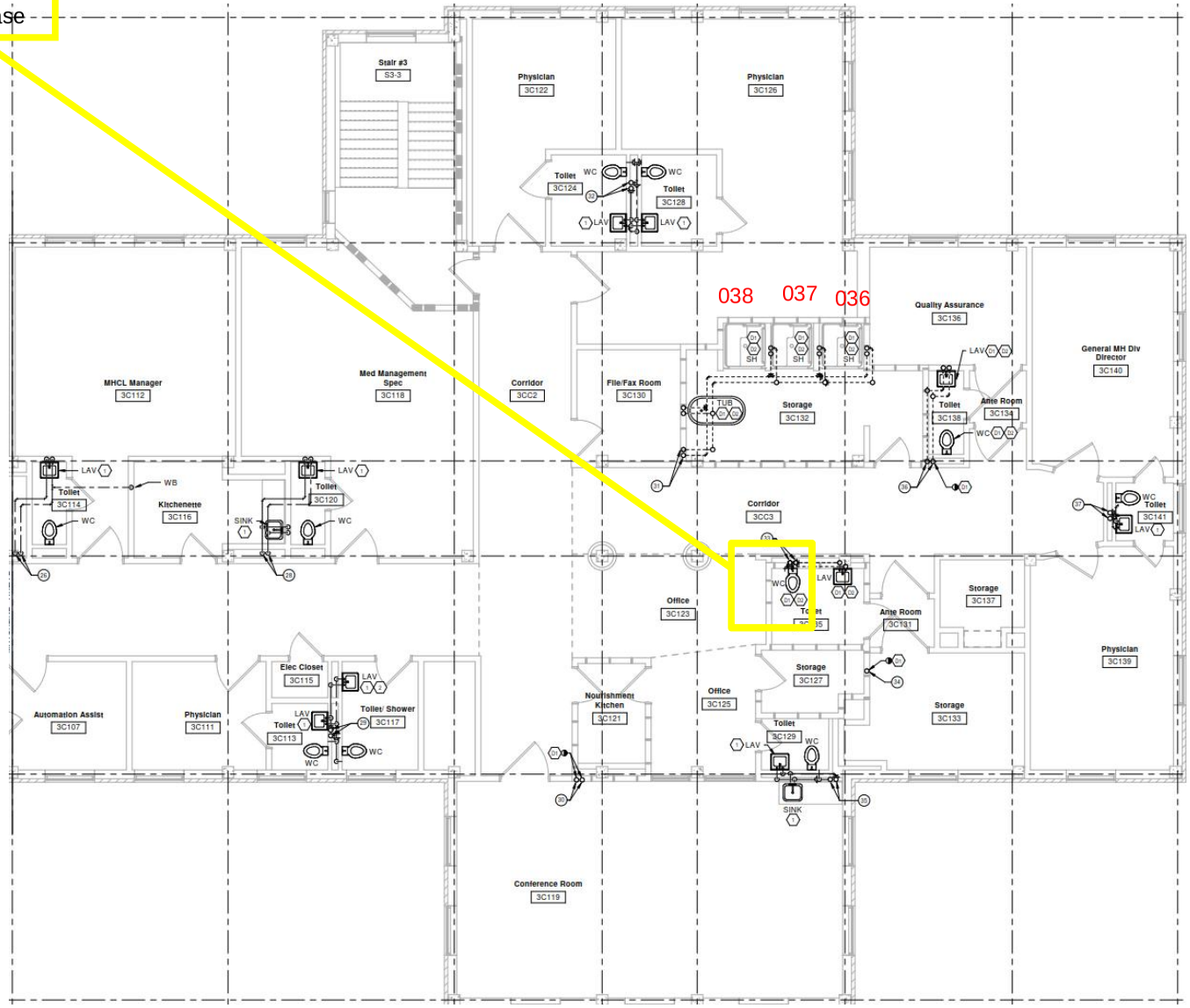
Chillicothe VAMC

Building 35 – Third Floor Plan Area B

Exhibit

54

No Access Pipes In Chase



N

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

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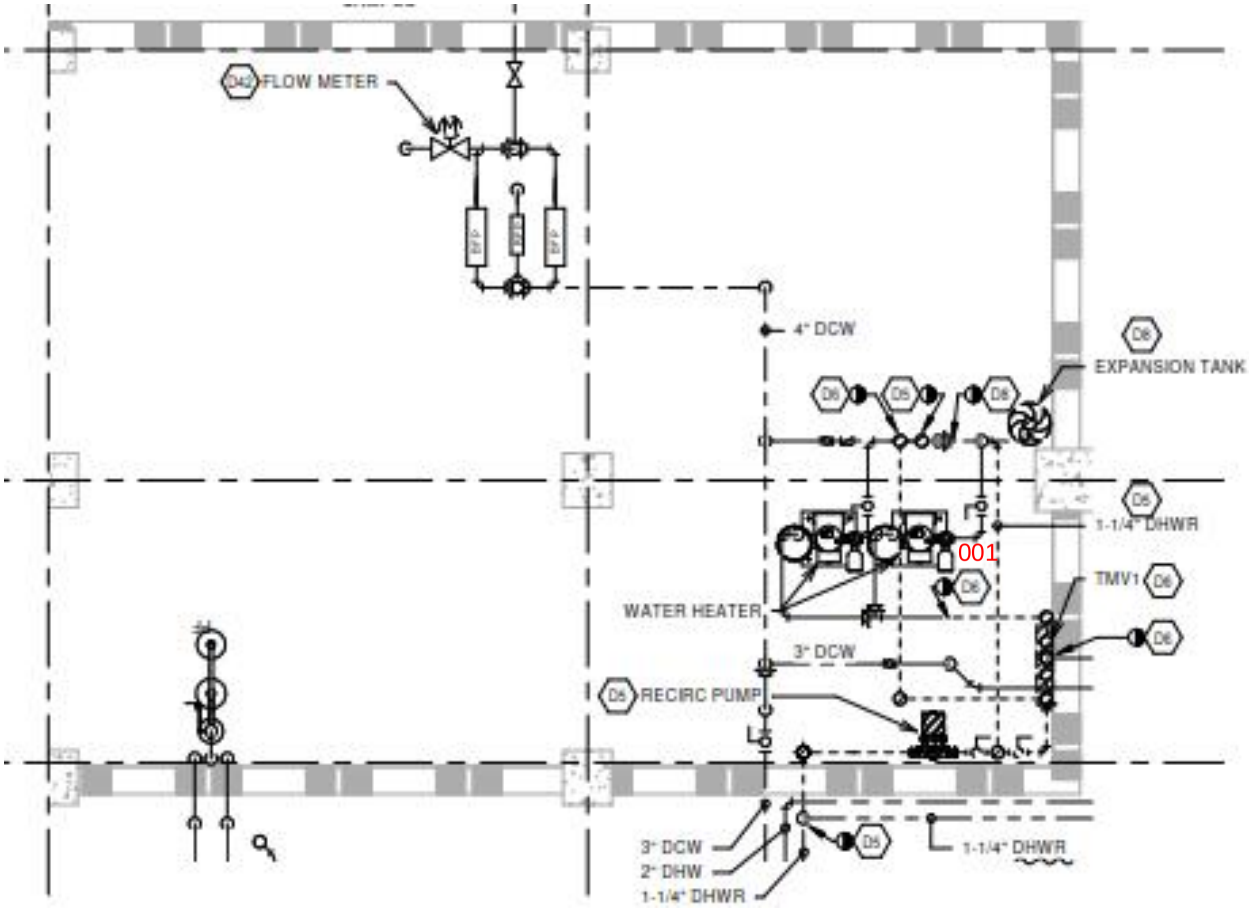
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 35 – Third Floor Plan Area C

Exhibit

55



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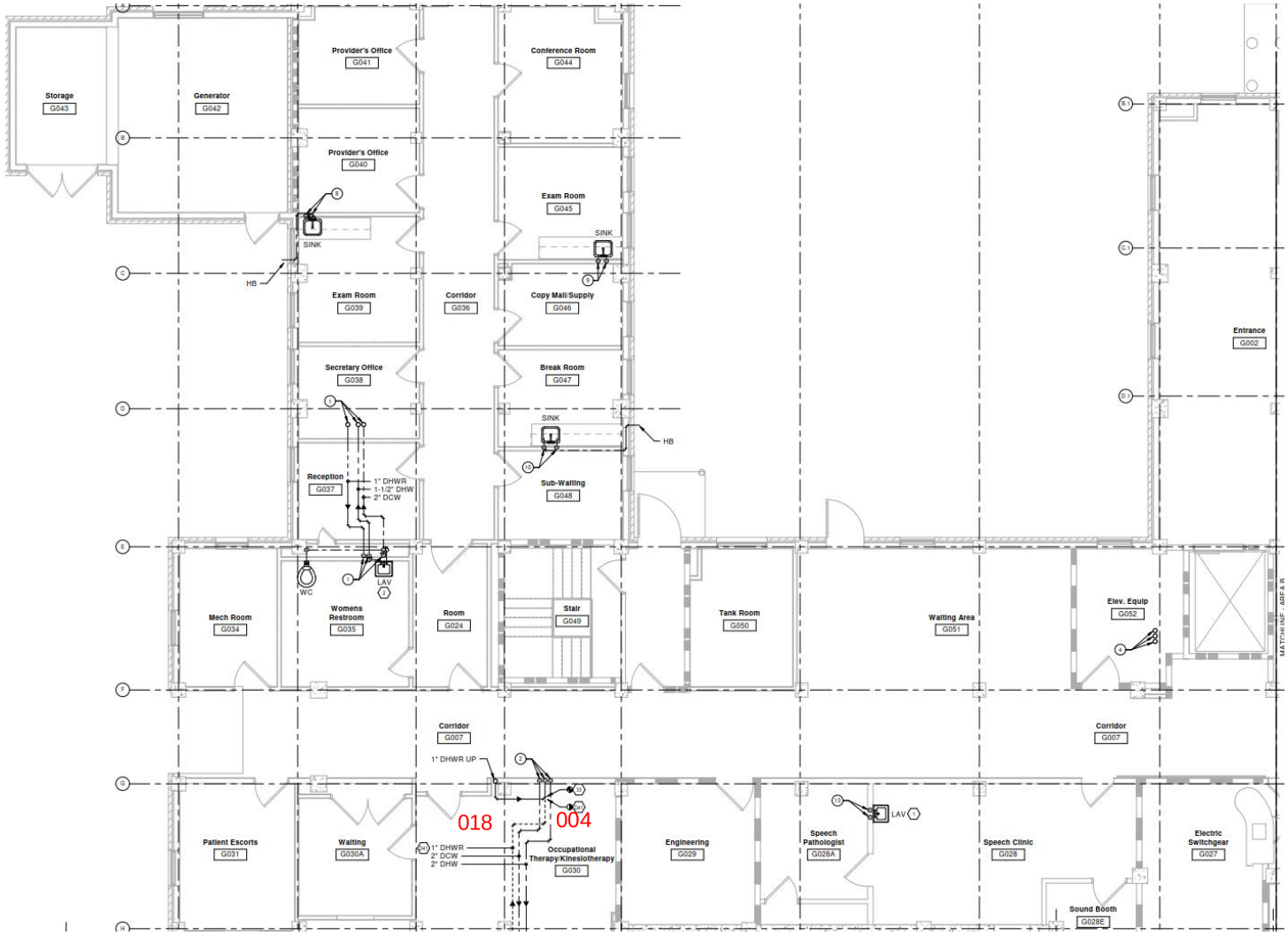
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 210 – Mechanical Room

Exhibit

56



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ASBESTOS SAMPLE LOCATION DIAGRAM

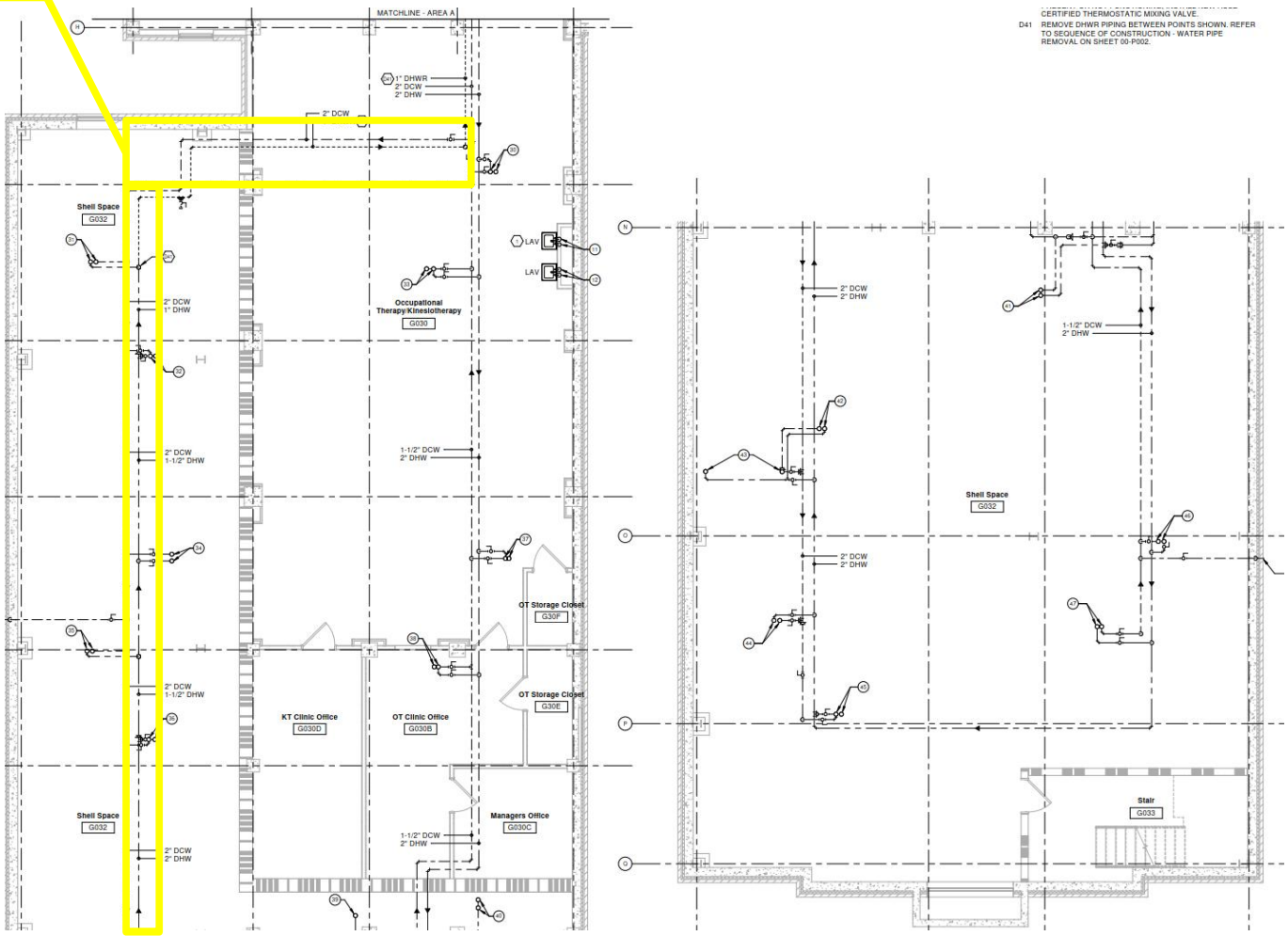
Chillicothe VAMC

Building 210 – Basement Plan Area A

Exhibit

57

No Access



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Approved by: JAT	Date: 09/18/19	

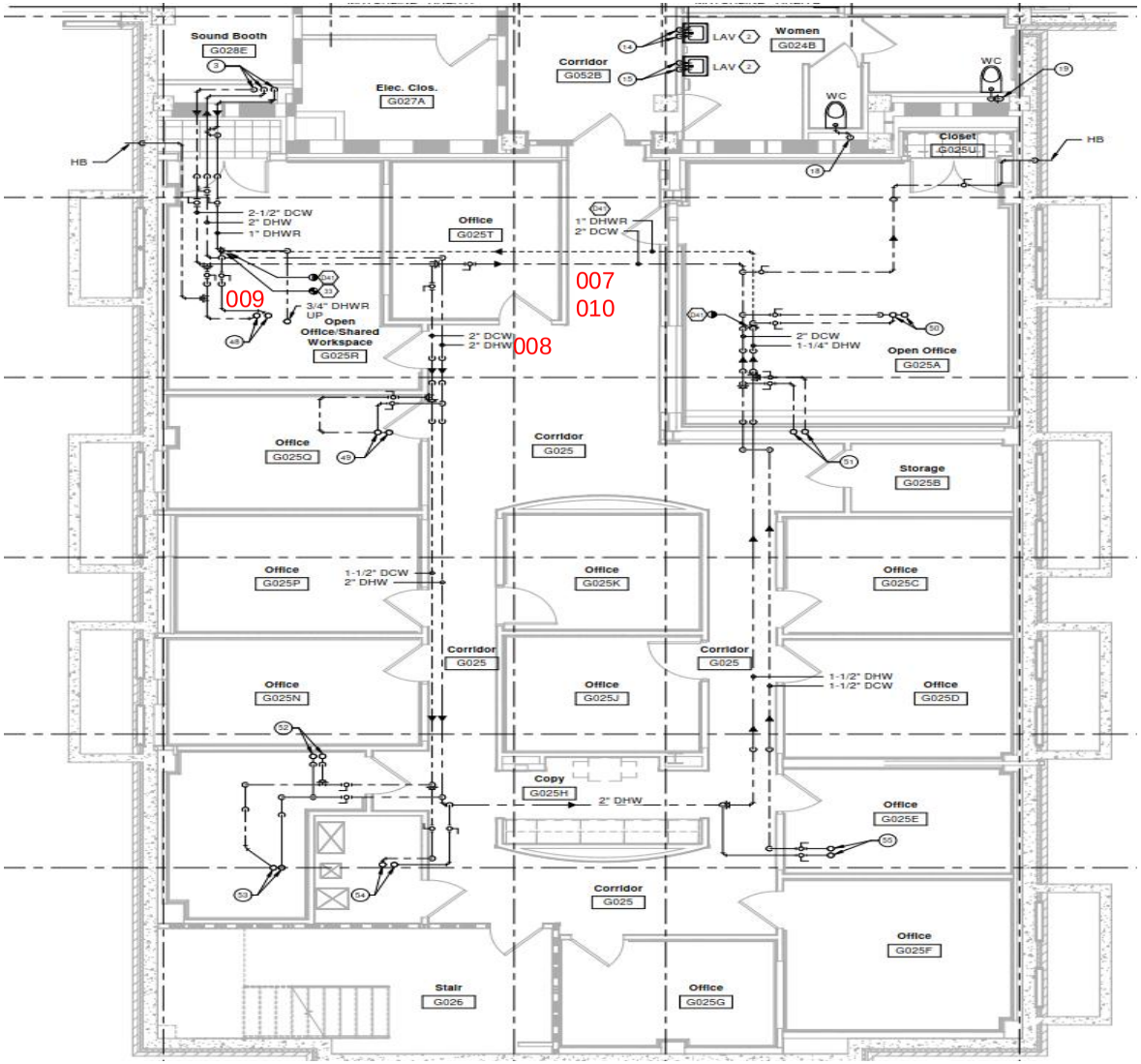
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 210 – Basement Plan Area C

Exhibit

58



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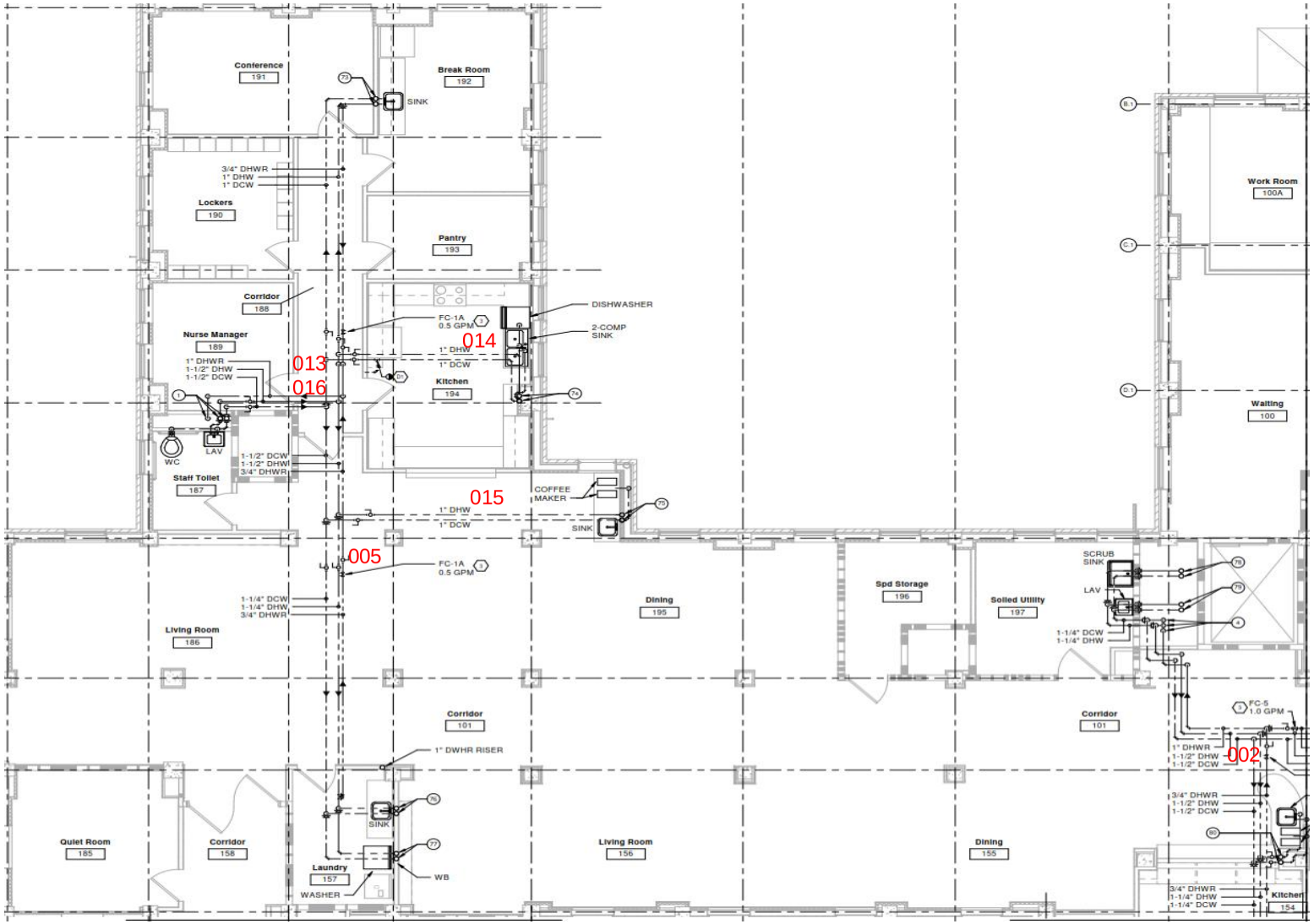
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 210 – Basement Plan Area D

Exhibit

59



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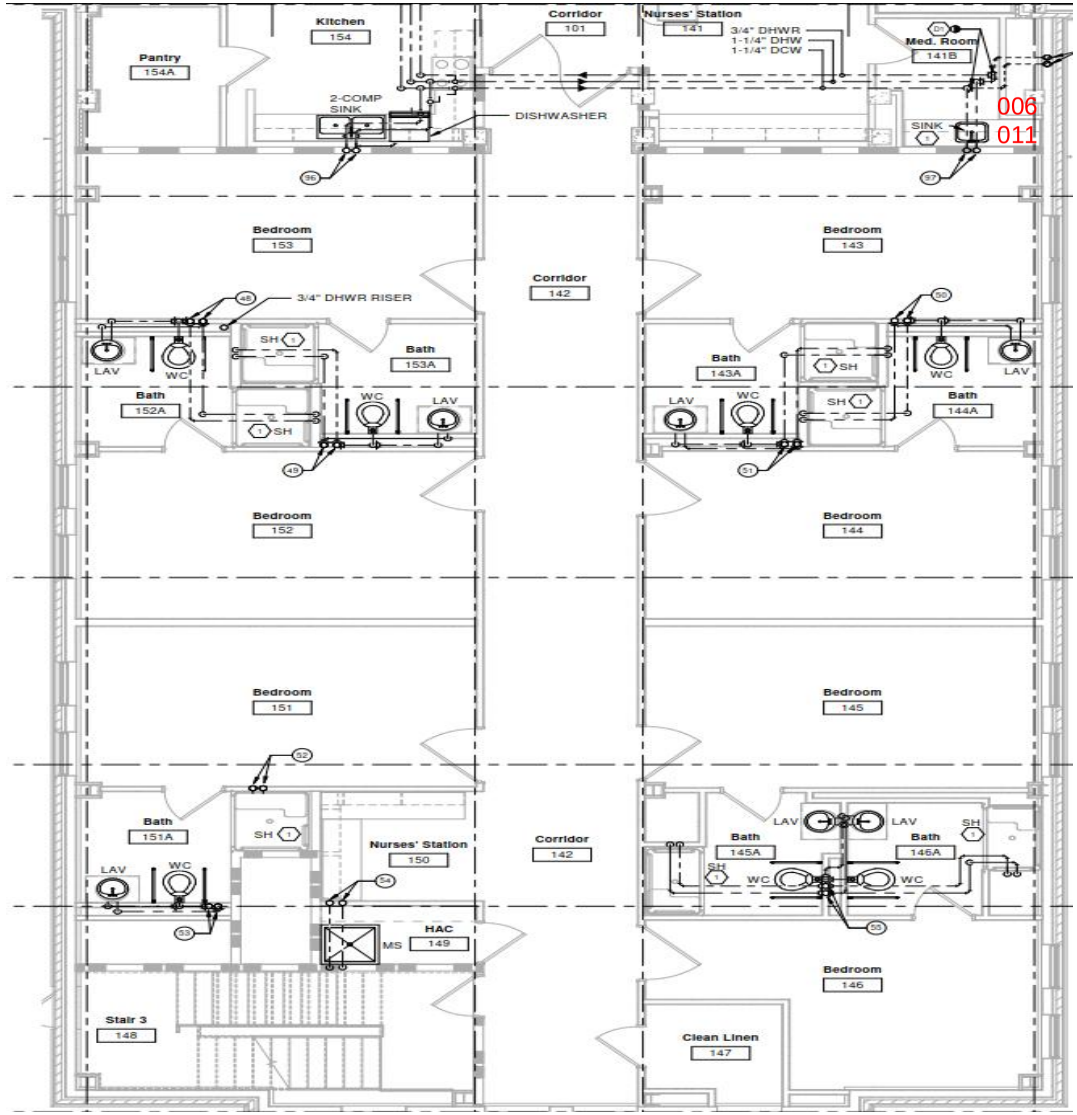
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 210 – First Floor Plan Area A

Exhibit

60



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ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

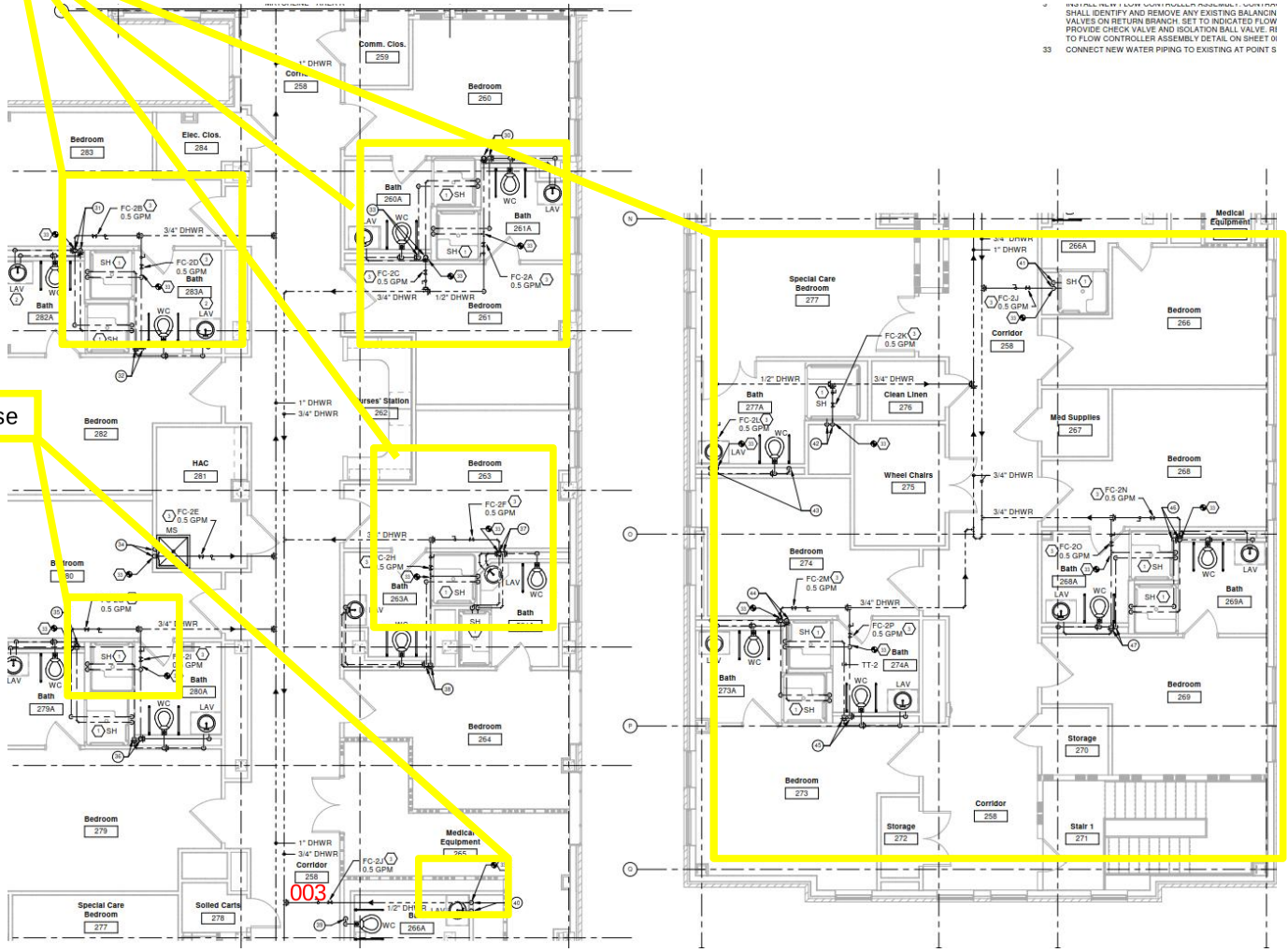
Building 210 – First Floor Plan Area D

Exhibit

61

No Access Occupied

No Access Pipe in Chase



N

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Date:	09/18/19

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ASBESTOS SAMPLE LOCATION DIAGRAM

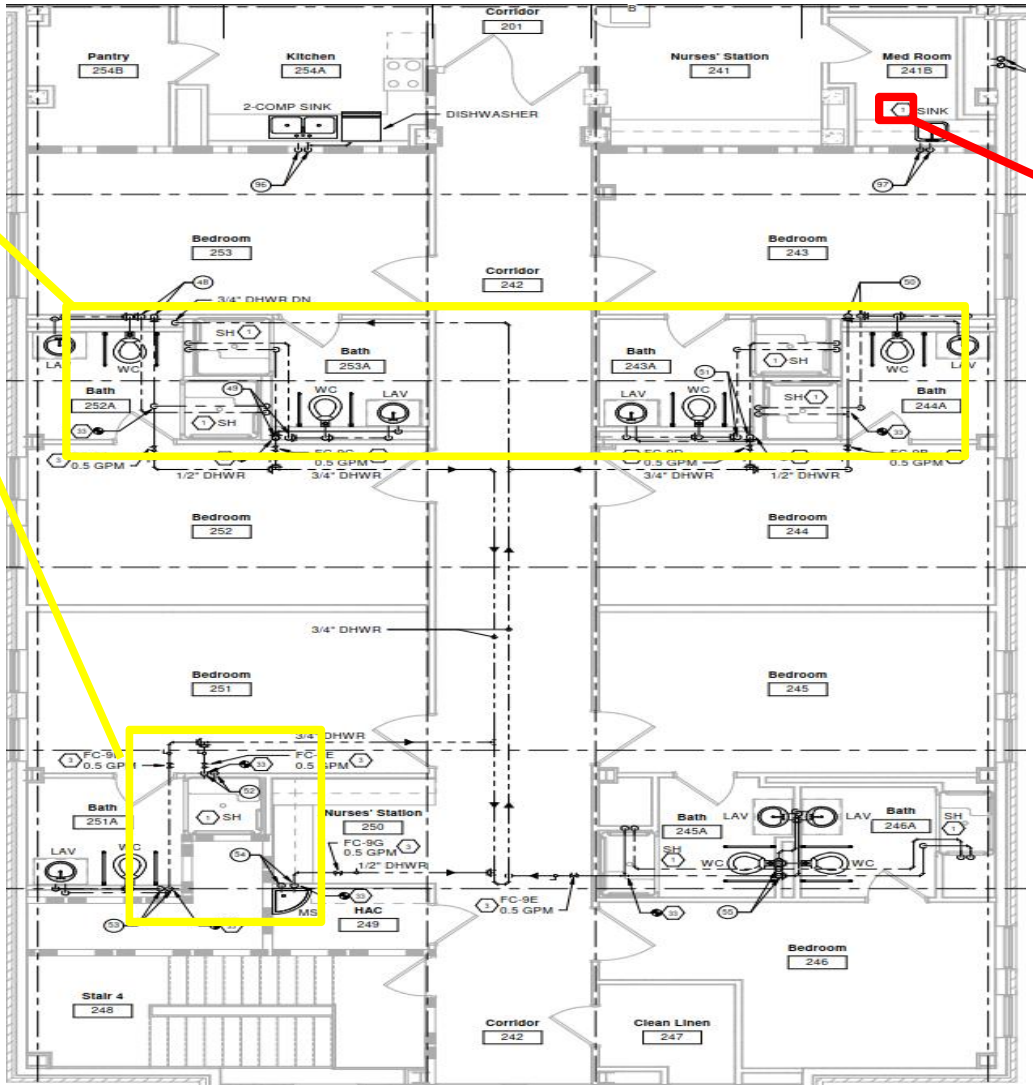
Chillicothe VAMC

Building 210 – Second Floor Plan Area C

Exhibit

62

No Access Occupied



012
017
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N

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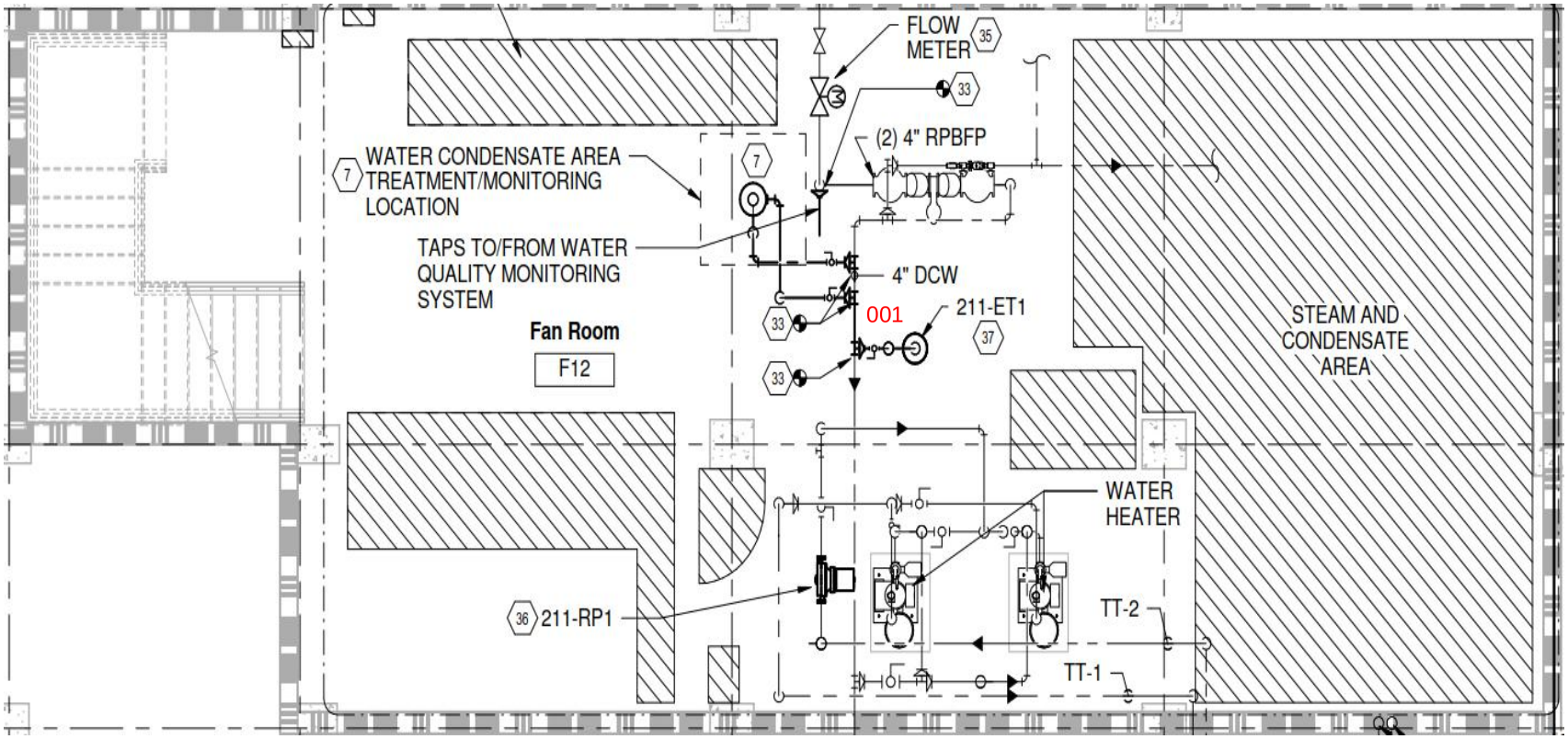
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 210 – Second Floor Plan Area D

Exhibit

63



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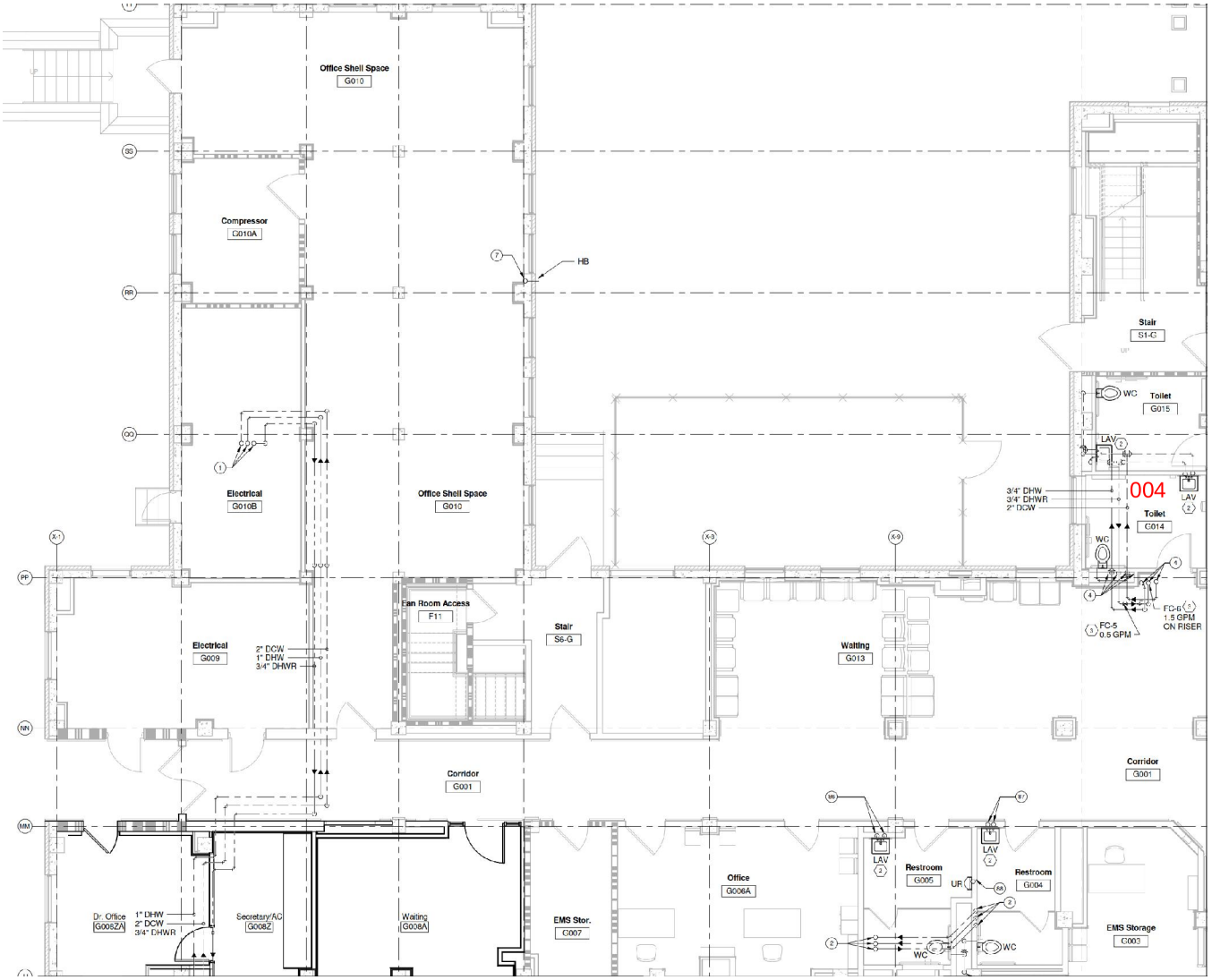
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 211 – Sub Basement Area A

Exhibit

64



N

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ASBESTOS SAMPLE LOCATION DIAGRAM

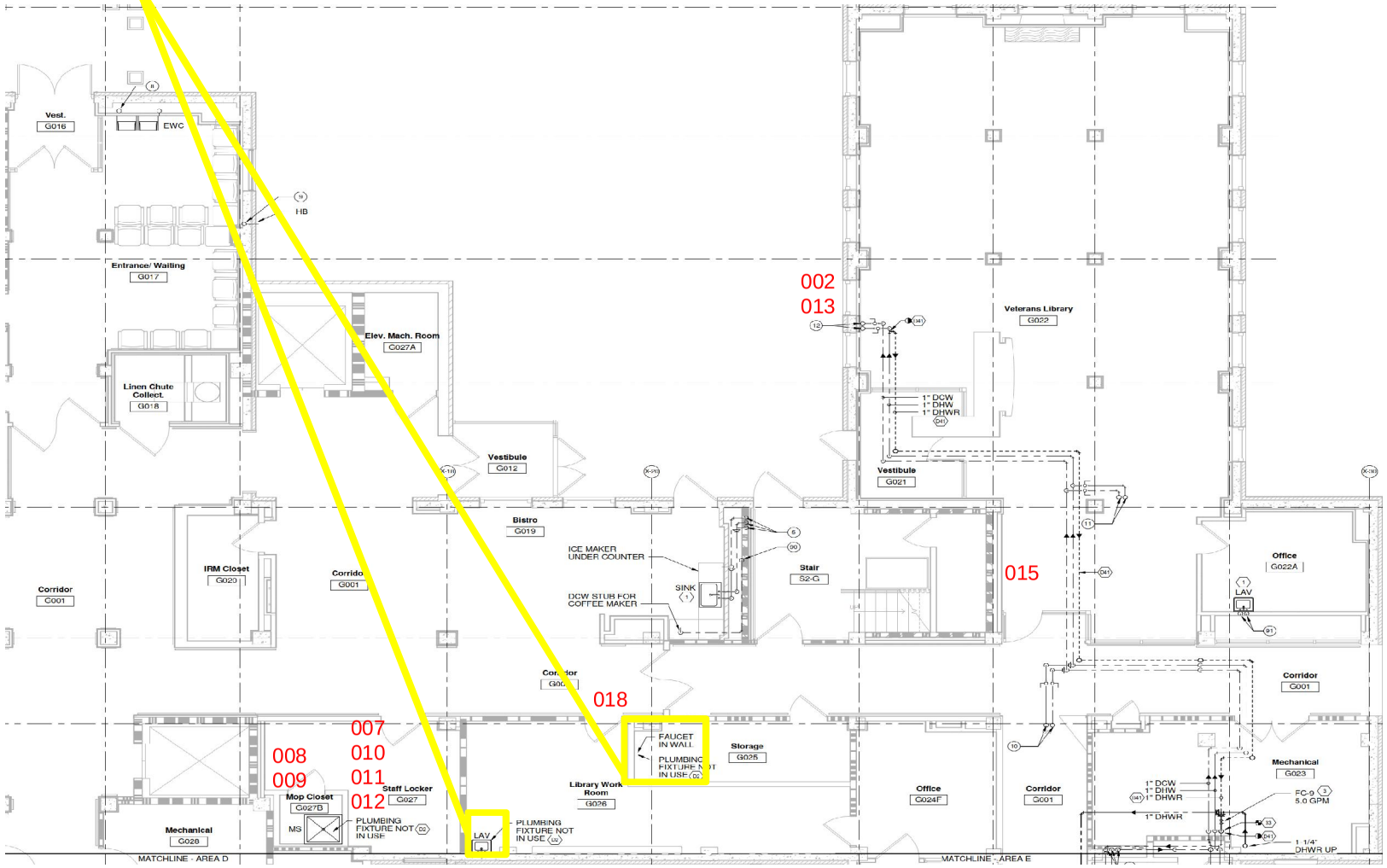
Chillicothe VAMC

Building 211 –Basement Area A

Exhibit

65

No Access Pipe in Chase



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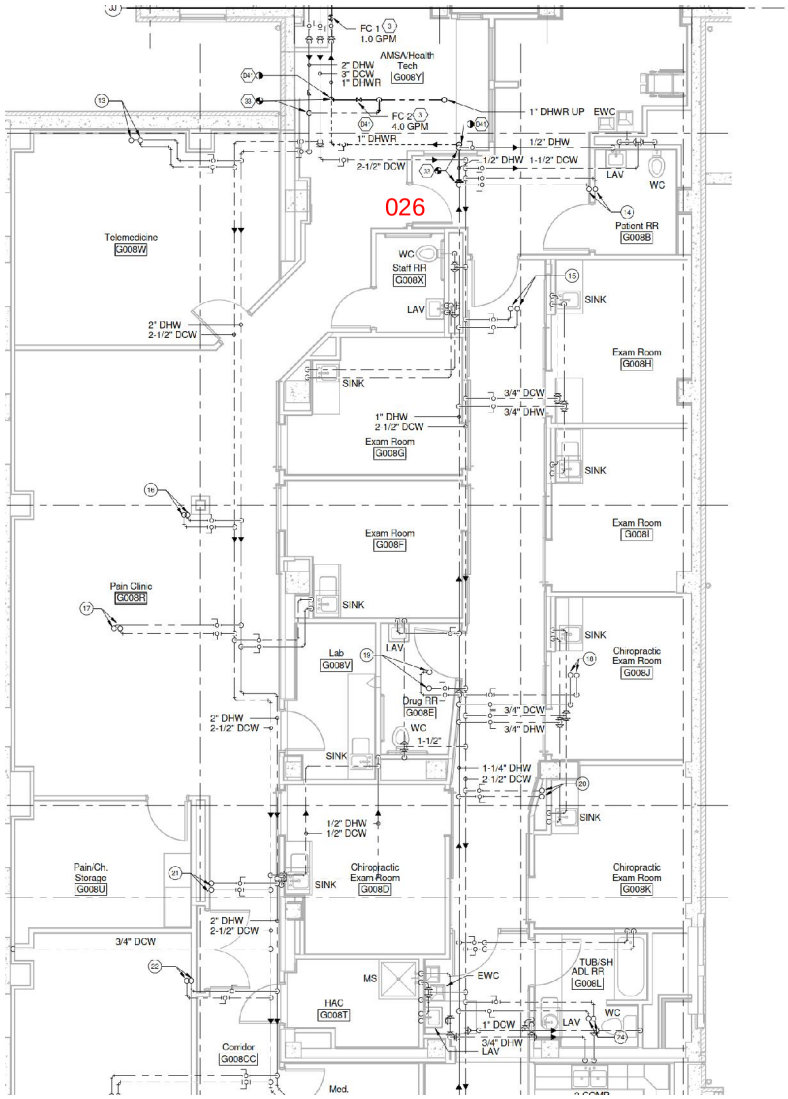
ASBESTOS SAMPLE LOCATION DIAGRAM

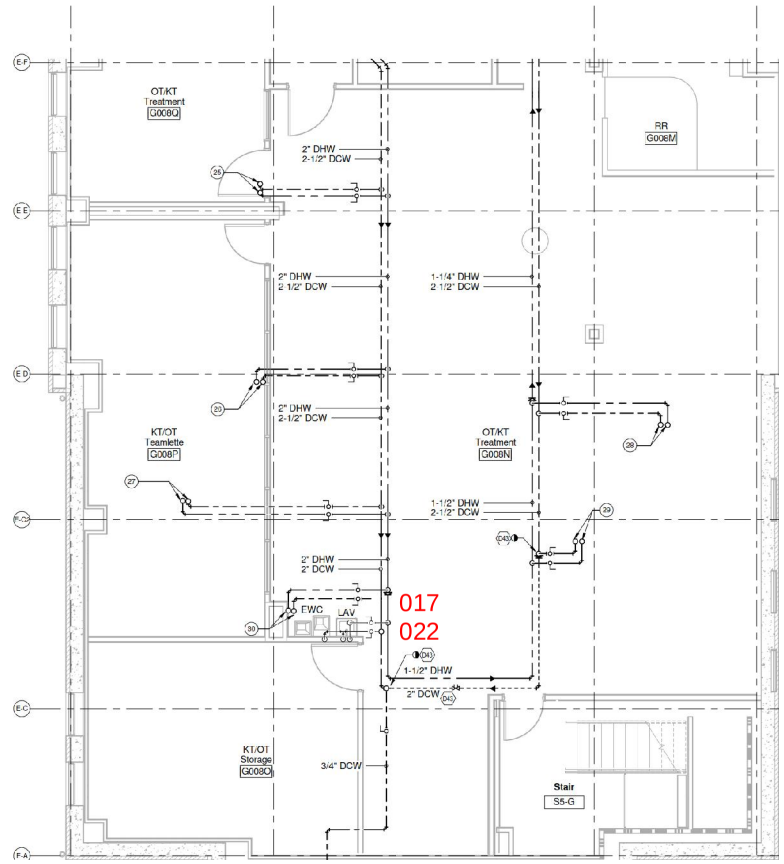
Chillicothe VAMC

Building 211 –Basement Area B

Exhibit

66





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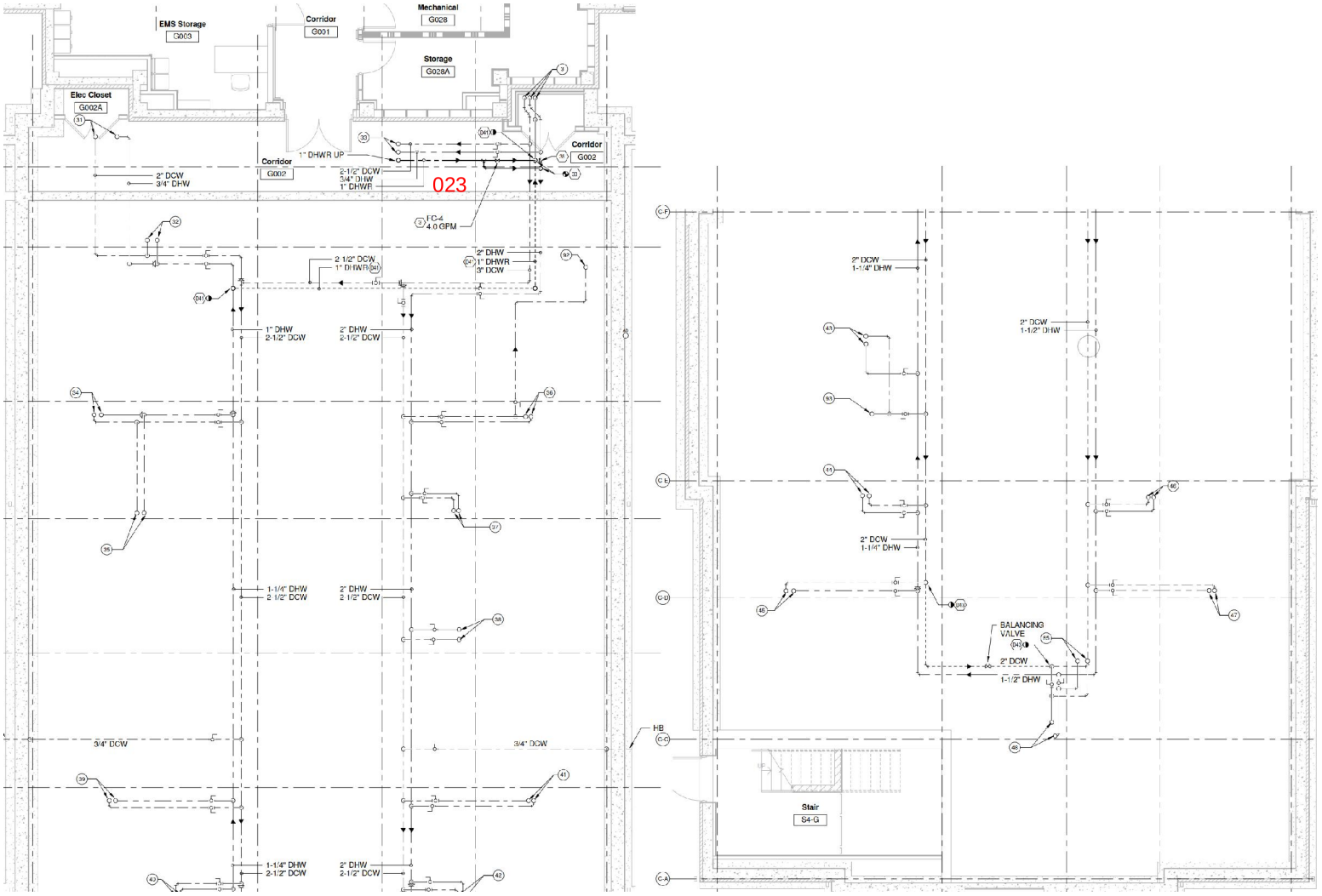
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 211 –Basement Area C

Exhibit

67



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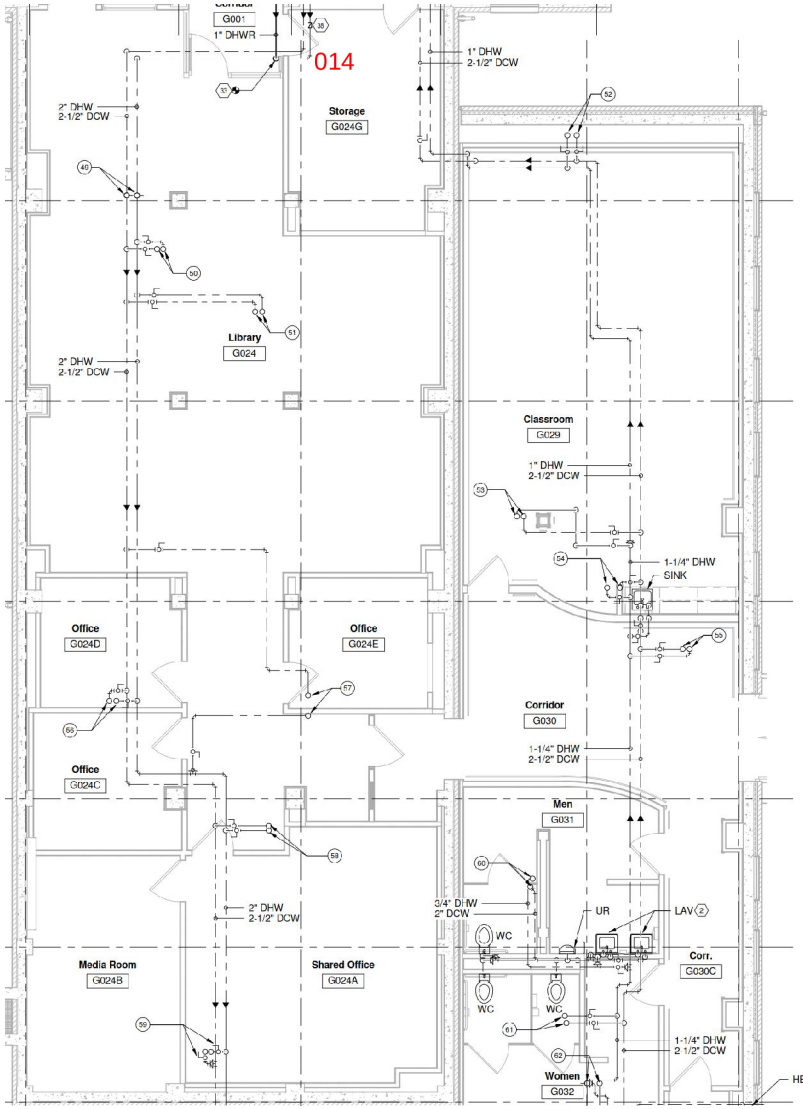
ASBESTOS SAMPLE LOCATION DIAGRAM

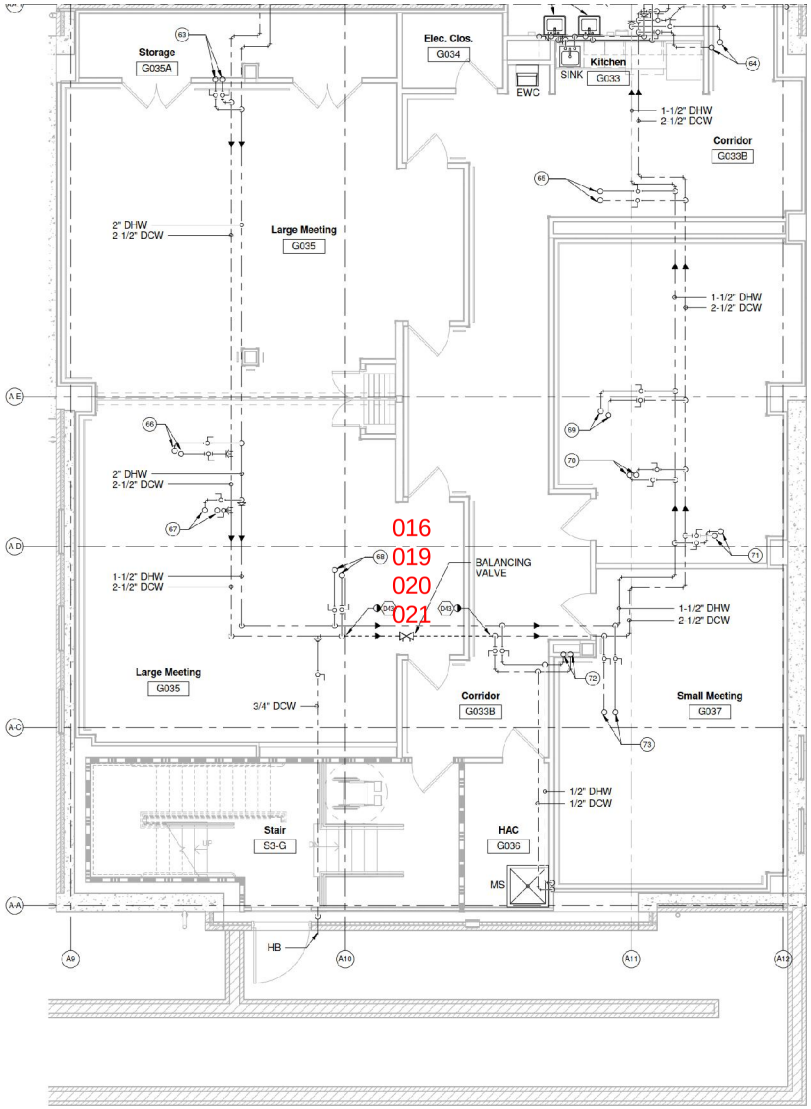
Chillicothe VAMC

Building 211 –Basement Area D

Exhibit

68





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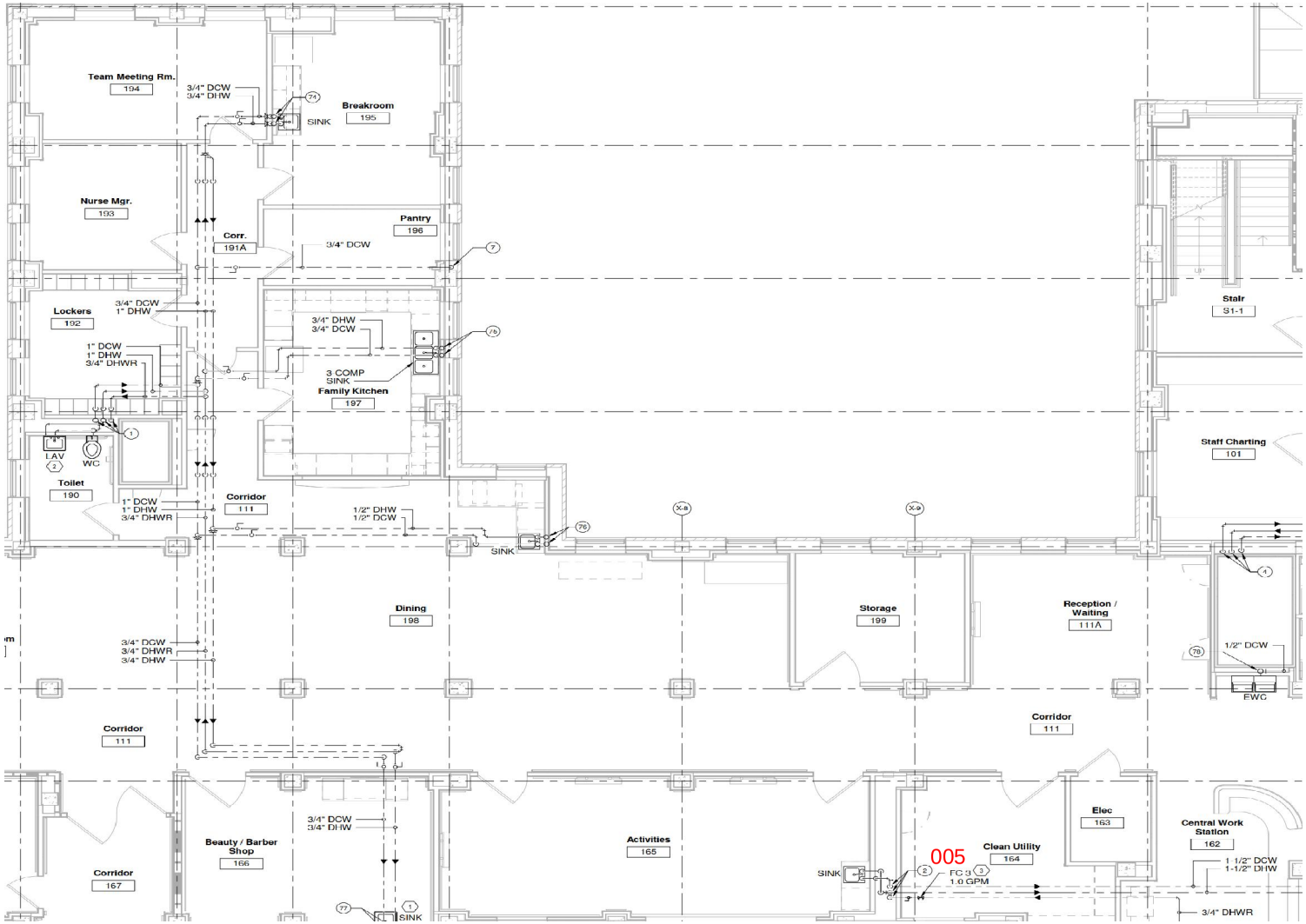
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 211 –Basement Area E

Exhibit

69



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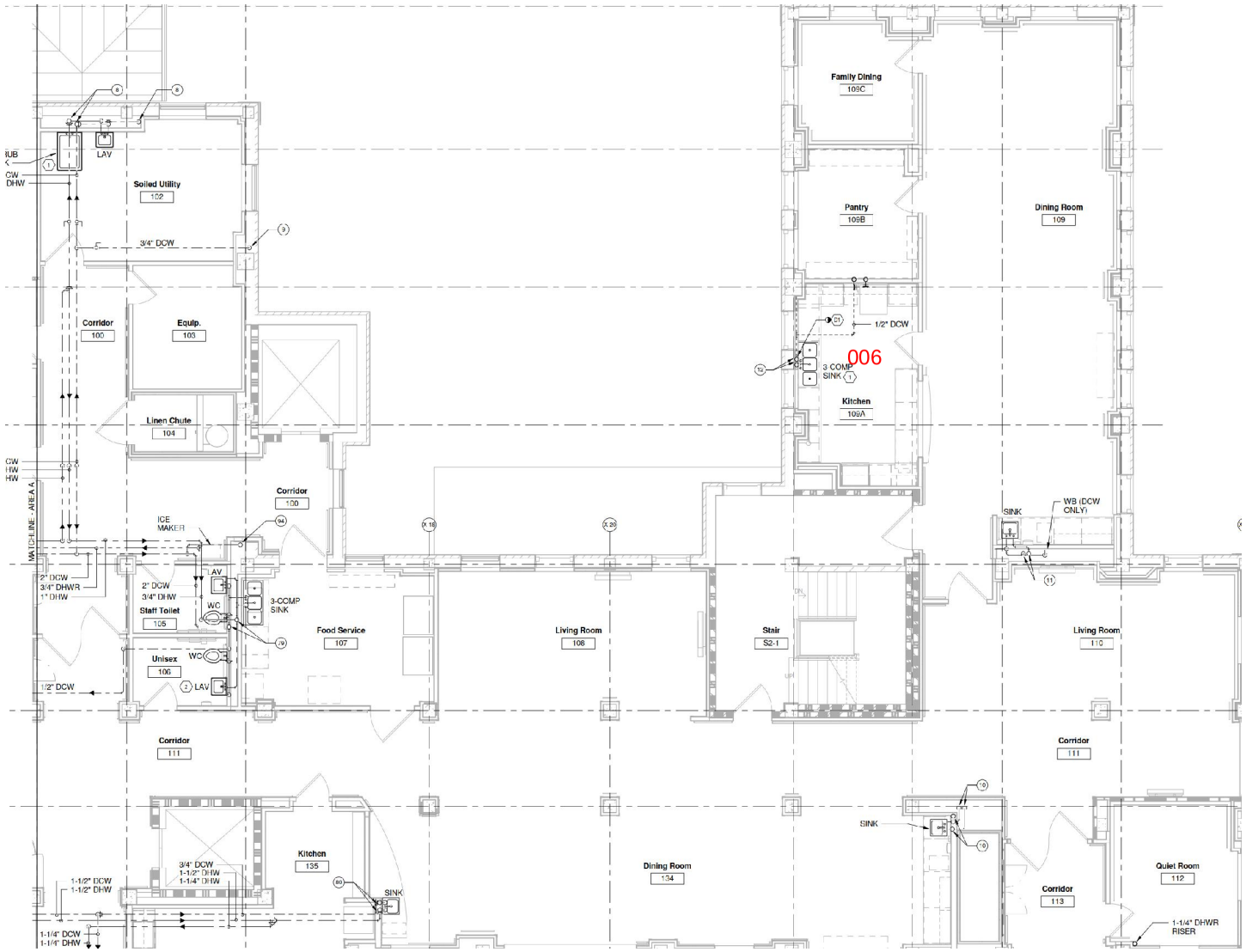
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 211 –First Floor Area A

Exhibit

70



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ASBESTOS SAMPLE LOCATION DIAGRAM

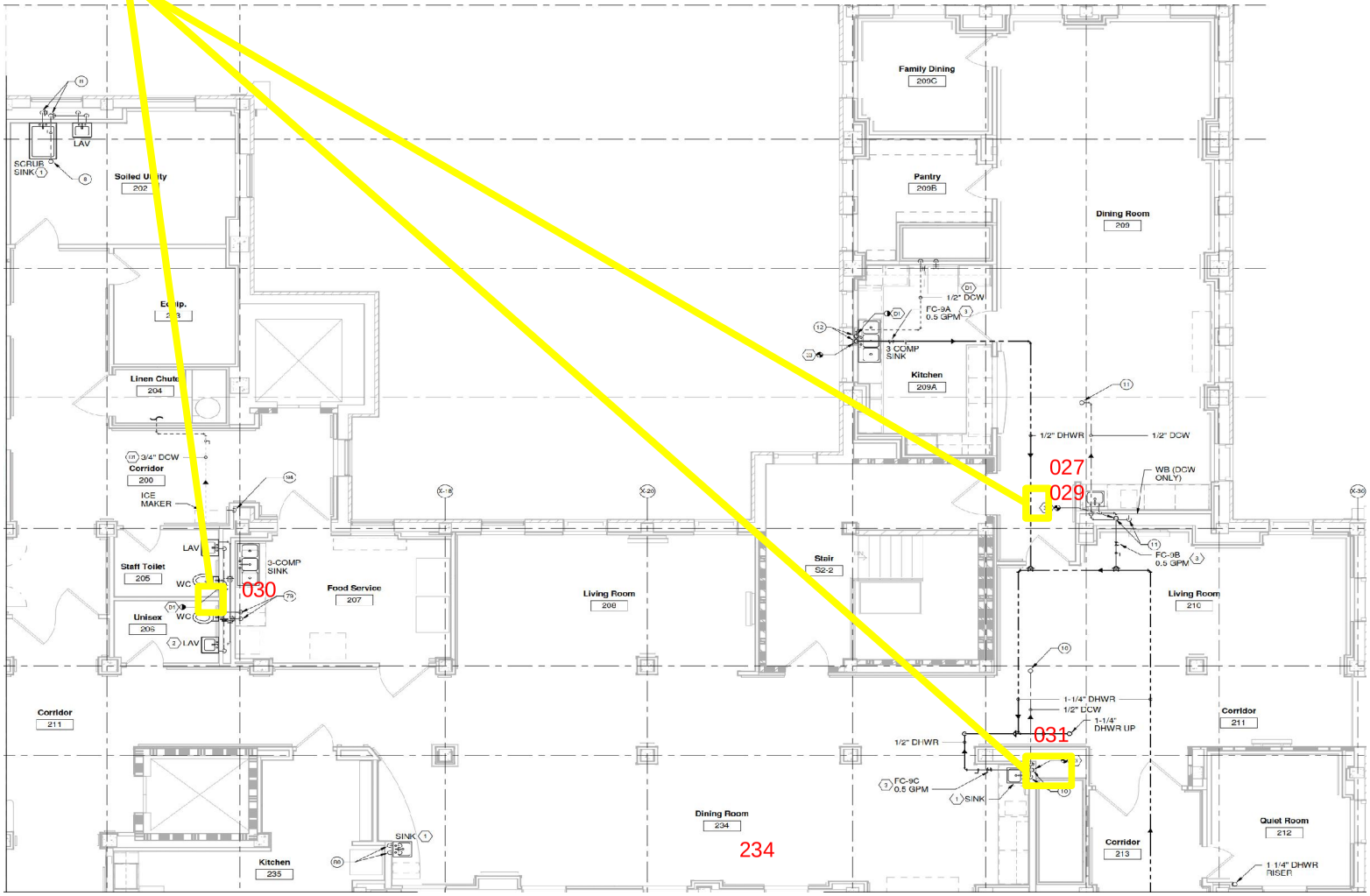
Chillicothe VAMC

Building 211 –First Floor Area B

Exhibit

71

No Access Pipe in Chase



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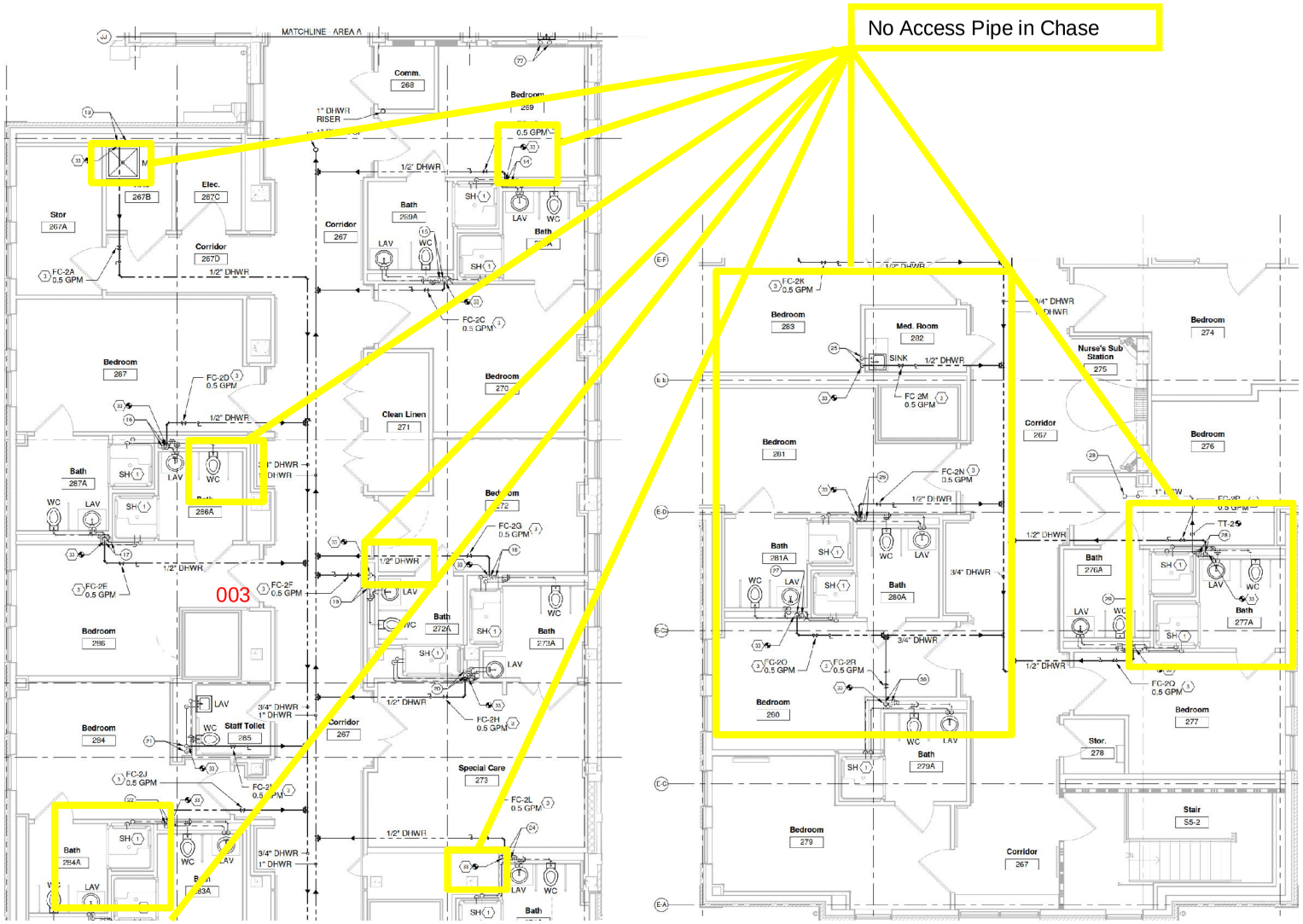
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 211 –Second Floor Area B

Exhibit

72



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ASBESTOS SAMPLE LOCATION DIAGRAM

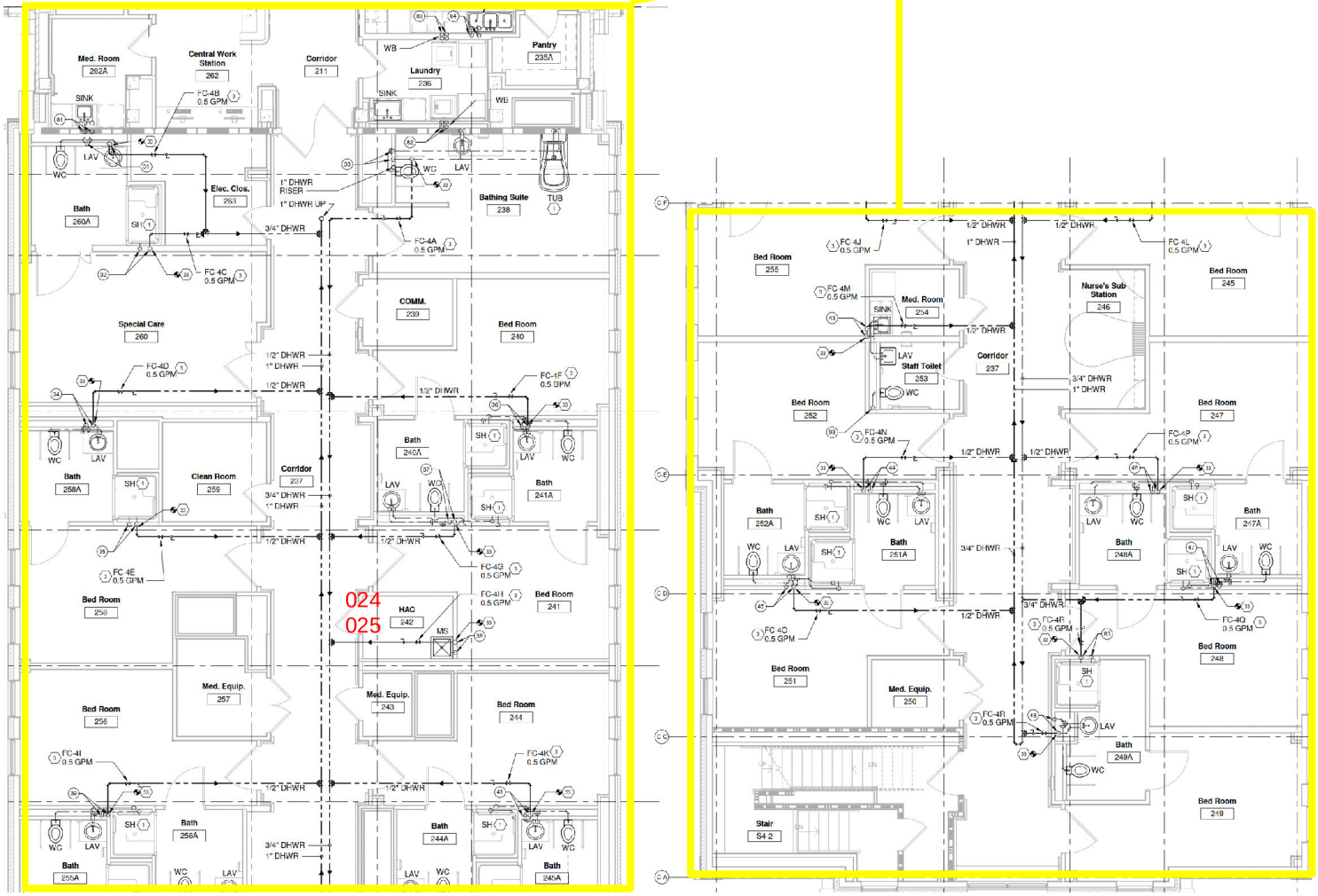
Chillicothe VAMC

Building 211 –Second Floor Area C

Exhibit

73

No Access Pipe in Chase



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ASBESTOS SAMPLE LOCATION DIAGRAM

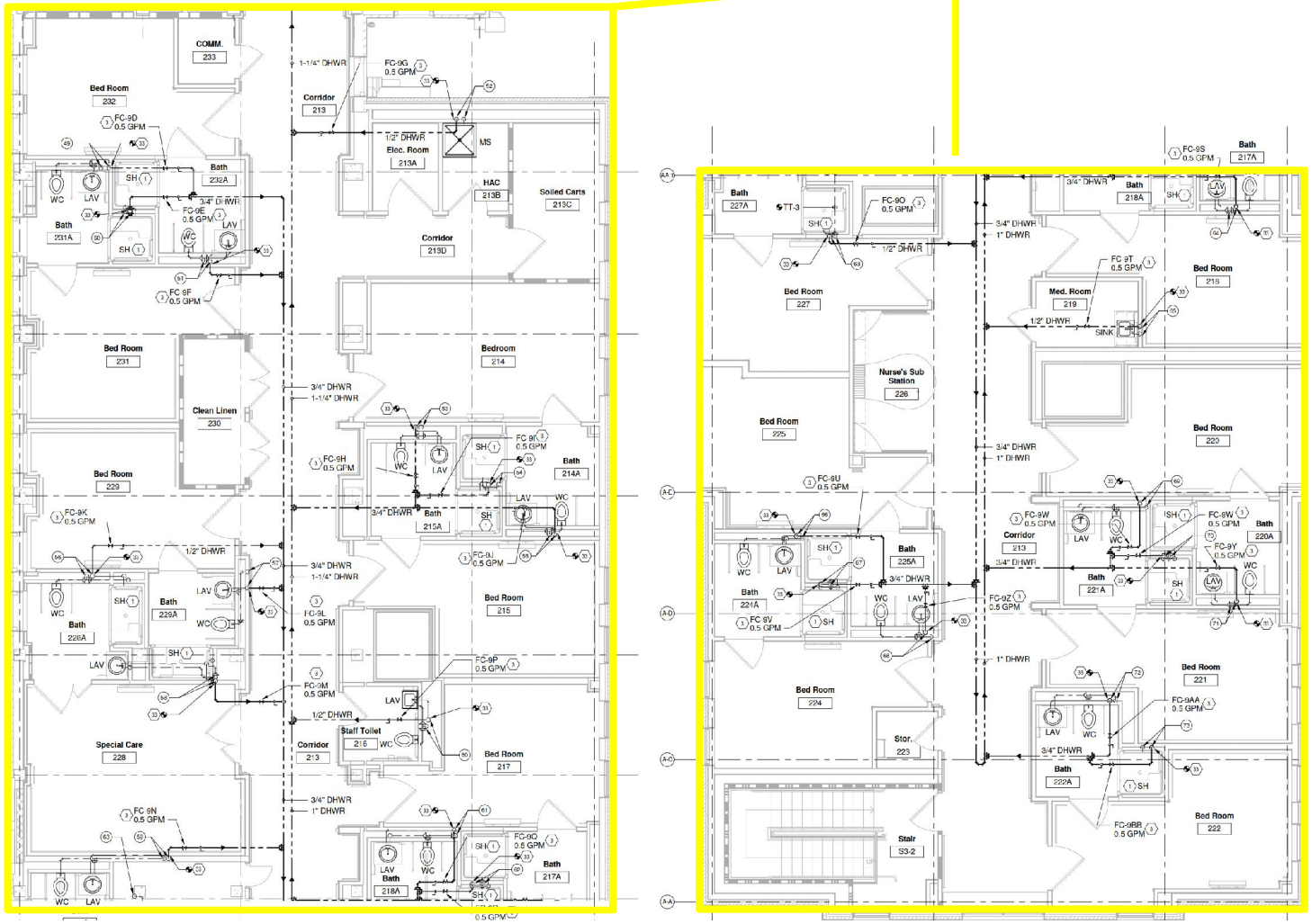
Chillicothe VAMC

Building 211 –Second Floor Area D

Exhibit

74

No Access Pipe in Chase



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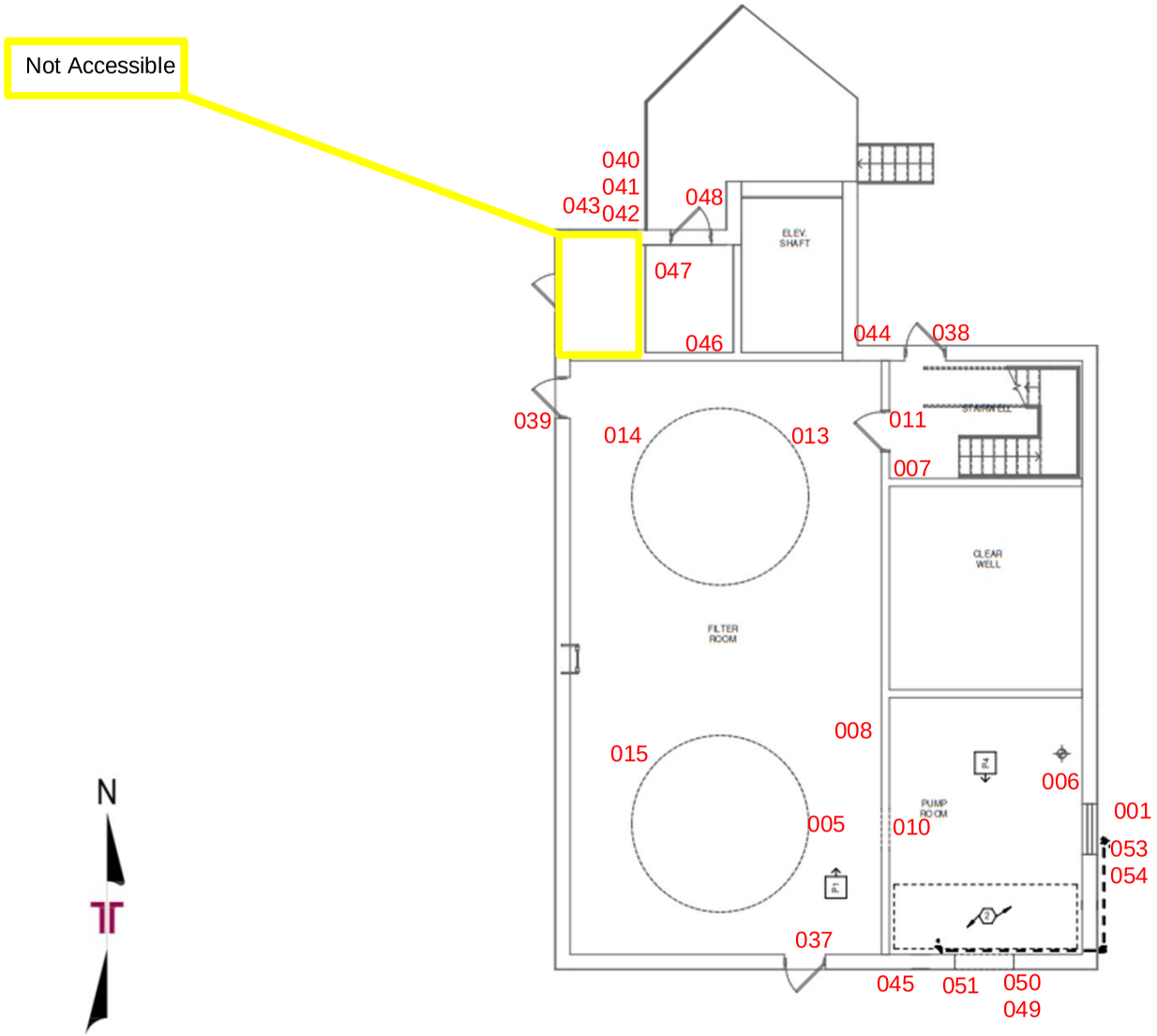
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 211 –Second Floor Area E

Exhibit

75



The following materials were identified to contain asbestos:

- **White Interior Window Caulk and White Exterior Window Glazing (Pump Room and Chemical Feed Room)**
- **White Interior Expansion Caulking (Throughout)**
- **White Interior Door Caulking (Throughout)**
- **White Interior Window Glazing (3rd Floor Stairwell Landing)**
- **9”x9” Grey Floor Tile with Black Mastic (Lab Entry, Lab and Restroom)**
- **White Interior Window Caulking (Lab Windows)**
- **Lab Drying Rack (Lab)**
- **Joint Compound within Drywall Ceiling System (Elevator Equipment Room**

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Approved by: JAT	Date: 09/18/19	

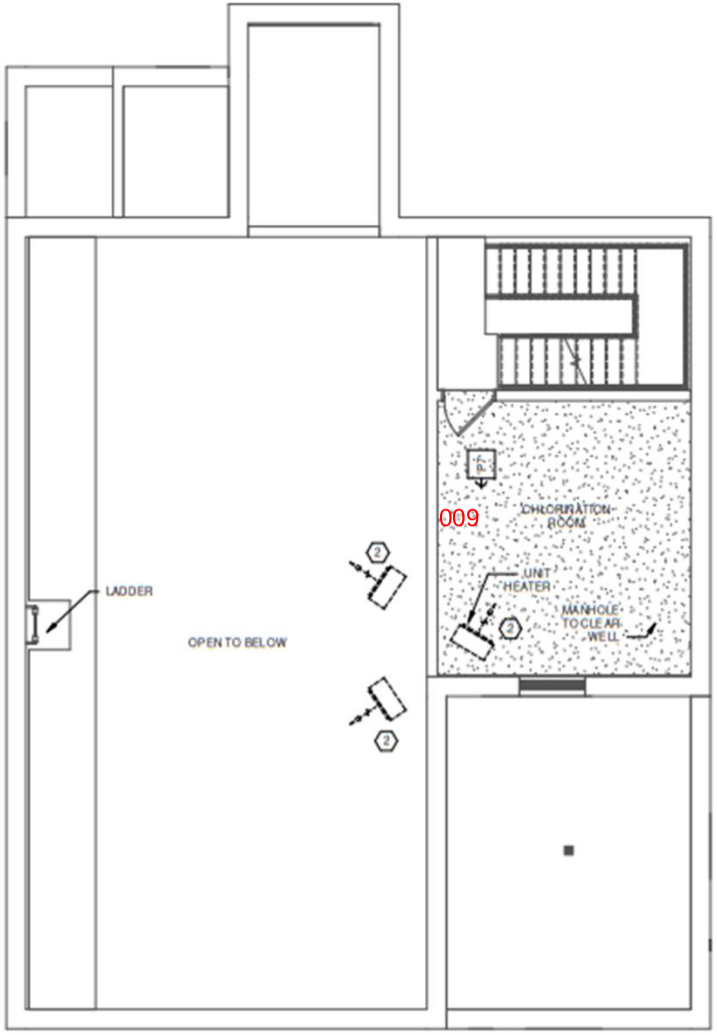
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 256 – 1st Floor

Exhibit

76



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- **White Interior Window Caulking (Lab Windows)**
- **Lab Drying Rack (Lab)**
- **Joint Compound within Drywall Ceiling System (Elevator Equipment Room**

N

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Approved by: JAT	Date: 9/19/19	

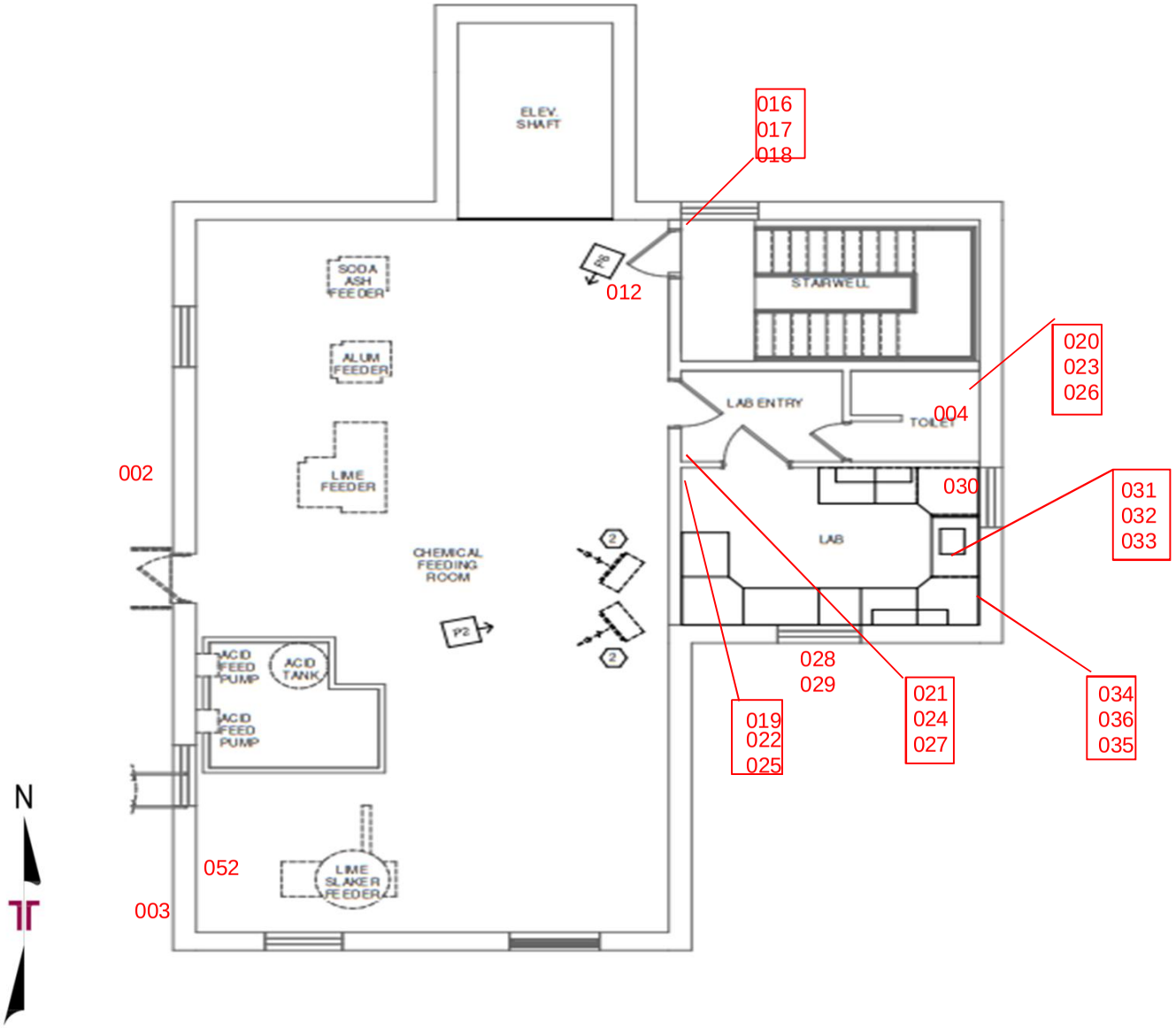
ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 256 – 2nd Floor

Exhibit

77



The following materials were identified to contain asbestos:

- **White Interior Window Caulk and White Exterior Window Glazing (Pump Room and Chemical Feed Room)**
- **White Interior Expansion Caulking (Throughout)**
- **White Interior Door Caulking (Throughout)**
- **White Interior Window Glazing (3rd Floor Stairwell Landing)**
- **9"x9" Grey Floor Tile with Black Mastic (Lab Entry, Lab and Restroom)**
- **White Interior Window Caulking (Lab Windows)**
- **Lab Drying Rack (Lab)**
- **Joint Compound within Drywall Ceiling System (Elevator Equipment Room**

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

Project Manager:	JV
Drawn by:	GV
Checked by:	JV
Approved by:	JAT
Project No.	N1197373
Scale:	N.T.S.
Date:	9/19/19

Terracon
Consulting Engineers & Scientists
3601 Mojave Court, Suite A Columbia, Missouri 65202
PH. (573) 214-2677 FAX. (573) 214-2714

ASBESTOS SAMPLE LOCATION DIAGRAM

Chillicothe VAMC

Building 256 – 3rd Floor

Exhibit

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APPENDIX F

PHOTOS

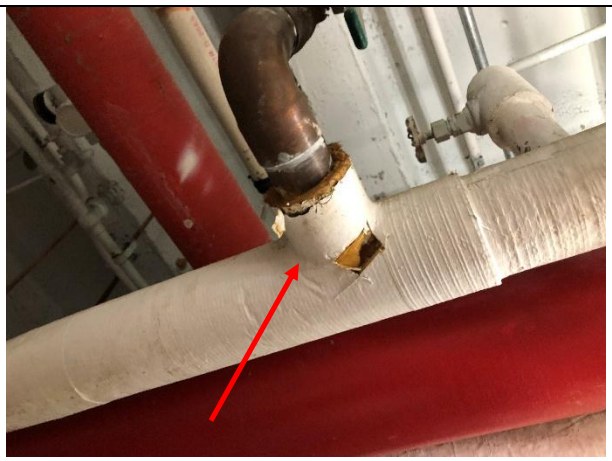

Photo #1 - HA 27-1: Building 27 Asbestos-Containing White Mastic on Non-Asbestos-Containing Fiberglass Pipe Insulation.

Photo #2 - HA 27-7: Building 27 Assumed Asbestos-Containing Aircell Pipe Insulation (out of reach to sample).

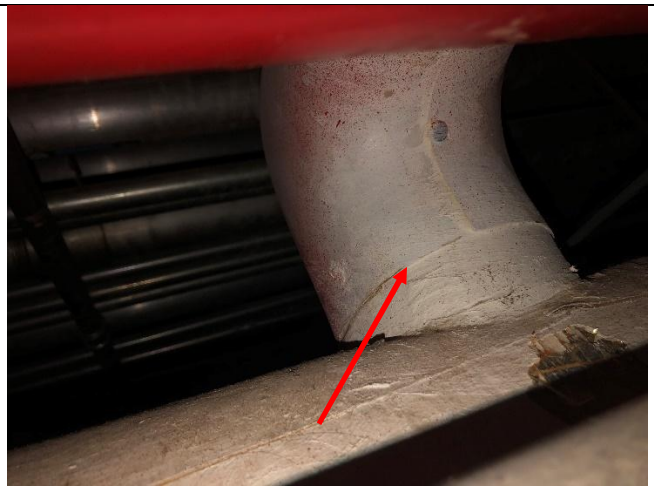

Photo #3 - HA 30-2: Building 30 Asbestos-Containing White Mastic on Non-Asbestos-Containing Fiberglass Pipe Insulation.

Photo #4 - HA 256-1: Building 256 Asbestos-Containing White Interior Window Caulk.

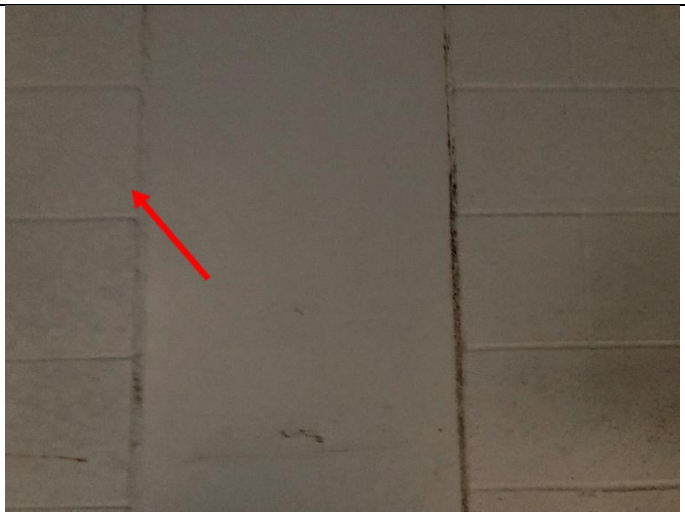

Photo #5 - HA 256-3: Building 256 Asbestos-Containing White Expansion Caulking Interior.

Photo #6 - HA 256-4: Building 256 Asbestos-Containing White Interior Door Caulking.

Photo #7 - HA 256-6: Building 256 Asbestos-Containing White Interior Window Glazing.

Photo #8 - HA 256-7: Building 256 Asbestos-Containing 9”x9” Grey Floor Tile with Black Mastic.

Photo #9 - HA 256-10: Building 256 Asbestos-Containing White Window Caulking Interior.

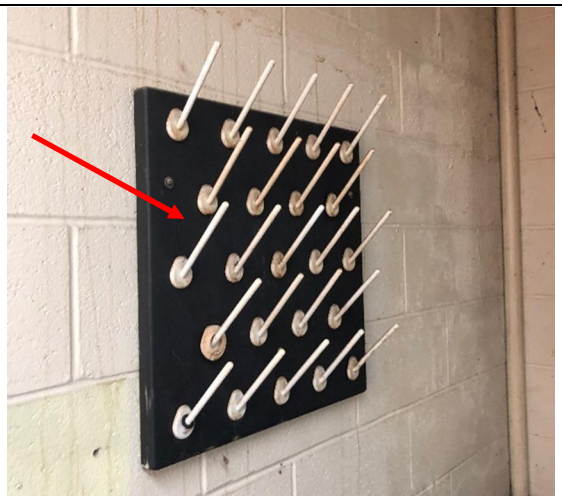

Photo #10 - HA 256-12: Building 256 Asbestos-Containing Lab Drying Rack.

No Photo Available

Photo #11 - HA 256-16: Building 256 Asbestos-Containing Joint Compound within the Drywall System..

Photo #12 - HA 256-18: Building 256 Asbestos-Containing White Exterior Window Glazing System.

SECTION 02 83 33.13
LEAD PAINT REMOVAL AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

All paints shall be assumed to contain lead, and appropriately addressed when disturbed in accordance to the proper specification section (this section for any paint removal operations or see below for any demolition and surface preparation sections).

1.2 RELATED REQUIREMENTS

A. Demolition Disturbing Lead Paint: Section 02 41 00, DEMOLITION.

B. If applicable, Surface Preparation Disturbing Lead Paint: Section 09 91 00, PAINTING.

1.3 DEFINITIONS

A. Action Level: Employee exposure, without regard to use of respirator, to lead airborne concentration of 30 micrograms per cubic meter (0.03 parts per million) of air averaged over 8-hour period. As used in this section, ”30 micrograms per cubic meter of air (0.03 parts per million)" refers to action level.

B. Area Monitoring: Sampling of lead concentrations within lead control area and inside physical boundaries which are representative of airborne lead concentrations which may reach breathing zone of personnel potentially exposed to lead.

C. Breathing Zone: Area within hemisphere, forward of shoulders, with 150 mm to 225 mm (6 to 9 inches) radius and center at nose or mouth of employee.

D. Certified Industrial Hygienist (CIH): As used in this section, refers to an Industrial Hygienist employed by Contractor.

E. Change Rooms and Shower Facilities: Rooms within designated physical boundary around lead control area equipped with separate storage facilities for clean protective work clothing and equipment and for street clothes which prevent cross- contamination.

F. Competent Person: Person capable of identifying lead hazards in work area and authorized by contractor to take corrective action.

G. Decontamination Room: Room for removal of contaminated personal protective equipment (PPE).

H. Eight-Hour Time Weighted Average (TWA): Airborne concentration of lead averaged over 8-hour workday to which an employee is exposed.

I. High Efficiency Particulate Air (HEPA) Filter Equipment: HEPA filtered vacuuming equipment with UL 586 filter system capable of collecting and retaining lead-contaminated paint dust. HEPA filter means 99.97 percent efficient against 0.3 micron (0.012 mil) size particles.

J. Lead: Metallic lead, inorganic lead compounds, and organic lead soaps. Excluded from this definition are other organic lead compounds.

K. Lead Control Area: Enclosed area or structure with full containment to prevent spreading lead dust, paint chips, and debris from lead-based paint removal operations. Lead control area is isolated by physical boundaries to prevent unauthorized entry of personnel.

L. Lead Permissible Exposure Limit (PEL): Fifty micrograms per cubic meter (0.05 parts per million) of air as 8-hour time weighted average as determined by 29 CFR Part 1910.1025. When employee is exposed for more than 8 hours per work day, determine PEL by following formula. PEL micrograms/cubic meter (parts per million) of air = 400/No. of hrs. worked per day.

M. Personnel Monitoring: Sampling of lead concentrations within employee breathing zone to determine 8-hour time weighted average concentration according to 29 CFR Part 1910.1025. Take samples representative of employee's work tasks.

N. Physical Boundary: Area physically roped or partitioned off around enclosed lead control area to limit unauthorized entry of personnel. As used in this section, "inside boundary" shall mean same as "outside lead control area."

1.4 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American National Standards Institute (ANSI):

1. Z9.2-12 - Fundamentals Governing the Design & Operation of Local Exhaust Ventilation Systems.

C. Code of Federal Regulations (CFR):

1. 29 CFR Part 1910 - Occupational Safety and Health Standards.
2. 29 CFR Part 1926 - Safety and Health Regulations for Construction.
3. 40 CFR Part 260 - Hazardous Waste Management System: General.
4. 40 CFR Part 261 - Identification and Listing of Hazardous Waste.

5. 40 CFR Part 262 - Standards Applicable to Generators of Hazardous Waste.
6. 40 CFR Part 263 - Standards Applicable to Transporters of Hazardous Waste.
7. 40 CFR Part 264 - Standards for Owners and Operations of Hazardous Waste Treatment, Storage, and Disposal Facilities.
8. 40 CFR Part 265 - Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities.
9. 40 CFR Part 268 - Land Disposal Restrictions.
10. 49 CFR Part 172 - Hazardous Material Table, Special Provisions, Hazardous Material Communications, Emergency Response Information, and Training Requirements, and Security Plans.
11. 49 CFR Part 178 - Specifications for Packagings.

D. Underwriters Laboratories (UL):
1. 586-09 - High-Efficiency, Particulate, Air Filter Units.

1.5 PRE-REMOVAL MEETINGS

A. Conduct pre-removal meeting at project site minimum 30 days before beginning Work of this section.
1. Required Participants:
a. Contracting Officer's Representative.
b. Certified Industrial Hygienist.
c. Contractor.
d. Paint removal contractor.
e. Other installers responsible for finishing resulting surfaces.
2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
a. Respiratory protection program.
b. Hazard communication program.
c. Hazardous waste management plan.
d. Safety and health regulation compliance.
e. Employee training.
f. Removal schedule.
g. Removal sequence.
h. Preparatory work.
i. Protection before, during, and after removal.
j. Removal.
k. Inspecting and testing.

l. Other items affecting successful completion.

3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.6 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Description of each product.
   a. Paint removal products.
   b. Vacuum filters.
   c. Respirators.
2. Safety data sheet for each paint removal product.
3. Installation instructions.
   a. Paint removal products.

C. Test Reports: Submit testing laboratory reports.

1. Submit air monitoring results within three working days, signed by testing laboratory employee performing air monitoring, employee analyzing sample, and CIH.

D. Certificates: Certify completed training.

1. Submit certificate for each employee signed and dated by CIH and employee stating employee was trained.

E. Qualifications: Substantiate qualifications comply with specifications.

1. Paint removal contractor.
2. Testing laboratory.
   a. Name, address, and telephone number.
   b. Current evidence of participation in NIOSH PAT Program.
   c. Copy of current AIHA accreditation certificate.
3. Industrial hygienist.
   a. Name, address, and telephone number.
   b. Resume showing previous experience.
   c. Copy of current ABIH CIH certification.
4. Paint disposal facility.
   a. Name, address, and telephone number.
   b. Current license or authorization to receive and dispose lead contaminated waste.

F. Record Documents:

1. Completed and signed hazardous waste manifest from waste transporter.
2. Paint disposal facility receipts and disposition reports.
3. Certification of medical examinations.
4. Employee training certification.

1.7 QUALITY ASSURANCE

A. Safety and Health Regulation Compliance:
   1. Comply with laws, ordinances, rules, and regulations of federal, state, and local authorities having jurisdiction regarding removing, handling, storing, transporting, and disposing lead waste materials.
      a. Comply with applicable requirements of 29 CFR Part 1910.1025.
      b. Notify Contracting Officer's Representative and request resolution of conflicts between regulations and specified requirements before starting work.
   2. Comply with the local laws, ordinances, criteria, rules and regulations regarding removing, handling, storing, transporting, and disposing lead-contaminated materials.

B. Paint Removal Contractor: Experienced contractor, registered or licensed by applicable state agency regulating lead-based paint removal.

C. Testing Laboratory: State certified independent testing laboratory experienced in airborne lead monitoring, testing, and reporting.
   1. Successful participant in NIOSH Proficiency Analytical Testing (PAT) Program within prior 12 months.
   2. Accredited by American Industrial Hygiene Association (AIHA).

D. Certified Industrial Hygienist: Certified as CIH by American Board of Industrial Hygiene in comprehensive practice and responsible for:
   1. Certify Training.
   2. Review and approve lead-based paint removal plan for conformance to applicable referenced standards.
   3. Inspect lead-based paint removal work for conformance with approved plan.
   4. Direct monitoring.
   5. Ensure work is performed according to specifications.
   6. Ensure personnel and environment hazardous exposures are adequately controlled.

E. Paint Disposal Facility: State certified disposal facility qualified to receive and dispose lead-based paint.

F. Lead-based Paint Removal Plan:

1. Submit detailed, site-specific plan describing lead-based paint removal procedures.
2. Include sketch showing location, size, and details of lead control areas, decontamination rooms, change rooms, shower facilities, and mechanical ventilation system.
3. Include eating, drinking, and restroom procedures, interface of trades, work sequencing, collected wastewater and paint debris disposal plan, air sampling plan, respirators, protective equipment, and detailed description of containment methods ensuring airborne lead concentrations do not exceed action level outside lead control area.
   a. Eating, drinking, and smoking are not acceptable within lead control area.
4. Include air sampling, training and strategy, sampling methodology, frequency, duration, and qualifications of air monitoring personnel.

G. Respiratory Protection Program: Establish and implement program required by 29 CFR Part 1910.134, 29 CFR Part 1910.1025, and 29 CFR Part 1926.62.

1. Provide each employee negative pressure or other appropriate respirator.
   a. Test fit each employee's respirator at initial fitting and maximum 6 month intervals, as required by 29 CFR Part 1926.62.

H. Hazard Communication Program: Establish and implement program required by 29 CFR Part 1910.1200.

I. Hazardous Waste Management Plan: Establish and implement plan according to applicable requirements of Federal, State, and local hazardous waste regulations including the following:

1. Identification of hazardous wastes associated with work.
2. Estimated quantities of generated and disposed waste.
3. Names and qualifications of each contractor transporting, storing, treating, and disposing wastes. Include facility location and 24-hour point of contact. Provide two copies of state hazardous waste permits and EPA Identification numbers.

4. Names and qualifications (experience and training) of personnel working on-site with hazardous wastes.
5. List of required waste handling equipment including cleaning, volume reduction, and transport equipment.
6. Spill prevention, containment, and cleanup contingency implementation measures.
7. Work plan and schedule for waste containment, removal, and disposal with daily waste cleaned up and containerization.
8. Hazardous waste disposal cost.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 PAINT REMOVAL PRODUCTS

A. Chemical Stripper: Biodegradable, non-toxic, capable of removing existing paint layers in one application, and acceptable to CIH.

2.2 ACCESSORIES

A. Waste Collection Drums: 49 CFR Part 178; Type 1A2, steel, removable head, 200 L (55 gal.) capacity, capable of containing waste without loss.
B. Vacuum Cleaner: HEPA filtered type.
C. Scrapers:
   1. Metal type for use on metal, concrete, and masonry surfaces.
   2. Plastic type for use on wood, plaster, gypsum board, and other surfaces.
D. Rinse Water: Potable.
E. Cleaning Cloths: Cotton.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Before exposure to lead-contaminated dust, provide workers with comprehensive medical examination required by 29 CFR Part 1926.62 (I) (1) (i) and (ii).
   1. Exemption: Examination is not required when employee medical records show last examination required by 29 CFR Part 1926.62(I) was completed within previous 12 months.

B. Maintain complete and accurate employee medical records according to 29 CFR Part 1910.20.

C. Train each employee performing paint removal, disposal, and air sampling operations according to 29 CFR Part 1926.62.

1. Certify training is completed before employee is permitted to work on project and enter lead control area.

3.2 PREPARATION

A. Protect existing work indicated to remain.

1. Perform paint removal work without damaging and contaminating adjacent work.
2. Restore damage and contamination to original condition.

B. Notify Contracting Officer 20 calendar days before starting paint removal work.

C. Lead Control Area Requirements:

1. Establish lead control area by completely enclosing lead-based paint removal work area with 6-mil polyethylene sheeting containment barriers.
2. Contain removal operations using negative pressure full containment system with minimum one change room and HEPA filtered exhaust.

D. Boundary Requirements: Provide physical boundaries around lead control area by roping off areas designated on drawings or other enclosures to ensure that airborne lead concentrations do not meet or exceed action level outside of lead control area.

E. Heating, Ventilating and Air Conditioning (HVAC) Systems: Shut down, lock out, and isolate HVAC systems supplying exhausting, and passing through lead control areas. Seal HVAC inlets and outlet within lead control area with 6-mil plastic sheet and tape. Tape seal seams in HVAC components passing through lead control area.

F. Change Room and Shower Facilities: Provide clean change rooms and shower facilities within physical boundary around lead control area according to 29 CFR Part 1926.62.

G. Mechanical Ventilation System:

1. Provide ventilation system to control personnel exposure to lead according to 29 CFR Part 1926.57.
2. Design, construct, install, and maintain HEPA filtered fixed local exhaust ventilation system according to ANSI Z9.2 and approved by CIH.

3. Exhaust ventilation air to exterior wherever possible.
4. When exhaust ventilation air must be recirculated into work area, provide HEPA filter with reliable back-up filter and controls to monitor lead concentration in return air and to bypass recirculation system automatically when system fails.

H. Personnel Protection: Provide and use required protective clothing and equipment within lead control area.

I. Warning Signs: Provide warning signs complying with 29 CFR Part 1926.62 at lead control area approaches. Locate signs so personnel read signs and take necessary precautions before entering lead control area.

3.3 WORK PROCEDURES

A. Remove lead-based paint according to approved lead-based paint removal plan.
1. Perform work only in presence of CIH or Industrial Hygienist (IH) Technician under direction of CIH ensuring continuous inspection of work in progress and direction of air monitoring activities.
2. Handle, store, transport, and dispose lead or and lead contaminated waste according to 40 CFR Part 260, 40 CFR Part 261, 40 CFR Part 262, 40 CFR Part 263, 40 CFR Part 264, and 40 CFR Part 265. Comply with land disposal restriction notification requirements as required by 40 CFR Part 268.

B. Use procedures and equipment required to limit occupational and environmental lead exposure when lead-based paint is removed according to 29 CFR Part 1926.62.

C. Dispose removed paint and waste according to Environmental Protection Agency (EPA), federal, state, and local requirements.

D. Personnel Exiting Procedures:
1. When personnel exit lead control area, comply with the following procedures:
a. Vacuum exposed clothing surfaces.
b. Remove protective clothing and equipment in decontamination room. Place clothing in approved impermeable disposal bag.
c. Shower.
d. Dress in clean clothes before leaving lead control area.

E. Monitoring - General:
1. Monitor airborne lead concentrations according to 29 CFR Part 1910.1025 by testing laboratory as directed by CIH.

2. Take personal air monitoring samples on employees anticipated to have greatest exposure risk as determined by CIH. Additionally, take air monitoring samples on minimum 25 percent of work crew or minimum of two employees, whichever is greater, during each work shift.
3. Submit results of air monitoring samples, signed by CIH, within 24 hours after taking air samples. Notify Contracting Officer's Representative immediately of lead exposure at or exceeding action level outside of lead control area.

F. Monitoring During Paint Removal:
1. Perform personal and area monitoring during entire paint removal operation.
2. Conduct area monitoring at physical boundary daily for each work shift to ensure unprotected personnel are not exposed above action level anytime.
3. For outdoor operations, take at least one sample on each shift leeward of lead control area. When adjacent areas are contaminated, clean area of contamination and have CIH visually inspect and certify lead contamination is cleaned.
4. Stop work when outside boundary lead levels meet or exceed action level. Notify Contracting Officer's Representative, immediately.
5. Correct conditions causing increased lead concentration as directed by CIH.
6. Review sampling data collected during work stoppage to determine if conditions require additional work method modifications as determined by CIH.
7. Resume paint removal when approved by CIH.

3.4 LEAD-BASED PAINT REMOVAL

A. Remove paint within areas indicated on drawings completely exposing substrate. Minimize damage to substrate.
B. Comply with paint removal processes described lead paint removal plan.
C. Lead-Based Paint Removal: Select processes for each application to minimize work area lead contamination and waste.

3.5 SUBSTRATE SURFACE PREPARATION

A. Protect substrates from deterioration and contamination until refinished.
1. Protect metal substrates from flash rusting.
B. Prepare and paint substrates according to Section 09 91 00, PAINTING.

3.6 FIELD QUALITY CONTROL

A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.

B. Perform sampling and testing for:

1. Air monitoring.
2. Lead based paint.

3.7 CLEANING AND DISPOSAL

A. Cleaning:

1. Maintain lead control area surfaces free of accumulating paint chips and dust. Confine dust, debris, and waste to work area.
2. Vacuum clean work area daily, at end of each shift, and when paint removal operation is complete.

B. CIH Certification: Certify in writing that inside and outside lead control area air monitoring samples are less than action level, employee respiratory protection was adequate, the work was performed according to 29 CFR Part 1926.62, and no visible accumulations of lead-based paint and dust remain on worksite.

1. Do not remove lead control area or roped-off boundary and warning signs before Contracting Officer's Representative's receipt of CIH's certification.
2. Reclean areas showing dust or residual paint chips.

C. Testing: Where indicated and when directed by Contracting Officer's Representative, test lead-based paint residue and used abrasive according to 40 CFR Part 261 for hazardous waste.

D. Waste Collection:

1. Collect lead-contaminated materials including waste, scrap, debris, bags, containers, equipment, and clothing, which may produce airborne lead contamination.
2. Place lead contaminated materials in waste disposal drums. Label each drum identifying waste type according to 49 CFR Part 172 and date waste materials were first put into drum. Obtain and complete the Uniform Hazardous Waste Manifest forms. Comply with land disposal restriction notification requirements required by 40 CFR Part 268:
3. Coordinate temporary storage location on project site with Contracting Officer's Representative.

E. Waste Disposal:

1. Do not store hazardous waste drums in temporary storage location longer than 90 calendar days from drum label date.
2. Remove, transport, and deliver drums to paint disposal facility.
   a. Obtain signed receipt including date, time, quantity, and description of materials received according to 40 CFR Part 262.
   b. Obtain final report of materials disposition after disposal completion.

- - - E N D - - -

SECTION 03 30 53
(SHORT-FORM) CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place structural concrete.
2. Slab on grade infill.
3. Suspended slab infill on metal deck.
4. Foundation wall infill.
5. Footings.
6. Equipment pads.
7. Preparation of existing surfaces to receive concrete.
8. Preparation of existing surface to received concrete topping.

1.2 RELATED REQUIREMENTS

A. Materials Testing and Inspection During Construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Concrete Roads, Walks, and Similar Exterior Site Work: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this Section.

B. American Concrete Institute (ACI):

1. 117-15 - Tolerances for Concrete Construction, Materials and Commentary.
2. 117M-10(R2015) - Tolerances for Concrete Construction, Materials and Commentary.
3. 211.1-91(R2009) - Proportions for Normal, Heavyweight, and Mass Concrete.
4. 211.2-98(R2004) - Selecting Proportions for Structural Lightweight Concrete.
5. 301/310M-10 - Structural Concrete.
6. 305.1-14 - Hot Weather Concreting.
7. 306.1-90(R2002) - Cold Weather Concreting.
8. 318/318M-14 - Building Code Requirements for Structural Concrete and SP-66-04-ACI Detailing Manual.
9. 347-04 - Guide to Formwork for Concrete.

C. ASTM International(ASTM):

1. A615/A615M-15ae1 - Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
2. A996/A996M-15 - Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
3. A1064/A1064M-15 - Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
4. C33/C33M-13 - Concrete Aggregates.
5. C39/C39M-15a - Compressive Strength of Cylindrical Concrete Specimens.
6. C94/C94M-15a - Ready-Mixed Concrete.
7. C143/C143M-15 - Slump of Hydraulic Cement Concrete.
8. C150/C150M-15 - Portland Cement.
9. C171-07 - Sheet Material for Curing Concrete.
10. C192/C192M-15 - Making and Curing Concrete Test Specimens in the Laboratory.
11. C219-14a - Terminology Relating to Hydraulic Cement.
12. C260/C260M-10a - Air-Entraining Admixtures for Concrete.
13. C330/C330M-14 - Lightweight Aggregates for Structural Concrete.
14. C494/C494M-15 - Chemical Admixtures for Concrete.
15. C618-15 - Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
16. C881/C881M-14 - Epoxy-Resin-Base Bonding Systems for Concrete.
17. C989/C989M-14 - Slag Cement for Use in Concrete and Mortars.
18. C1240-15 - Silica Fume Used in Cementitious Mixtures.
19. D1751-04(2013el) - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
20. E1155-14 - Determining FF Floor Flatness and FL Floor Levelness Numbers.
21. E1745-11 - Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

D. International Concrete Repair Institute:

1. 310.2R-2013 - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:
   1. Large scale drawings of reinforcing steel.
C. Manufacturer's Literature and Data:
   1. Concrete Mix Design with recent compression tests of concrete mix.
   2. Air-entraining admixture, chemical admixtures, and curing compounds.
   3. Indicate manufacturer's recommendation for each application.
D. Certificates: Certify products comply with specifications.
   1. Each ready mix concrete batch delivered to site.

1.5 DELIVERY

A. Deliver each ready-mixed concrete batch with mix certification in duplicate according to ASTM C94/C94M.

1.6 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II.
B. Pozzolans:
   1. Fly Ash: ASTM C618, Class C or F including supplementary optional physical requirements.
   2. Slag: ASTM C989/C989M; Grade 80, Grade 100 or Grade 120.
   3. Silica Fume: ASTM C1240.

.

C. Coarse Aggregate: ASTM C33/C33M.
   1. Size 467 for footings and walls over 300 mm (12 inches) thick.
   2. Size 7 for coarse aggregate for applied topping and metal pan stair fill.
   3. Size 67 for other applications.
D. Fine Aggregate: ASTM C33/C33M.
E. Lightweight Aggregate for Structural Concrete: ASTM C330/C330M, Table 1.
F. Mixing Water: Fresh, clean, and potable.
G. Air-Entraining Admixture: ASTM C260/C260M.
H. Chemical Admixtures: ASTM C494/C494M.

I. Vapor Barrier: ASTM E1745, Class A with a minimum puncture resistance of 2200 g (3000 lbs.); minimum 0.38 mm (15 mil) thick.

J. Reinforcing Steel: ASTM A615/A615M or ASTM A996/A996M, deformed. See Structural Drawings for grade.

K. Forms: Wood, plywood, metal, or other materials, approved by Contracting Officer, of grade or type suitable to obtain type of finish specified.

1. Plywood: Exterior grade, free of defects and patches on contact surface.
2. Lumber: Sound, grade-marked, S4S stress graded softwood.
3. Form coating: As recommended by Contractor.

L. Welded Wire Fabric: ASTM A1064/A1064M, plain; Grade 56; Grade 65; Grade 70; Grade 75; Grade 80; sized as indicated.

M. Expansion Joint Filler: ASTM D1751.

N. Sheet Materials for Curing Concrete: ASTM C171.

O. Abrasive Aggregates: Aluminum oxide grains or emery grits.

P. Liquid Densifier/Sealer: 100 percent active colorless aqueous siliconate solution.

Q. Grout, Non-Shrinking: Premixed ferrous or non-ferrous. Grout to show no settlement or vertical drying shrinkage at 3 days. Compressive strength for grout, at least 18 MPa (2500 psi) at 3 days and 35 MPa (5000 psi) at 28 days.

2.2 ACCESSORIES

A. Bonding Agent: ASTM C 1059/C 1059M, Type II.

B. Structural Adhesive: ASTM C881, 2-component material suitable for use on dry or damp surfaces. Provide material Type, Grade, and Class to suit Project requirements.

C. Water Stops: Rubber base with self-healing properties. Expanding clay based products not acceptable.

D. Weeps: Geotextile type as recommended by Contractor and approved by Contracting Officer.

2.3 CONCRETE MIXES

A. Design concrete mixes according to ASTM C94/C94M, Option C.

B. Compressive strength at 28 days: minimum 30 MPa (4,000 psi).

C. Submit mix design and results of compression tests to the Contracting Officer for his evaluation. Identify all materials, including admixtures, making-up the concrete.

D. Maximum Slump for Vibrated Concrete: 100 mm (4 inches) tested according to ASTM C143.

E. Cement and Water Factor (See Table I):

TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE				
Concrete: Strength	Non-Air-Entrained		Air-Entrained	
Min. 28 Day Comp. Str. MPa (psi)	Min. Cement kg/cu. m (lbs./cu. yd.)	Max. Water Cement Ratio	Min. Cement kg/cu. m (lbs./cu. yd.)	Max. Water Cement Ratio
35 (5000)1,3	375 (630)	0.45	385 (650)	0.40
30 (4000)1,3	325 (550)	0.55	340 (570)	0.50
25 (3000)1,3	280 (470)	0.65	290 (490)	0.55
25 (3000)1,2	300 (500)	*	310 (520)	*

Footnotes:
1. If trial mixes are used, achieve a compressive strength 8.3 MPa (1 200 psi) in excess of f'c. For concrete strengths greater than 35 MPa (5,000 psi), achieve a compressive strength 9.7 MPa (1,400 psi) in excess of f’c.
2. Lightweight Structural Concrete: Pump mixes may require higher cement values as specified in ACI 318/318M.
3. For Concrete Exposed to High Sulfate Content Soils: Maximum water cement ratio is 0.44.
* Laboratory Determined according to ACI 211.1 for normal weight concrete or ACI 211.2 for lightweight structural concrete.

F. Air-entrainment as specified, and conform with the following for air content table:

TABLE II - TOTAL AIR CONTENT FOR VARIOUS SIZES OF COARSE AGGREGATES	
Nominal Maximum Size of Coarse Aggregate	Total Air Content, percent
10 mm (3/8 inches)	6 Moderate exposure; 7.5 severe exposure
13 mm (1/2 inches)	5.5 Moderate exposure; 7 severe exposure
19 mm (3/4 inches)	5 Moderate exposure; 6 severe exposure

TABLE II - TOTAL AIR CONTENT FOR VARIOUS SIZES OF COARSE AGGREGATES	
Nominal Maximum Size of Coarse Aggregate	Total Air Content, percent
25 mm (1 inches)	4.5 Moderate exposure; 6 severe exposure
40 mm (1 1/2 inches)	4.5 Moderate exposure; 5.5 severe exposure

2.4 BATCHING AND MIXING

A. Store, batch, and mix materials according to ASTM C94/C94M.
   1. Job-Mixed: Batch mix concrete in stationary mixers as specified in ASTM C94/C94M.
   2. Ready-Mixed Concrete: Comply with ASTM C94/C94M, except use of non-agitating equipment for transporting concrete to Site is not acceptable.
   3. Mixing Structural Lightweight Concrete: Charge mixer with 2/3 of total mixing water and total aggregate for each batch. Mix ingredients minimum 30 seconds in stationary mixer or minimum 10 revolutions at mixing speed in truck mixer. Add remaining mixing water and other ingredients and continue mixing. Above procedure may be modified as recommended by aggregate producer.
   4. When aggregate producer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

PART 3 - EXECUTION

3.1 FORMWORK

A. Installation: Conform to ACI 347. Construct forms to obtain concrete of the shapes, dimensions and profiles indicated, with tight joints.
B. Design and construct forms to prevent bowing-out of forms between supports and to be removable without prying against or otherwise damaging fresh concrete.
C. When patching formed concrete, seal form edges against existing surface to prevent leakage; set forms so that patch is flush with adjacent surfaces.
D. Treating and Wetting: Treat or wet concrete contact surfaces:
   1. Coat plywood and lumber forms with non-staining form sealer.

2. Wet wood forms thoroughly when they are not treated with form release agent.
3. Prevent water from accumulating and remaining within forms.
4. Clean and coat removable metal forms with light form oil before reinforcement is placed.
5. In hot weather, cool metal forms by thoroughly wetting with water just before placing concrete.
6. Prevent water from accumulating and remaining within forms.

E. Inserts, Sleeves, and Similar Items: Install flashing reglets, masonry ties, anchors, inserts, wires, hangers, sleeves, boxes for floor hinges, and other cast-in items specified in other Sections. Place where indicated, square, flush and secured to formwork.

F. Construction Tolerances - General: Install and maintain concrete formwork to assure completion of work within specified tolerances.

G. Adjust or replace completed work exceeding specified tolerances before placing concrete.

3.2 REINFORCEMENT

A. Install concrete reinforcement according to ACI 318 and ACI SP-66.

B. Support and securely tie reinforcing steel to prevent displacement during placing of concrete.

C. Drilling for Dowels in Existing Concrete: Use sharp bits, drill hole slightly oversize, fill with epoxy grout, inset the dowel, and remove excess epoxy.

3.3 VAPOR BARRIER

A. Except where membrane waterproofing is required, place interior concrete slabs on a continuous vapor barrier.

B. Lap joints 150 mm (6 inches) and seal with a compatible pressure-sensitive tape.

C. Patch punctures and tears.

3.4 PLACING CONCRETE

A. Remove water from excavations before concrete is placed. Remove hardened concrete, debris and other foreign materials from interior of forms, and from inside of mixing and conveying equipment. Obtain approval from Contracting Officer's Representative before placing concrete.

B. Install screeds at required elevations for concrete slabs.

C. Roughen and clean free from laitance, foreign matter, and loose particles before placing new concrete on existing concrete.
   1. Blow-out areas with compressed air and immediately coat contact areas with adhesive in compliance with manufacturer's instructions.
D. Place structural concrete according to ACI 301 and ACI 318.
E. Convey concrete from mixer to final place of deposit by method that will prevent segregation or loss of ingredients. Do not deposit, in Work, concrete that has attained its initial set or has contained its water or cement more than 1 1/2 hours. Do not allow concrete to drop freely more than 1500 mm (5 feet) in unexposed work nor more than 900 mm (3 feet) in exposed work.
F. Place and consolidate concrete in horizontal layers not exceeding 300 mm (12 inches) in thickness. Consolidate concrete by spading, rodding, and mechanical vibrator. Do not secure vibrator to forms or reinforcement. Continuously vibrate during placement of concrete.
G. Concrete Fill in Stair Tread and Landing Pans: Coat steel with bonding agent and fill pans with concrete. Reinforce with 2 inch by 2 inch by 1.6 mm (0.06 inch) welded wire mesh at midpoint.
H. Hot Weather Concrete Placement: As recommended by ACI 305.1 to prevent adversely affecting properties and serviceability of hardened concrete.
I. Cold Weather Concrete Placement: As recommended by ACI 306.1, to prevent freezing of thin sections less than 300 mm (12 inches) and to permit concrete to gain strength properly.
   1. Do not use calcium chloride without written approval from Contracting Officer's Representative.

3.5 TOLERANCES

A. Slab on Grade Finish Tolerance: Comply with ACI 117, FF-number and FL-number method.
   1. Paragraph 4.8.3, Class A 3 mm (1/8 inches) for offset in form-work.
   2. Table R4.8.4, "Flat" 6 mm (1/4 inch) in 3 m (10 feet) for slabs.

3.6 PROTECTION AND CURING

A. Protect exposed surfaces of concrete from premature drying, wash by rain or running water, wind, mechanical damage, and excessive hot or cold temperatures.
B. Curing Methods: Cure concrete with curing compound using wet method with sheets.

C. Formed Concrete Curing: Wet the tops and exposed portions of formed concrete and keep moist until forms are removed.
   1. If forms are removed before 14 days after concrete is cast, install sheet curing materials as specified above.
D. Concrete Flatwork Curing:
   1. Install sheet materials according to the manufacturer's instructions.
      a. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

3.7 FORM REMOVAL

A. Maintain forms in place until concrete is self-supporting, with construction operation loads.
B. Remove fins, laitance and loose material from concrete surfaces when forms are removed. Repair honeycombs, rock pockets, sand runs, spalls, or otherwise damaged surfaces by patching with the same mix as concrete minus the coarse aggregates.
C. Finish to match adjacent surfaces.

3.8 FINISHES

A. Vertical and Overhead Surface Finishes:
   1. Surfaces Concealed in Completed Construction: As-cast; no additional finishing required.
   2. Surfaces Exposed in Unfinished Areas: As-cast; no additional finishing required.
      a. Mechanical rooms.
      b. Electrical rooms.
   3. Surfaces Exposed to View Scheduled for Paint Finish: Remove fins, burrs and similar projections by mechanical means approved by Contracting Officer's Representative flush with adjacent surface. Lightly rub with fine abrasive stone or hone. Use ample amount of water during rubbing without working up a lather of mortar or changing texture of concrete.
   4. Surfaces Exposed to View in Finished Areas: Grout finish, unless otherwise shown, for uniform color and smooth finish treated.
      a. Remove laitance, fins and burrs.
      b. Scrub concrete with wire brushes. Clean stained concrete surfaces with hone or stone.

c. Apply grout composed of 1 part Portland cement and 1 part clean, fine sand (smaller than 600 micro-m (No. 30) sieve). Work grout into surface of concrete with cork floats or fiber brushes until pits and honeycomb are filled.

d. After grout has hardened, but is still plastic, remove surplus grout with sponge rubber float and by rubbing with clean burlap.

e. In hot, dry weather fog spray surfaces with water to keep grout wet during setting period. Complete finished areas in same day. Confine limits of finished areas to natural breaks in wall surface. Do not leave grout on concrete surface overnight.

B. Slab Finishes:

1. Allow bleed water to evaporate before surface is finished. Do not sprinkle dry cement on surface to absorb water.

2. Scratch Finish: Rake or wire broom after partial setting slab surfaces to received bonded applied cementitious application, within 2 hours after placing, to roughen surface and provide permanent bond between base slab and applied cementitious materials.

3. Float Finish: Interior and exterior ramps, interior stair treads, and platforms, both equipment pads, and slabs to receive non-cementitious materials, except as specified.

a. Screen and float to smooth dense finish.

b. After first floating, while surface is still soft, check surfaces for alignment using straightedge or template. Correct high spots by cutting down with trowel or similar tool. Correct low spots by filling in with material same composition as floor finish. Remove any surface projections on floated finish by rubbing or dry grinding. Refloat slab to uniform sandy texture.

4. Steel Trowel Finish: Applied toppings, concrete surfaces to receive resilient floor covering or carpet, future floor roof and other monolithic concrete floor slabs exposed to view without other finish indicated or specified.

a. Delay final steel troweling to secure smooth, dense surface, usually when surface can no longer be dented by fingers. During final troweling, tilt steel trowel at slight angle and exert heavy pressure on trowel to compact cement paste and form dense, smooth surface.

b. Finished surface: Free from trowel marks. Uniform in texture and appearance.

5. Broom Finish: Finish exterior slabs, ramps, and stair treads with bristle brush moistened with clear water after surfaces have been floated.

6. Finished Slab Flatness (FF) and Levelness (FL):

a. Slab on Grade: Specified overall value FF 25/FL 20. Minimum local value FF 17/FL 15.

b. Test flatness and levelness according to ASTM E1155.

3.9 SURFACE TREATMENTS

A. Mix and apply the following surface treatments according to manufacturer's instructions.

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Liquid Densifier/Sealer: Use for exposed concrete floors and concrete floors to receive carpeting except those specified to receive non-slip finish.

C. Slip Resistant Finish:

1. Except where safety nosing and tread coverings are shown, apply abrasive aggregate to treads and platforms of concrete steps and stairs, and to surfaces of exterior concrete ramps and platforms.

a. Broadcast aggregate uniformly over concrete surface. Trowel concrete surface to smooth dense finish. After curing, rub treated surface with abrasive brick and water sufficiently to slightly expose abrasive aggregate.

3.10 APPLIED TOPPING

A. Install concrete topping with thickness and strength shown with only enough water to ensure stiff, workable, plastic mix.

B. Continuously place applied topping until entire area is complete, struck off with straightedge, compact by rolling or tamping, float and steel trowel to hard smooth finish.

3.11 RESURFACING FLOORS

A. Remove existing flooring by abrasive blasting or grinding, in areas to receive resurfacing, to expose existing structural slab. Achieve a

surface profile of 2 to 4 according to ICRI 310.2R for the condition found at Site.

B. Prepare exposed structural slab surface by cleaning, wetting, and applying adhesive according to manufacturer's instructions as specified in the flooring section.

3.12 FOUNDATION WALL INFILL

A. Install air-entrained concrete at foundation wall infill, as indicated.

B. Install expansion and contraction joints, waterstops, weep holes, reinforcement and railing sleeves, as indicated.

C. Finish exposed surfaces to match adjacent concrete surfaces, new or existing.

D. Place porous backfill, as indicated on Drawings.

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SECTION 04 05 13
MASONRY MORTARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Masonry mortar installed by other concrete and masonry sections.

1.2 RELATED REQUIREMENTS

A. Mortar used in Section:

1. Section 04 05 16, MASONRY GROUTING.
2. Section 04 20 00, UNIT MASONRY.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. ASTM International (ASTM):

1. C40/C40M-11 - Organic Impurities in Fine Aggregates for Concrete.
2. C91/C91M-12 - Masonry Cement.
3. C144-11 -Aggregate for Masonry Mortar.
4. C150/C150M-15 - Portland Cement.
5. C207-06(2011) - Hydrated Lime for Masonry Purposes.
6. C270-14a - Mortar of Unit Masonry.
7. C595/C595M-15e1 - Blended Hydraulic Cements.
8. C780-15 - Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
9. C979/C979M-10 - Pigments for Integrally Colored Concrete.
10. C1329/C1329M-15 - Mortar Cement.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Description of each product.

C. Test Reports: Certify each product complies with specifications.

1. Mortar.
2. Admixtures.

D. Certificates: Certify each product complies with specifications.

1. Portland cement.
2. Masonry cement.
3. Mortar cement.

4. Hydrated lime.
5. Fine aggregate.
6. Color admixture.

E. Qualifications: Substantiate qualifications comply with specifications.
1. Testing laboratory.

1.5 QUALITY ASSURANCE

A. Preconstruction Testing:
1. Engage independent testing laboratory to tests and submit reports.
a. Deliver samples to laboratory in number and quantity required for testing.
2. Test mortar and materials specified.
3. Mortar:
a. Test for compressive strength and water retention according to ASTM C270.
b. Minimum Mortar compressive strengths 28 days:
1) Type M: 17.2 MPa (2,500 psi).
2) Type S: 12.4 MPa (1,800 psi).
3) Type N: 5.1 MPa (750 psi).
4. Non Staining Cement: Test for water soluble alkali.
a. Water Soluble Alkali: Maximum 0.03 percent.
5. Sand: Test for deleterious substances, organic impurities, soundness and grading.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.
B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.
C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store masonry materials under waterproof covers on planking clear of ground.
1. Protect loose, bulk materials from contamination.
B. Protect products from damage during handling and construction operations.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Hydrated Lime: ASTM C207, Type S.

B. Aggregate for Masonry Mortar: ASTM C144 and as follows:

1. Light colored sand for mortar for laying face brick.
2. White plastering sand meeting sieve analysis for mortar joints for pointing except that 100 percent passes No. 8 sieve, and maximum 5 percent retained on No. 16 sieve.
3. Test sand for color value according to ASTM C40/C40M. Sand producing color darker than specified standard is unacceptable.

C. Blended Hydraulic Cement: ASTM C595/C595M, Type IS, IP.

D. Masonry Cement: ASTM C91/C91M. Type N, S, Or M.

1. Use white masonry cement whenever white mortar is specified.

E. Mortar Cement: ASTM C1329/C1329M, Type N, S or M.

F. Portland Cement: ASTM C150/C150M, Type I.

1. Use white Portland cement wherever white mortar is specified.

G. Pigments: ASTM C979/C979M; inorganic, inert, mineral pigments only, unaffected by atmospheric conditions, nonfading, alkali resistant, and water insoluble.

H. Water: Potable, free of substances that are detrimental to mortar, masonry, and metal.

2.2 PRODUCTS - GENERAL

A. Basis of Design – match existing.

B. Provide each product from one manufacturer.

2.3 MIXES

A. Pointing Mortar for New Work:

1. For Cast Stone or Precast Concrete: Proportion by volume; one part white Portland cement, two parts white sand, and 1/5 part hydrated lime.
2. Pointing Mortar for Glazed Structural Facing Tile:

a. Proportion by volume: One part white Portland cement, two parts of graded white sand passing Number 50 sieve, and 1/8 part hydrated lime.

B. Tuck Pointing Mortar for Repair Work: Tuck pointing mortar specified in Section 04 01 00, MAINTENANCE OF MASONRY.

C. Masonry Mortar: ASTM C270.

1. Admixtures:

a. Do not use mortar admixtures, and color admixtures unless approved by Contracting Officer's Representative.

b. Do not use antifreeze compounds.

D. Colored Mortar:

1. Maintain uniform mortar color for exposed work, throughout.

2. Match mortar color in approved sample.

3. Alteration Work Mortar Color: Match existing mortar.

E. Color Admixtures:

1. Proportion as specified by manufacturer.

2. For color – match existing.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

3.2 MIXING

A. Measure ingredients by volume using known capacity container.

B. Mix for 3 to 5 minutes in a mechanically operated mortar mixer.

C. Mix water with dry ingredients in sufficient amount to provide a workable mixture which will adhere to vertical surfaces of masonry units.

D. Mortar Stiffened Because of Water Loss Through Evaporation:

1. Re-temper by adding water to restore to proper consistency and workability.

2. Discard mortar reaching initial set or unused within two hours of mixing.

E. Pointing Mortar:

1. Mix dry ingredients with enough water to produce damp mixture of workable consistency retaining shape when formed into ball.

2. Allow mortar to stand in dampened condition for 60 to 90 minutes.

3. Add water to bring mortar to a workable consistency before use.

3.3 MORTARING

A. Type S Mortar: Use for masonry containing vertical reinforcing bars (non-engineered) masonry below grade, and engineered reinforced unit masonry work.

B. Brick Veneer Over Frame Back Up Walls: Use Type S Portland cement-lime mortar.

C. Type N Mortar: Use for other masonry work.

D. Type N Mortar: Use for pointing items and tuck pointing specified.

3.4 FIELD QUALITY CONTROL

A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.

1. Take and test samples during progress of work according to ASTM C780.

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SECTION 04 05 16
MASONRY GROUTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Grout for filling hollow concrete masonry cores.

1.2 RELATED REQUIREMENTS

A. Grout used in Section:

1. Section 04 20 00, UNIT MASONRY.

B. Section 09 91 00, PAINTING.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American National Standards Institute (ANSI):

1. A118.6-10 - Standard Cement Grouts for Tile Installation.

C. ASTM International (ASTM):

1. C40/C40M-11 - Organic Impurities in Fine Aggregates for Concrete.
2. C150/C150M-15 - Portland Cement.
3. C207-06(2011) - Hydrated Lime for Masonry Purposes.
4. C404-11 - Aggregates for Masonry Grout.
5. C476-11 - Grout for Masonry.
6. C595/C595M-15e1 - Blended Hydraulic Cement.
7. C979/C979M-10 - Pigments for Integrally Colored Concrete.
8. C1019-14 - Sampling and Testing Grout.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Description of each product.

C. Test Reports: Certify each product complies with specifications.

1. Grout, each type.
2. Cement.
3. Aggregate.

D. Certificates: Certify each product complies with specifications.

1. Blended hydraulic cement.
2. Portland cement.

3. Grout.
4. Hydrated lime.
5. Aggregate.
6. Color admixture.

1.5 QUALITY ASSURANCE

A. Preconstruction Testing:
1. Engage independent testing laboratory to perform tests and submit reports.
   a. Deliver samples to laboratory in number and quantity required for testing.
2. Grout:
   a. Test compressive strength according to ASTM C1019 standard.
3. Cement:
   a. Test for water soluble alkali (nonstaining) when nonstaining cement is specified.
   b. Nonstaining cement containing more than 0.03 percent water soluble alkali.
4. Aggregate:
   a. Test for deleterious substances, organic impurities, soundness and grading.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.
B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.

1.7 STORAGE AND HANDLING

A. Store masonry materials under waterproof covers on planking clear of ground, and protect damage from handling, dirt, stain, water and wind.
B. Protect products from damage during handling and construction operations.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Grout Components:

1. Hydrated Lime: ASTM C207, Type S.
2. Aggregate For Masonry Grout: ASTM C404, Size 8.
3. Blended Hydraulic Cement: ASTM C595, Type IS, IP.
4. Portland Cement: ASTM C150, Type I.
5. Liquid Acrylic Resin:
   a. A formulation of acrylic polymers and modifiers in liquid form designed for use as an additive for mortar to improve physical properties.
6. Water: Potable, free of substances that are detrimental to grout, masonry, and metal.

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer.

2.3 MIXES

A. Grout: ASTM C476; fine grout and coarse grout.

B. Ready-Mixed Grout: ANSI A118.8.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Clean mortar from masonry cells protruding more than 13 mm (1/2 inch) to permit grout flow.

D. Remove debris from grout spaces.

E. Verify reinforcement is correctly placed before placing grout.

3.2 MIXING

A. Mix grout in mechanically operated mixer.

1. Mix grout for five minutes, minimum.

B. Measure ingredients by volume using container of known capacity.

C. Mix water with grout dry ingredients.

1. Slump Range: 200 to 275 mm (8 to 11 inches).

3.3 GROUTING

A. Install grout according to Section 04 20 00, UNIT MASONRY.

B. Use fine grout for filling wall cavities and hollow concrete masonry units where smallest cell dimension is 50 mm (2 inches) or less.

C. Use either fine grout or coarse grout for filling wall cavities and hollow concrete masonry units where smallest cell dimension is greater than 50 mm (2 inches).

D. Use grout for filling bond beam or lintel units.

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SECTION 04 20 00
UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Concrete masonry unit (CMU) assemblies for:
   1. Exterior walls.
   2. Interior walls and partitions.

1.2 RELATED REQUIREMENTS

A. Sealants and Sealant Installation: Section 07 92 00, JOINT SEALANTS.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.
B. American Concrete Institute (ACI):
   1. 315-99 - Details and Detailing of Concrete Reinforcement.
   2. 530.1/ASCE 6/TMS 602-13 - Specification for Masonry Structures.
C. ASTM International (ASTM):
   1. A615/A615M-15ae1 - Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   2. A951/A951M-14 - Steel Wire for Masonry Joint Reinforcement.
   3. A1064/A1064M-15 - Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
   4. C34-13 - Structural Clay Load-Bearing Wall tile.
   5. C55-14a - Concrete Building Brick.
   6. C56-13 - Structural Clay Nonloadbearing Tile.
   7. C62-13a - Building Brick (Solid Masonry Units Made from Clay or Shale).
   8. C67-14 - Sampling and Testing Brick and Structural Clay Tile.
   9. C90-14 - Load-Bearing Concrete Masonry Units.
   10. C126-15 - Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units.
   11. C216-15 - Facing Brick (Solid Masonry Units Made From Clay or Shale).
   12. C612-14 - Mineral Fiber Block and Board Thermal Insulation.
   13. C744-14 - Prefaced Concrete and Calcium Silicate Masonry Units.
   14. D1056-14 - Flexible Cellular Materials - Sponge or Expanded Rubber.
   15. D2240-05(2010) - Rubber Property-Durometer Hardness.
   16. F1667-15 - Driven Fasteners: Nails, Spikes, and Staples.

D. American Welding Society (AWS):
   1. D1.4/D1.4M-11 - Structural Welding Code - Reinforcing Steel.
E. Brick Industry Association (BIA):
   1. TN 11B-88 - Guide Specifications for Brick Masonry, Part 3.
F. Federal Specifications (Fed. Spec.):
   1. FF-S-107C(2) - Screws, Tapping and Drive.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Submittal Drawings:
   1. Fabrication, bending, and placement of reinforcing bars. Comply with ACI 315. Show bar schedules, diagrams of bent bars, stirrup spacing, lateral ties and other arrangements and assemblies.
   2. Special masonry shapes, profiles, and placement.
   3. Masonry units for typical window and door openings, and, for special conditions as affected by structural conditions.
C. Manufacturer's Literature and Data:
   1. Description of each product.
   2. Installation instructions.
D. Samples:
   1. Face brick: Sample panel, 200 mm by 400 mm (8 inches by 16 inches,) showing full color range and texture of bricks, bond, and proposed mortar joints.
   2. Ceramic Glazed Facing Brick: Sample panel, 200 mm by 400 mm (8 inches by 16 inches,) showing full color range and texture of bricks, bond, and proposed mortar joints.
   3. Concrete masonry units, when exposed in finish work.
   4. Anchors and Ties: Each type.
   5. Joint Reinforcing: 1200 mm (48 inches) long each type.
   6. Glazed Structural Facing Tile: Clipped panels (triplicate) of four wall units with base units, showing color range, each color and texture.
E. Test reports: Certify products comply with specifications.
   1. Ceramic glazed facing brick.
F. Certificates: Certify products comply with specifications.
   1. Face brick.

2. Solid and load-bearing concrete masonry units, including fire-resistant rated units.
3. Ceramic glazed facing brick.
4. Glazed structural clay facing tile.
5. Structural clay tile units.

G. Delegated Design Drawings and Calculations: Signed and sealed by responsible design professional.

1.5 QUALITY ASSURANCE

A. Welders and Welding Procedures Qualifications: AWS D1.4/D1.4M.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.
B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.
C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store products above grade, protected from contamination.
B. Protect products from damage during handling and construction operations.

1.8 FIELD CONDITIONS

A. Hot and Cold Weather Requirements: Comply with ACI 530.1/ASCE 6/TMS 602.

1.9 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Delegated Design: Prepare submittal documents including design calculations and drawings signed and sealed by registered design professional, licensed in state where work is located.

2.2 PRODUCTS - GENERAL

A. Basis of Design – match existing.
B. Provide each product from one manufacturer.

2.3 UNIT MASONRY PRODUCTS

A. Brick:
   1. Face Brick:
      a. ASTM C216, Grade SW, Type FBS.
      b. Brick when tested according to ASTM C67: Classified slightly efflorescent or better.
      c. Size:
         1) Modular.
         2) Thin Brick: 13 mm (1/2 inch) thick with angle shapes for corners.
   2. Building Brick: ASTM C62, Grade MW for backup and interior work; Grade SW where in contact with earth.
   3. Ceramic Glazed Facing Brick: ASTM C126.
   4. One Face Exposed: Grade S, Type I.
   5. Two Faces Exposed: Grade S, Type II.

B. Concrete Masonry Units (CMU):
   1. Hollow and Solid Load-Bearing Concrete Masonry Units: ASTM C90.
      a. Unit Weight: Normal weight.
      b. Fire rated units for fire rated partitions.
   2. Sizes: Modular, 200 mm by 400 mm (8 inches by 16 inches) nominal face dimension; thickness as indicated on drawings.
   3. For molded faces used as a finished surface, use concrete masonry units with uniform fine to medium surface texture unless specified otherwise.
   4. Use bullnose concrete masonry units at corners exposed in finished work with 25 mm (1 inch) minimum radius rounded vertical exterior corners (bullnose units).

2.4 ANCHORS, TIES, AND REINFORCEMENT

A. Steel Reinforcing Bars: ASTM A615/A615M; Grade 60, deformed bars.

B. Joint Reinforcement:
   1. Form from wire complying with ASTM A951/A951M.
   2. Hot dipped galvanized after fabrication.
   3. Width of joint reinforcement 40 mm (1.6 inches) less than nominal thickness of masonry wall or partition.
   4. Cross wires welded to longitudinal wires.
   5. Joint reinforcement minimum 3000 mm (10 feet) long, factory cut.
   6. Joint reinforcement with crimp formed drip is not acceptable.

7. Maximum spacing of cross wires 400 mm (16 inch) to longitudinal wires.
8. Ladder Design:
   a. Longitudinal wires deformed 5 mm (0.20 inch) diameter wire.
   b. Cross wires 4 mm (0.16 inch) diameter.
9. Trussed Design:
   a. Longitudinal and cross wires minimum 4 mm (0.16 inch nominal) diameter.
   b. Longitudinal wires deformed.
10. Multiple Wythes and Cavity Wall Ties:
   a. Longitudinal wires 4 mm (0.16 inch), two in each wythe with ladder truss wires 4 mm (0.16 inch) overlay, welded to each longitudinal wire.
   b. Longitudinal wires 4 mm (0.16 inch) with U shape 4 mm (0.16 inch) rectangular ties extending into other wythe minimum 75 mm (3 inches) spaced 400 mm on center (16 inches). Adjustable type with U shape tie designed to receive 4 mm (0.16 inch) pintle projecting into other wythe 75 mm (3 inches min.).

C. Adjustable Veneer Anchor for Framed Walls:
1. Two piece, adjustable anchor and tie.
2. Anchor and tie may be either loop or angle type; provide only one type throughout.
3. Loop Type:
   a. Anchor: Screw-on galvanized steel anchor strap 2.75 mm (0.11 inch) by 19 mm (3/4 inch) wide by 225 mm (9 inches) long, with 9 mm (0.35 inch) offset and 100 mm (4 inch) adjustment. Provide 5 mm (0.20 inch) hole at each end for fasteners.
   b. Ties: Triangular tie, fabricated of 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Ties long enough to engage anchor and be embedded minimum 50 mm (2 inches) into bed joint of masonry veneer.
4. Angle Type:
   a. Anchor: Minimum 2 mm (16 gage) thick galvanized steel angle shaped anchor strap. Provide hole in vertical leg for fastener. Provide hole near end of outstanding leg to suit upstanding portion of tie.

b. Tie: Fabricate from 5 mm (0.20 inch) diameter galvanized cold drawn steel wire. Form "L" shape to be embedded minimum 50 mm (2 inches) into the bed joint of masonry veneer and provide upstanding leg to fit through hole in anchor and be long enough to allow 50 mm (2 inches) of vertical adjustment.

D. Dovetail Anchors:

1. Corrugated steel dovetail anchors formed of 1.5 mm (0.06 inch) thick by 25 mm (1 inch) wide galvanized steel, 90 mm (3-1/2 inches) long where used to anchor 100 mm (4 inch) nominal thick masonry units, 140 mm (5-1/2 inches) long for masonry units more than 100 mm (4 inches) thick.
2. Triangular wire dovetail anchor 100 mm (4 inch) wide formed of 4 mm (9 gage) steel wire with galvanized steel dovetail insert. Anchor length to extend minimum 75 mm (3 inches) into masonry, 25 mm (1 inch) into 40 mm (1-1/2 inch) thick units.
3. Form dovetail anchor slots from 0.6 mm (0.02 inch) thick galvanized steel (with felt or fiber filler).

E. Individual Ties:

1. Rectangular ties: Form from 5 mm (3/16 inch) diameter galvanized steel rod to rectangular shape minimum 50 mm (2 inches) wide by sufficient length for ends of ties to extend within 25 mm (1 inch) of each face of wall. Ties that are crimped to form drip are not acceptable.
2. Adjustable Cavity Wall Ties:
   a. Adjustable wall ties may be furnished at Contractor's option.
   b. Two piece type permitting up to 40 mm (1-1/2 inch) adjustment.
   c. Form ties from 5 mm (3/16 inch) diameter galvanized steel wire.
   d. Form one piece to rectangular shape 105 mm (4-1/8 inches) wide by length required to extend into bed joint 50 mm (2 inches).
   e. Form other piece to 75 mm (3 inch) long by 75 mm (3 inch) wide shape, having 75 mm (3 inch) long bent section for engaging 105 mm (4-1/8 inch) wide piece to form adjustable connection.

F. Wall Ties, (Mesh or Wire):

1. Mesh wall ties formed of ASTM A1064/A1064M, W0.5, 2 mm, (0.08 inch) galvanized steel wire 13 mm by 13 mm (1/2 inch by 1/2 inch) mesh, 75 mm (3 inches) wide by 200 mm (8 inches) long.

2. Rectangular wire wall ties formed of W1.4, 3 mm, (0.12 inch) galvanized steel wire 50 mm (2 inches) wide by 200 mm (8 inches) long.

G. Adjustable Steel Column Anchor:

1. Two piece anchor consisting of a 6 mm (1/4 inch) diameter steel rod to be welded to steel with offset ends, rod to permit 100 mm (4 inch) vertical adjustment of wire anchor.
2. Triangular shaped wire anchor 100 mm (4 inches) wide formed from 5 (3/16 inch) diameter galvanized wire, to extend minimum 75 mm (3 inches) into joints of masonry.

H. Adjustable Steel Beam Anchor:

1. Z or C type steel strap, 30 mm (1 1/4 inches) wide, 3 mm (1/8 inch) thick.
2. Flange hook minimum 38 mm (1 1/2 inches) long.
3. Length to embed in masonry minimum 50 mm (2 inches) in 100 mm (4 inch) nominal thick masonry and 100 mm (4 inches) in thicker masonry.
4. Bend masonry end minimum 40 mm (1 1/2 inches).

I. Ridge Wall Anchors:

1. Form from galvanized steel minimum 25 mm (1 inch) wide by 5 mm (3/16 inch) thick by 600 mm (24 inches) long, plus 50 mm (2 inch) bends.
2. Other lengths as indicated on drawings.

2.5 ACCESSORIES

A. Shear Keys:

1. Solid extruded cross-shaped section of rubber, neoprene, or polyvinyl chloride, with durometer hardness of approximately 80 when tested according to ASTM D2240, and minimum shear strength of 3.5 MPa (500 psi).
2. Shear Key Dimensions: Nominal 70 mm by 8 mm for long flange and 38 mm by 16 mm for short flange (2-3/4 inches by 5/16 inch for long flange, and 1-1/2 inches by 5/8 inch for short flange).

B. Weeps:

1. Weep Hole Wicks: Glass fiber ropes, 10 mm (3/8 inch) minimum diameter, 300 mm (12 inches) long.
2. Weep Tubing: Round, polyethylene, 9 mm (3/8 inch) diameter, 100 mm (4 inches) long.

3. Weep Hole: Flexible PVC louvered configuration with rectangular closure strip at top.

C. Cavity Drain Material: Open mesh polyester sheets or strips to prevent mortar droppings from clogging the cavity.

D. Preformed Compressible Joint Filler:
1. Thickness and depth to fill joint.
2. Closed Cell Neoprene: ASTM D1056, Type 2, Class A, Grade 1, B2F1.
3. Non-Combustible Type: ASTM C612, Type 5, Max. Temp.1800 degrees F.

E. Box Board:
1. Mineral Fiber Board: ASTM C612, Type 1.
2. 25 mm (1 inch) thickness.
3. Other spacing material having similar characteristics is acceptable subject to Contracting Officer's Representative's approval.

F. Masonry Cleaner:
1. Detergent type cleaner selected for each type masonry.
2. Acid cleaners are not acceptable.
3. Use soapless type specially prepared for cleaning brick or concrete masonry as appropriate.

G. Fasteners:
1. Concrete Nails: ASTM F1667, Type I, Style 11, 19 mm (3/4 inch) minimum length.
2. Masonry Nails: ASTM F1667, Type I, Style 17, 19 mm (3/4 inch) minimum length.
3. Screws: FS-FF-S-107, Type A, AB, SF thread forming or cutting.

H. Welding Materials: AWS D1.4/D1.4M, type to suit application.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.
1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Keep finish work free from mortar smears or spatters, and leave neat and clean.

C. Wall Openings:

1. Fill hollow metal frames built into masonry walls and partitions solid with mortar as laying of masonry progresses.
2. When items are not available when walls are built, prepare openings for subsequent installation.

D. Tooling Joints:
1. Do not tool until mortar has stiffened enough to retain thumb print when thumb is pressed against mortar.
2. Tool while mortar is soft enough to be compressed into joints and not raked out.
3. Finish joints in exterior face masonry work with jointing tool, and provide smooth, water-tight concave joint unless specified otherwise.
4. Tool Exposed interior joints in finish work concave unless specified otherwise.

E. Partition Height:
1. Extend partitions minimum 100 mm (4 inches) above suspended ceiling or to overhead construction where no ceiling occurs.
2. Extend following partitions to overhead construction.
   a. Full height partitions, and fire partitions and smoke partitions indicated on drawings.
   b. Both walls at expansion joints.
   c. Corridor walls.
   d. Walls at stairway and stair halls, elevators, dumbwaiters, trash and laundry chute shafts, and other vertical shafts.
   e. Walls at refrigerator space.
   f. Reinforced masonry partitions.
3. Extend finished masonry partitions minimum 100 mm (4 inches) above suspended ceiling and continue with concrete masonry units or structural clay tile to overhead construction:

F. Lintels:
1. Lintels are not required for openings less than 1000 mm (40 inches) wide that have hollow metal frames.
2. Openings 1025 mm (41 inches) wide to 1600 m (63 inches) wide without structural steel lintel or frames, require lintel formed of concrete masonry lintel or bond beam units filled with grout and reinforced with one No. 16 (No. 5) rod top and bottom for each 100 mm (4 inches) of nominal thickness unless shown otherwise.

3. Precast concrete lintels of 25 MPa (3,000 psi) concrete, same thickness as partition, and with one No. 16 (No. 5) deformed bar top and bottom for each 100 mm (4 inches) of nominal thickness, is acceptable in lieu of reinforced CMU masonry lintels.
4. Use steel lintels, for openings greater than 1600 m (63 inches) wide, brick masonry openings, and elevator openings unless shown otherwise.
5. Doors having overhead concealed door closers require steel lintel, and pocket for closer box.
6. Lintel Bearing Length: Minimum 100 mm (4 inches) at both ends.
7. Build masonry openings or arches over wood or metal centering and supports when steel lintels are not used.

G. Wall, Furring, and Partition Units:
1. Lay out field units to provide one-half running bond, unless indicated otherwise.
2. Align head joints of alternate vertical courses.
3. At sides of openings, balance head joints in each course on vertical center lines of openings.
4. Minimum Masonry Unit Length: 100 mm (4 inches).
5. On interior partitions provide 6 mm (1/4 inch) open joint for caulking between existing construction, exterior walls, concrete work, and abutting masonry partitions.
6. Use minimum 100 mm (4 inches) nominal thick masonry for free standing furring, unless indicated otherwise.
7. Do not abut existing plastered surfaces except suspended ceilings with new masonry partitions.

H. Use minimum 100 mm (4 inches) nominal thick masonry for fireproofing steel columns unless indicated otherwise.

I. Before connecting new masonry with previously laid masonry, remove loosened masonry or mortar, and clean and wet work in place as specified under wetting.

J. When new masonry partitions start on existing floors, machine cut existing floor finish material down to concrete surface.

K. Structural Steel Encased in Masonry:
1. Where structural steel is encased in masonry and voids between steel and masonry are filled with mortar, provide minimum 25 mm (1 inch)

mortar free expansion space between masonry and steel by applying box board material to steel before masonry is laid.

2. Do not install spacing material where steel is bearing on masonry or masonry is bearing on steel.

L. Chases:

1. Do not install chases in masonry walls and partitions exposed to view in finished work, including painted or coated finishes on masonry.
2. Masonry 100 mm (4 inch) nominal thick may have electrical conduits 25 mm (1 inch) or less in diameter when covered with soaps, or other finishes.
3. Fill recess chases after installation of conduit, with mortar and finish flush.
4. When pipes or conduits, or both occur in hollow masonry unit partitions retain minimum one web of hollow masonry units.

M. Wetting and Wetting Test:

1. Test and wet brick and clay tile according to BIA TN 11B.
2. Do not wet concrete masonry units or glazed structural facing tile before laying.

N. Temporary Formwork: Provide formwork and shores as required for temporary support of reinforced masonry elements.

O. Construct formwork to conform to shape, line and dimensions indicated on drawings. Make sufficiently tight to prevent mortar, grout, or concrete leakage. Brace, tie and support formwork as required to maintain position and shape during construction and curing of reinforced masonry.

P. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other reasonable temporary construction loads.

Q. Minimum Curing Times Before Removing Shores and Forms:

1. Girders and Beams: 10 days.
2. Slabs: 7 days.
3. Reinforced Masonry Soffits: 7 days.

3.2 INSTALLATION - ANCHORAGE

A. Veneer to Framed Walls:

1. Install adjustable veneer anchors.

2. Fasten anchor to stud through sheathing with self-drilling and tapping screw, one at both ends of loop type anchor.
3. Space anchors maximum 400 mm (16 inches) on center vertically at each stud.

B. Veneer to Concrete Walls:
1. Install dovetail slots in concrete vertically at 400 mm (16 inches) on centers.
2. Locate dovetail anchors at 400 mm (16 inch) maximum vertical intervals.
3. Anchor new masonry facing to existing concrete with adjustable cavity wall ties spaced at 400 mm, (16 inches) maximum vertical intervals, and at 400 mm (16 inches) maximum horizontal intervals. Fasten ties to concrete with power actuated fasteners or concrete nails.

C. Masonry Facing to Backup and Cavity Wall Ties:
1. Use individual ties for new work.
2. Stagger ties in alternate courses, and space at 400 mm (16 inches) maximum vertically, and 400 mm (16 inches) horizontally.
3. At openings, provide additional ties spaced maximum 900 mm (36 inches) apart vertically around perimeter of opening, and within 300 mm (12 inches) from edge of opening.
4. Anchor new masonry facing to existing masonry with adjustable cavity wall ties spaced at 400 mm (16 inch) maximum vertical intervals and at every second masonry unit horizontally. Fasten ties to masonry with masonry nails.
5. Option: Install joint reinforcing for multiple wythes and cavity wall ties spaced maximum 400 mm (16 inches) vertically.
6. Tie interior and exterior wythes of reinforced masonry walls together with individual ties. Provide ties at intervals maximum 400 mm (16 inches) on center horizontally, and 400 mm (16 inches) on center vertically. Lay ties in the same line vertically in order to facilitate vibrating of the grout pours.

D. Anchorage of Abutting Masonry:
1. Anchor interior 100 mm (4 inch) thick masonry partitions to exterior masonry walls with wall ties. Space ties at 600 mm (24 inches) maximum vertical intervals. Extend ties 100 mm (4 inches) minimum into masonry.

2. Anchor interior masonry bearing walls or interior masonry partitions over 100 mm (4 inches) thick to masonry walls with rigid wall anchors spaced at 400 mm (16 inch) maximum vertical intervals.
3. Anchor abutting masonry walls and partitions to concrete with dovetail anchors. Install dovetail slots vertically in concrete at centerline of abutting wall or partition. Locate dovetail anchors at 400 mm (16 inch) maximum vertical intervals. Secure anchors to existing wall with two 9 mm (3/8 inch) by 75 mm (3 inch) expansion bolts or two power-driven fasteners.
4. Anchor abutting interior masonry partitions to existing concrete and existing masonry construction, with adjustable wall ties. Extend ties minimum 100 mm (4 inches) into joints of new masonry. Fasten ties to existing concrete and masonry construction, with powder actuated drive pins, nail or other means that provides rigid anchorage. Install anchors at 400 mm (16 inch) maximum vertical intervals.

E. Masonry Furring:
1. Anchor masonry furring less than 100 mm (4 inches) nominal thick to masonry walls or to concrete with adjustable wall ties or dovetail anchors.
2. Space at maximum 400 mm (16 inches) on center in both directions.

F. Anchorage to Steel Beams or Columns:
1. Use adjustable beam anchors on each flange.
2. At columns weld steel rod to steel columns at 300 mm (12 inch) intervals, and place wire ties in masonry courses at 400 mm (16 inches) maximum vertically.

3.3 INSTALLATION - REINFORCEMENT

A. Joint Reinforcement:
1. Install joint reinforcement in CMU wythe of combination brick and CMU, cavity walls, and single wythe concrete masonry unit walls or partitions.
2. Reinforcing is acceptable in lieu of individual ties for anchoring brick facing to CMU backup in exterior masonry walls.
3. Locate joint reinforcement in mortar joints at 400 mm (16 inch) maximum vertical intervals.

4. Additional joint reinforcement is required in mortar joints at both 200 mm (8 inches) and 400 (16 inches) above and below windows, doors, louvers and similar openings in masonry.
5. Wherever brick masonry is backed up with stacked bond masonry, install multiple wythe joint reinforcement in every two courses of CMU backup, and in corresponding joint of facing brick.

B. Steel Reinforcing Bars:
1. Install reinforcing bars in cells of hollow masonry units where required for vertical reinforcement and in bond beam units for horizontal reinforcement. Install in wall cavities of reinforced masonry walls where indicated on drawings.
2. Bond Beams:
   a. Form Bond beams of load-bearing concrete masonry units filled with grout and reinforced with two No. 15m (No. 5) reinforcing bars unless shown otherwise. Do not cut reinforcement.
   b. Brake bond beams only at expansion joints and at control joints, if shown.
3. Stack Bond:
   a. Locate additional joint reinforcement in vertical and horizontal joints as indicated on drawings.
   b. Anchor vertical reinforcement into foundation or wall or bond beam below.
   c. Provide temporary bracing for walls over 8 feet tall until permanent horizontal bracing is completed.
4. Grout openings:
   a. Leave cleanout holes in double wythe walls during construction by omitting units at base of one side of wall.
   b. Locate 75 mm by 75 mm (3 inches. by 3 inches.) min. cleanout holes at location of vertical reinforcement.
   c. Keep grout space clean of mortar accumulation and debris. Clean as work progresses and immediately before grouting.

3.4 INSTALLATION - BRICK EXPANSION AND CMU CONTROL JOINTS

A. Provide brick expansion joint (EJ) and CMU control joints (CJ) where indicated on drawings.
B. Keep joint free of mortar and other debris.
C. Joints Occur In Masonry Walls:
1. Install preformed compressible joint filler in brick wythe.

2. Install cross shaped shear keys in concrete masonry unit wythe with preformed compressible joint filler on both sides of shear key.

D. Use standard notched concrete masonry units (sash blocks) made in full and half-length units where shear keys are used to create a continuous vertical joint.

E. Interrupt joint reinforcement at expansion and control joints.

F. Fill opening in exposed face of expansion and control joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

3.5 INSTALLATION - BUILDING EXPANSION AND SEISMIC JOINTS

A. Keep expansion and seismic joints open and free of mortar. Remove mortar and other debris.

B. Install non-combustible, compressible type joint filler to fill space completely except where sealant is shown on joints in exposed finish work.

C. Fill opening in exposed face of expansion and seismic joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

3.6 INSTALLATION - ISOLATION JOINT

A. Where full height walls and partitions lie parallel or perpendicular to and under structural beams and shelf angles, provide minimum 9 mm (3/8 inch) separation between walls and partitions and bottom of beams and shelf angles.

B. Insert continuous full width strip of non-combustible type compressible joint filler.

C. Fill opening in exposed face of isolation joints with sealant as specified in Section 07 92 00, JOINT SEALANTS.

3.7 INSTALLATION - BRICKWORK

A. Lay clay brick according to BIA TN 11B.

B. Laying:

1. Lay brick in one-half running bond with bonded corners, unless indicated otherwise. Match bond of existing building on alterations and additions.
2. Maintain bond pattern throughout.
3. Do not use brick smaller than half-brick at any angle, corner, break, and jamb.
4. Where length of cut brick is greater than one half length, maintain vertical joint location.

5. Lay exposed brickwork joints symmetrical about center lines of openings.
6. Do not structurally bond multi-wythe brick walls, unless indicated on drawings.
7. Before starting work, lay facing brick on foundation wall and adjust bond to openings, angles, and corners.
8. Lay brick for sills with wash and drip.
9. Build solid brickwork as required for anchorage of items.

C. Joints:
1. Exterior And Interior Joint Widths: Lay for three equal joints in 200 mm (8 inches) vertically, unless shown otherwise.
2. Rake joints for pointing with colored mortar when colored mortar is not full depth.
3. Arches:
   a. Flat arches (jack arches) lay with camber of 1 in 200 (1/16 inch per foot) of span.
   b. Face radial arches with radial brick with center line of joints on radial lines.
   c. Form Radial joints of equal width.
   d. Bond arches into backing with metal ties in every other joint.

D. Weep Holes:
1. Install weep holes at 600 mm (24 inches) on center in bottom of vertical joints of exterior masonry veneer or cavity wall facing over foundations, bond beams, and other water stops in wall.
2. Form weep holes using wicks made of mineral fiber insulation strips turned up 200 mm (8 inches) in cavity. Anchor top of strip to backup to securely hold in place.
3. Install sand or pea gravel in cavity approximately 75 mm (3 inches) high between weep holes.

E. Solid Exterior Walls:
1. Build with 100 mm (4 inches) of nominal thick facing brick, backed up with concrete masonry units 100 mm (4 inches) nominal thick face brick.
2. Construct solid brick jambs minimum 20 mm (0.81 inches) wide at exterior wall openings and at recesses, except where exposed concrete unit backup is shown.
3. Do not install full bonding headers.

4. Parging:
   a. For solid masonry walls, lay backup to height of six brick courses, parge backup with 13 mm (1/2 inch) of mortar troweled smooth; then lay exterior wythe to height of backup.
   b. Make parging continuous over backup, and extend 150 mm (6 inches) onto adjacent concrete or masonry.
   c. Parge ends and backs for recesses in exterior walls to thickness of 13 mm (1/2 inch).
   d. Parge inside surface of exterior walls to produce true even surface to receive insulation.
5. Coordinate with building insulation for thickness of insulation and allowance of air space behind exterior wythe.
6. In locations where hurricane driven rains are expected, install bituminous dampproofing on cavity side of inner wythe.

F. Cavity Walls:
1. Keep air space clean of mortar accumulations and debris.
2. Lay the interior wythe of the masonry wall full height where air barrier is required on cavity face. Coordinate to install air barrier before laying outer wythe.
3. Insulated Cavity Type Exterior Walls:
   a. Install insulation against cavity face of inner masonry wythe.
   b. Place insulation between rows of ties or joint reinforcing. Adhere insulation to masonry surface with a bonding agent as recommended by insulation manufacturer.
   c. Lay outer masonry wythe up with air space between insulation and masonry units.
4. Veneer Framed Walls:
   a. Build with 100 mm (4 inches) of face brick over sheathed stud wall with air space.
   b. Keep air space clean of mortar accumulations and debris.

3.8 INSTALLATION - CONCRETE MASONRY UNITS

A. Types and Uses:
1. Provide special concrete masonry shapes as required, including lintel and bond beam units, sash units, and corner units. Provide solid concrete masonry units, where full units cannot be installed, or where needed for anchorage of accessories.

2. Provide solid load-bearing concrete masonry units or grout cell of hollow units at jambs of openings in walls, where structural members impose loads directly on concrete masonry, and where shown.
3. Provide rounded corner (bullnose) shapes at opening jambs in exposed work and at exterior corners.
4. Do not install brick jambs in exposed finish work.
5. Install concrete building brick only as filler in backup material where not exposed.
6. Construct fire resistance in fire rated partitions meeting fire ratings indicated on drawings.
7. Structural Clay Tile Units (Option):
   a. Structural clay tile units load-bearing or non-load bearing as required, may be installed in lieu of concrete masonry units, only, but not as an exposed surface, foundation walls or where otherwise noted.
   b. Set units as specified for concrete masonry units.
   c. Install brick or load-bearing structural clay tile units, with cores set vertically, and filled with grout where structural members impose concentrated load directly on structural clay tile masonry.
8. Where lead-lined concrete masonry unit partitions terminate below underside of overhead floor or roof deck, fill remaining open space between top of partition and underside of overhead floor or roof deck, with standard concrete masonry units of same thickness as lead lined units.

B. Laying:
1. Lay concrete masonry units with 9 mm (3/8 inch) joints, with a bond overlap of minimum 1/4 of unit length, except where stack bond is indicated on drawings.
2. Do not wet concrete masonry units before laying.
3. Bond external corners of partitions by overlapping alternate courses.
4. Lay first course in a full mortar bed.
5. Set anchorage items as work progress.
6. Where ends of anchors, bolts, and other embedded items, project into voids of units, completely fill voids with mortar or grout.

7. Provide 6 mm (1/4 inch) open joint for sealant between existing construction, exterior walls, and abutting masonry partitions.
8. Lay concrete masonry units with full face shell mortar beds and fill head joint beds for depth equivalent to face shell thickness.
9. Lay concrete masonry units so cores of units, that are to be filled with grout, are vertically continuous with joints of cross webs of such cores completely filled with mortar. Unobstructed core openings minimum 50 mm (2 inches) by 75 mm (3 inches).
10. Do not wedge masonry against steel reinforcing. Minimum 13 mm (1/2 inch) clear distance between reinforcing and masonry units.
11. Install deformed reinforcing bars of sizes indicated on drawings.
12. At time of placement, ensure steel reinforcement is free of loose rust, mud, oil, and other contamination capable of affecting bond.
13. Place steel reinforcement at spacing indicated on drawings before grouting.
14. Minimum clear distance between parallel bars: One bar diameter.
15. Hold vertical steel reinforcement in place vertically by centering clips, caging devices, tie wire, or other approved methods.
16. Support vertical bars near each end and at maximum 192 bar diameter on center.
17. Splice reinforcement or attach reinforcement to dowels by placing in contact and securing with wire ties.
18. Stagger splices in adjacent horizontal reinforcing bars. Lap reinforcing bars at splices a minimum of 40 bar diameters.
19. Grout cells of concrete masonry units, containing reinforcing bars, solid as specified.
20. Install cavity and joint reinforcement as masonry work progresses.
21. Rake joints 6 to 10 mm (1/4 to 3/8 inch) deep for pointing with colored mortar when colored mortar is not full depth.

C. Waterproofing Parging:
1. Parge earth side of concrete masonry unit basement walls with mortar applied in two coats, each coat 6 mm (1/4 inch) thick.
2. Clean wall surfaces to receive parging of dirt, oil, or grease, and moisten before application of first coat.
3. Roughen first coat when partially set, permit to hardened for 24 hours, and moisten before application of second coat.
4. Keep second coat damp for minimum 48 hours.

5. Thicken parging and round to form a cove at the junction of outside wall face and footing.

3.9 INSTALLATION - GLAZED STRUCTURAL FACING TILE

A. Lay facing tile in running bond unless indicated otherwise. Match existing adjacent bond and joints in alteration work.

B. Laying:

1. Set facing tile units in full bed of mortar with ends buttered, and units shoved into place. Fill joints with mortar, and rake out 9 mm (3/8 inch) deep for pointing.
2. Install clean units when set.
3. Perform cutting and grinding with power-driven cutting saws and grinders.
4. Cut or drill units to accommodate electrical outlets, plumbing fixtures, grab-bars, fittings, and equipment.
5. Cove Base Units:
   a. Set base flush with finish floor.
   b. Form base course of two-face partitions of two units to required thickness.
6. Lay out partitions enclosing pipes or conduits with thickness to provide 50 mm (2 inch) minimum coverage of pipes or conduits.
7. Joints:
   a. 6 mm (1/4 inch) nominal width for new work, match existing for alteration work.
   b. Maximum variations in joint width 2 mm (1/16 inch).
   c. Reinforce Two-Face partitions of 100 mm (4 inch) nominal thickness with continuous joint reinforcement, or wire mesh ties in joints at top of base, at top of glazed structural facing tile, and at three-course intervals.

3.10 POINTING

A. Fill joints with pointing mortar using rubber float trowel to apply mortar solidly into raked joints.

B. Wipe off excess mortar from joints of glazed masonry units with dry cloth.

C. Tool exposed joints to smooth concave joint.

D. At joints with existing work, match existing joint.

3.11 GROUTING

A. Preparation:
   1. Clean grout space of mortar droppings before placing grout.
   2. Close cleanouts.
   3. Install vertical solid masonry dams across grout space for full height of wall at intervals of maximum 9000 mm (30 feet). Do not bond dam units into wythes as masonry headers.
   4. Verify reinforcing bars are installed as indicated on drawings.

B. Placing:
   1. Place grout in grout space in lifts as specified.
   2. Consolidate each grout lift after free water has disappeared but before plasticity is lost.
   3. Do not slush with mortar or use mortar with grout.
   4. Interruptions:
      a. When grouting must be stopped for more than an hour, top off grout 40 mm (1-1/2 inches) below top of last masonry course.
      b. Grout from dam to dam on high lift method.
      c. Longitudinal run of masonry may be stopped off only by raking back one-half masonry unit length in each course and stopping grout 100 mm (4 inches) back of rake on low lift method.

C. Puddling Method:
   1. Consolidate by puddling with grout stick during and immediately after placing.
   2. Grout cores of concrete masonry units containing reinforcing bars solid as masonry work progresses.

D. Low Lift Method:
   1. Construct masonry to 1.5 m (5 feet) maximum height before grouting.
   2. Grout in one continuous operation and consolidate grout by mechanical vibration and reconsolidate after initial water loss and settlement has occurred.

E. High Lift Method:
   1. Do not pour grout until masonry wall has cured minimum of 4 hours.
   2. Place grout in 1.5 m (5 feet) maximum lifts.
   3. Exception:
      a. Where following conditions are met, place grout in 3.86 m (12.67 feet) maximum lifts.
      b. Masonry has cured minimum of 4 hours.

c. Grout slump is maintained between 250 and 275 mm (10 and 11 inches).

d. No intermediate reinforced bond beams are placed between top and bottom of grout lift.

4. When vibrating succeeding lifts, extend vibrator 300 to 450 mm (12 to 18 inches) into preceding lift.

3.12 PLACING REINFORCEMENT

A. General: Clean reinforcement of loose rust, mill scale, earth, ice or other materials which will reduce bond to mortar or grout. Do not use reinforcement bars with kinks or bends not shown on drawings or approved submittal drawings, or bars with reduced cross-section due to excessive rusting or other causes.

B. Position reinforcement accurately at spacing indicated on drawings. Support and secure vertical bars against displacement. Install horizontal reinforcement as masonry work progresses. Where vertical bars are shown in close proximity, provide clear distance between bars of minimum one bar diameter or 25 mm (1 inch), whichever is greater.

C. For columns, piers and pilasters, maintain clear distance between vertical bars as indicated on drawings, minimum 1.5 bar diameters or 38 mm (1-1/2 inches), whichever is greater. Provide lateral ties as indicated on drawings.

D. Splice reinforcement bars only where indicated on drawings, unless approved by Contracting Officer's Representative. Provide lapped splices. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.

E. Provide minimum lap as indicated on approved submittal drawings, or if not indicated, minimum 48 bar diameters.

F. Weld splices where indicated on drawings according to AWS D1.4/D1.4M.

G. Embed metal ties in mortar joints as work progresses, with minimum mortar cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations.

H. Embed prefabricated horizontal joint reinforcement as work progresses, with minimum cover of 15 mm (5/8 inch) on exterior face of walls and 13 mm (1/2 inch) at other locations. Lap joint reinforcement minimum 150 mm (6 inches) at ends. Use prefabricated “L” and “T” sections to provide continuity at corners and intersections. Cut and bend joint

reinforcement for continuity at returns, offsets, column fireproofing, pipe enclosures and other special conditions.

I. Anchoring: Anchor reinforced masonry work to supporting structure as indicated on drawings.

J. Anchor reinforced masonry walls at intersections with non-reinforced masonry.

3.13 INSTALLATION OF REINFORCED BRICK MASONRY

A. Mortar Jointing and Bedding:

1. Pattern Bond: Lay exterior wythes in pattern bond shown, or if not shown, lay in 1/2 running bond with vertical joints in each course centered on units in courses above and below. Lay inner wythes (if any) with units in each wythe bonded by lapping minimum 50 mm (2 inches). Bond and interlock each course of each wythe at corners and intersections. Do not use units with less than 100 mm (4 inch) nominal horizontal face dimension at corners or jambs.
2. Lay exterior wythes with bed (horizontal) and head (vertical) joints between units completely filled with mortar. Top of bed joint mortar may be sloped toward center of walls. Butter ends of units with sufficient mortar to completely fill head joints and shove into place. Do not furrow bed joints or slush head joints. Remove any mortar fins which protrude into grout space.
3. Maintain joint widths shown for head and bed joints, except for minor variations required to maintain pattern bond. If not shown, lay with 9 mm (3/8 inch) head and bed joints.
4. Maintain joint widths shown for head and bed joints, but adjust thickness of bed joints, if required, to allow for minimum 6 mm (1/4 inch) thickness of mortar between reinforcement and masonry units, except 6 mm (1/4 inch) bars (if any) may be laid in 13 mm (1/2 inch) thick bed joints and 5 mm (0.2 inch) diameter or smaller wire reinforcing may be laid in 9 mm (3/8 inch) thick bed joints.

B. Two-Wythe Wall Construction: Lay both wythes as specified for exterior wythes. Maintain grout space (collar or continuous vertical joint between wythes) of width indicated, but adjust, if required, to provide grout space minimum 13 mm (1/2 inch) wider than the sum of the vertical and horizontal reinforcement bars shown in grout space. Do not parge or fill grout space with mortar.

C. Limit extent of masonry construction to sections which do not exceed maximum grouting requirements. Provide temporary dams or barriers to control horizontal flow of grout at ends of wall sections. Build dams full height of grout pour. If masonry units are used, do not bond into permanent masonry wythes. Remove temporary dams after completion of grout pour.

D. Low-Lift Grouting:

1. Use Low-Lift grouting technique with fine grout for the following:
   a. Columns, piers or pilasters where masonry units are shown in core areas enclosed by exterior masonry units.
2. At Contractor’s option, low-lift grouting technique is acceptable for reinforced masonry construction with grout spaces wider than 50 mm (2 inches), except use coarse grout and place in lifts maximum 200 mm (8 inches) in height.
3. Construct low-lift masonry by placing reinforcement, laying masonry units and pouring grout as work progresses.
4. Place vertical reinforcement bars and supports before laying of masonry units. Extend above elevation of maximum pour height as required to allow for splicing. Horizontal reinforcement bars may be placed progressively with laying of masonry units.
5. Limit grout pours as required to prevent displacement of masonry by grout pressures (blowout), but do not exceed 1200 mm (4 feet) pour height.
6. Lay masonry units before each grout pour, but do not construct more than 300 mm (12 inches) above maximum grout pour height in exterior wythe and 100 mm (4 inches) above in other exterior wythe. Provide metal wall ties if required to prevent blowouts.
7. Consolidate immediately by rodding or puddling; do not use trowels. Place grout continuously; do not interrupt pouring of grout for more than one hour. If poured in lifts, place from center-to-center of masonry courses. Terminate pour 38 mm (1 1/2 inches) below top of highest course in pour.

E. High-Lift Grouting:

1. High-Lift grouting technique is acceptable for the following masonry construction:
   a. Two-wythe walls with grout spaces of 60 mm (2 1/2 inches) or greater width.

b. Columns, piers, or pilasters when no unit masonry fill is shown to be placed in reinforced grout space.

2. Place reinforcement and support in proper position, before laying of masonry units, except if shown to be placed in mortar joints, place as masonry units are laid. Place horizontal bars in grout spaces on same side of vertical bars.
3. Construct high-lift masonry by laying masonry to full height and width before placing grout. Provide cleanout holes in first course of masonry, and use high-pressure water jet stream to remove excess mortar from grout spaces, reinforcement bars and top surface of structural members which support wall. Clean grout spaces daily during construction of masonry.
4. Walls: Omit every other masonry unit in first course of one wythe to provide cleanout holes. Tie wythes together with metal ties as indicated on drawings or as required by code, but provide minimum 3.8 mm diameter (9 gage) wire ties spaced maximum 600 mm (24 inches) on center horizontally and 400 mm (16 inches) on center vertically for running pattern bond or 300 mm (12 inches) on center vertically for stack bond (if any).
5. Columns, Piers and Pilasters: Omit every other masonry unit around perimeter of member to provide cleanout holes. Provide reinforcing bands placed in bed joints as the masonry work progresses. Provide bands of the size and vertical spacing show, or as required by code, but minimum 3.8 mm diameter (9 gage) wire spaced 300 mm (12 inches) on center vertically.
6. Preparation of Grout Spaces: Before grouting, inspect and clean grout spaces. Remove dirt, dust, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper positioning. Clean top surface of structural members supporting masonry to ensure bond. After cleaning and inspection, close cleanout holes with matching masonry units and brace closures to resist grout pressures.
7. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist grout pressure, but minimum 3 days curing time. Install shores and bracing, if required, before starting grouting operations.

8. Place grout by pumping into grout spaces, unless alternate methods are acceptable to Contracting Officer's Representative.
9. Install coarse grout. Rod or vibrate each grout lift during placing and after excess moisture has been absorbed, but before plasticity is lost. Do not penetrate or damage grout placed in previous lifts or pours.
10. Limit grout pours to sections which can be completed in one working day with maximum one hour interruption of pouring operation. Limit pours so as not to exceed the capacity of masonry to resist displacement or loss of mortar bond due to grout pressures.
11. Do not exceed 3600 mm (12 feet) pour height.
12. Do not exceed 7600 mm (25 feet) horizontal pour dimension.
13. Where pour height exceeds 1200 mm (4 feet), place grout in series of lifts not exceeding 1200 mm (4 feet) height. Place each lift as continuous pouring operation. Allow minimum 30 minutes and maximum one hour between lifts of given pour.
14. When more than one pour is required to complete each section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 38 mm (1-1/2 inches) of top course of first pour. After grouted masonry is cured, remove temporary dams, and lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence, if more pours are required.

3.14 INSTALLATION OF REINFORCED CONCRETE UNIT MASONRY

A. Do not wet concrete masonry units (CMU).

B. Lay CMU units with full-face shell mortar beds. Fill vertical head joints (end joints between units) solidly with mortar from face of unit to distance behind face equal to thickness of longitudinal face shells. Solidly bed cross-webs of starting courses in mortar. Maintain head and bed 9 mm (3/8 inch) joint widths.

C. Where solid CMU units are shown, lay with full mortar head and bed joints.

D. Walls:

1. Pattern Bond: Lay CMU wall units in 1/2-running bond with vertical joints in each course centered on units in courses above and below, unless otherwise indicated. Bond and interlock each course at corners and intersections. Use special-shaped units where shown, and

as required for corners, jambs, sash, control joints, lintels, bond beams and other special conditions.

2. Maintain vertical continuity of core or cell cavities, which are to be reinforced and grouted, to provide minimum clear dimension indicated and to provide minimum clearance and grout coverage for vertical reinforcement bars. Keep cavities free of mortar. Solidly bed webs in mortar where adjacent to reinforced cores or cells.
3. Where horizontally reinforced beams (bond beams) are indicated on drawings, use special units or modify regular units to allow for placement of continuous horizontal reinforcement bars. Place small mesh expanded metal lath or wire screening in mortar joints under bond beam courses over cores or cells of non-reinforced vertical cells, or provide units with solid bottoms.

E. Columns, Piers and Pilasters:
1. Use CMU units of size, shape and number of vertical core spaces shown. If not shown, use units which provide minimum clearances and grout coverage for number and size of vertical reinforcement bars shown.
2. Provide pattern bond shown, or if not shown, alternate head joints in vertical alignment.

F. Grouting:
1. Use fine grout for filling spaces less than 100 mm (4 inches) in one or both horizontal directions.
2. Use coarse grout for filling 100 mm (4 inch) spaces or larger in both horizontal directions.
3. Grouting Technique: At Contractor’s option, use either low-lift or high-lift grouting techniques.

G. Low-Lift Grouting:
1. Provide minimum clear dimension of 50 mm (2 inches) and clear area of 5160 sq. mm (8 sq. inches) in vertical cores to be grouted.
2. Place vertical reinforcement before grouting of CMU. Extend above elevation of maximum pour height as required for splicing. Support in position at vertical intervals not exceeding 192 bar diameters nor 3 m (10 feet).
3. Lay CMU to maximum pour height. Do not exceed 1.5 m (5 feet) height, or if bond beam occurs below 1.5 m (5 feet) height, stop pour 38 mm (1-1/2 inches) below top of bond beam.

4. Rod or vibrate grout during placing. Place grout continuously; do not interrupt pouring of grout for more than one hour. Terminate grout pours 38 mm (1-1/2 inches) below top course of pour.
5. Bond Beams: Stop grout in vertical cells 38 mm (1-1/2 inches) below bond beam course. Place horizontal reinforcement in bond beams; lap at corners and intersections as indicated on drawings. Place grout in bond beam course before filling vertical cores above bond beam.

H. High-Lift Grouting:

1. Do not use high-lift grouting technique for grouting of CMU unless minimum cavity dimension and area is 75 mm (3 inches) and 6450 sq. mm (10 sq. inches), respectively.
2. Provide cleanout holes in first course at vertical cells which are to be filled with grout.
3. Use units with one face shell removed and provide temporary supports for units above, or use header units with concrete brick supports, or cut openings in one face shell.
4. Construct masonry to full height of maximum grout pour before placing grout.
5. Limit grout lifts to maximum height of 1.5 m (5 feet) and grout pour to maximum height of 7.3 m (24 feet), for single wythe hollow concrete masonry walls, unless otherwise indicated.
6. Place vertical reinforcement before grouting. Place before or after laying masonry units, to suit application. Tie vertical reinforcement to dowels at base of masonry where shown and thread CMU over or around reinforcement. Support vertical reinforcement at intervals not exceeding 192 bar diameters nor 3 m (10 feet).
7. Where individual bars are placed after laying masonry, place wire loops extending into cells as masonry is laid and loosen before mortar sets. After insertion of reinforcement bar, pull loops and bar to proper position and tie free ends.
8. Where reinforcement is prefabricated into cage units before placing, fabricate units with vertical reinforcement bars and lateral ties of the size and spacing indicated.
9. Place horizontal beam reinforcement as masonry units are laid.
10. Embed lateral tie reinforcement in mortar joints where indicated. Place as masonry units are laid, at vertical spacing shown.

11. Where lateral ties are shown in contact with vertical reinforcement bars, embed additional lateral tie reinforcement in mortar joints. Place as indicated on drawings, or if not shown, provide as required to prevent grout blowout or rupture of CMU face shells, but provide minimum 4.1 mm diameter (0.16 inch) wire ties spaced 400 mm (16 inches) on center for members with 500 mm (20 inches) or less side dimensions, and 200 mm (8 inches) on center for members with side dimensions exceeding 500 mm (20 inches).
12. Preparation of Grout Spaces: Before grouting, inspect and clean grout spaces. Remove dust, dirt, mortar droppings, loose pieces of masonry and other foreign materials from grout spaces. Clean reinforcement and adjust to proper position. Clean top surface of structural members supporting masonry to ensure bond. After final cleaning and inspection, close cleanout holes and brace closures to resist grout pressures.
13. Do not place grout until entire height of masonry to be grouted has attained sufficient strength to resist displacement of masonry units and breaking of mortar bond. Install shores and bracing, if required, before starting grouting operations.
14. Limit grout pours to sections which can be completed in one working day with maximum one hour interruption of pouring operation. Place grout in lifts which do not exceed 1.5 m (5 feet). Allow minimum 30 minutes and maximum one hour between lifts. Mechanically consolidate each lift.
15. Place grout in lintels or beams over openings in one continuous pour.
16. Where bond beam occurs more than one course below top of pour, fill bond beam course to within 25 mm (1 inch) of vertically reinforced cavities, during construction of masonry.
17. When more than one pour is required to complete a given section of masonry, extend reinforcement beyond masonry as required for splicing. Pour grout to within 38 mm (1-1/2 inches) of top course of first pour. After grouted masonry is cured, lay masonry units and place reinforcement for second pour section before grouting. Repeat sequence if more pours are required.

3.15 CONSTRUCTION TOLERANCES

A. Lay masonry units plumb, level and true to line within tolerances according to ACI 530.1/ASCE 6/TMS 602 and as follows:

B. Maximum variation from plumb:

1. In 3000 mm (10 feet) - 6 mm (1/4 inch).
2. In 6000 mm (20 feet) - 9 mm (3/8 inch).
3. In 12,000 mm (40 feet) or more - 13 mm (1/2 inch).

C. Maximum variation from level:

1. In any bay or up to 6000 mm (20 feet) - 6 mm (1/4 inch).
2. In 12,000 mm (40 feet) or more - 13 mm (1/2 inch).

D. Maximum variation from linear building lines:

1. In any bay or up to 6000 mm (20 feet) - 13 mm (1/2 inch).
2. In 12,000 mm (40 feet) or more - 19 mm (3/4 inch).

E. Maximum variation in cross-sectional dimensions of columns and thickness of walls from dimensions shown:

1. Minus 6 mm (1/4 inch).
2. Plus 13 mm (1/2 inch).

F. Maximum variation in prepared opening dimensions:

1. Accurate to minus 0 mm (0 inch).
2. Plus 6 mm (1/4 inch).

3.16 CLEANING AND REPAIR

A. General:

1. Clean exposed masonry surfaces on completion.
2. Protect adjoining construction materials and landscaping during cleaning operations.
3. Cut out defective exposed new joints to depth of approximately 19 mm (3/4 inch) and repoint.
4. Remove mortar droppings and other foreign substances from wall surfaces.

B. Brickwork:

1. First wet surfaces with clean water, then wash down with detergent solution. Do not use muriatic acid.
2. Brush with stiff fiber brushes while washing, and immediately wash with clean water.
3. Remove traces of detergent, foreign streaks, or stains of any nature.

C. Concrete Masonry Units:

1. Immediately following setting, brush exposed surfaces free of mortar or other foreign matter.
2. Allow mud to dry before brushing.

D. Glazed Structural Facing Tile or Brick Units:

1. Clean as recommended manufacturer. Protect light colored mortar joints from discoloration during cleaning.
2. Use on solid masonry walls.
3. Prepare schedule of test locations.

- - E N D - -

SECTION 05 50 00
METAL FABRICATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies items and assemblies fabricated from structural steel shapes and other materials as shown and specified.

B. Items specified.

1. Loose Lintels
2. Railings
3. Steel Pipe Bollards

1.2 RELATED WORK

A. Prime and finish painting: Section 09 91 00, PAINTING.

1.3 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings:

1. Each item specified, showing complete detail, location in the project, material and size of components, method of joining various components and assemblies, finish, and location, size and type of anchors.
2. Mark items requiring field assembly for erection identification and furnish erection drawings and instructions.
3. Provide templates and rough-in measurements as required.

C. Manufacturer's Certificates:

1. Anodized finish as specified.
2. Live load designs as specified.

D. Design Calculations for specified live loads including dead loads.

E. Furnish setting drawings and instructions for installation of anchors to be preset into concrete and masonry work, and for the positioning of items having anchors to be built into concrete or masonry construction.

1.4 QUALITY ASSURANCE

A. Each manufactured product shall meet, as a minimum, the requirements specified, and shall be a standard commercial product of a manufacturer regularly presently manufacturing items of type specified.

B. Each product type shall be the same and be made by the same manufacturer.

C. Assembled product to the greatest extent possible before delivery to the site.

D. Include additional features, which are not specifically prohibited by this specification, but which are a part of the manufacturer's standard commercial product.

1.5 APPLICABLE PUBLICATIONS

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

B. American Society of Mechanical Engineers (ASME):

B18.6.1-97.....Wood Screws

B18.2.2-87(R2010).....Square and Hex Nuts

C. American Society for Testing and Materials (ASTM):

A36/A36M-14.....Structural Steel

A47-99(R2014).....Malleable Iron Castings

A48-03(R2012).....Gray Iron Castings

A53-12.....Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless

A123-15.....Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A240/A240M-15.....Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.

A269-15.....Seamless and Welded Austenitic Stainless Steel Tubing for General Service

A307-14.....Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

A391/A391M-07(R2015)....Grade 80 Alloy Steel Chain

A786/A786M-15.....Rolled Steel Floor Plate

B221-14.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

B456-11.....Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium

B632-08.....Aluminum-Alloy Rolled Tread Plate

C1107-13.....Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

D3656-13.....Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns

F436-16.....Hardened Steel Washers

F468-06(R2015).....Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws and Studs for General Use

F593-13.....Stainless Steel Bolts, Hex Cap Screws, and Studs

F1667-15.....Driven Fasteners: Nails, Spikes and Staples

D. American Welding Society (AWS):

D1.1-15.....Structural Welding Code Steel

D1.2-14.....Structural Welding Code Aluminum

D1.3-18.....Structural Welding Code Sheet Steel

E. National Association of Architectural Metal Manufacturers (NAAMM)

AMP 521-01(R2012).....Pipe Railing Manual

AMP 500-06.....Metal Finishes Manual

MBG 531-09(R2017).....Metal Bar Grating Manual

MBG 532-09.....Heavy Duty Metal Bar Grating Manual

F. Structural Steel Painting Council (SSPC)/Society of Protective Coatings:

SP 1-15.....No. 1, Solvent Cleaning

SP 2-04.....No. 2, Hand Tool Cleaning

SP 3-04.....No. 3, Power Tool Cleaning

G. Federal Specifications (Fed. Spec):

RR-T-650E.....Treads, Metallic and Nonmetallic, Nonskid

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

A. In addition to the dead loads, design fabrications to support the following live loads unless otherwise specified.

B. Railings and Handrails: 900 N (200 pounds) in any direction at any point.

2.2 MATERIALS

A. Structural Steel: ASTM A36.

B. Steel Pipe (Bollard): ASTM A53.

1. Galvanized for exterior locations.
2. Type S, Grade A unless specified otherwise.
3. NPS (inside diameter) as shown.

C. Primer Paint: As specified in Section 09 91 00, PAINTING.

D. Modular Channel Units:

1. Factory fabricated, channel shaped, cold formed sheet steel shapes, complete with fittings bolts and nuts required for assembly.
2. Form channel within turned pyramid shaped clamping ridges on each side.
3. Provide case hardened steel nuts with serrated grooves in the top edges designed to be inserted in the channel at any point and be given a quarter turn so as to engage the channel clamping ridges. Provide each nut with a spring designed to hold the nut in place.
4. Factory finish channels and parts with oven baked primer when exposed to view. Channels fabricated of ASTM A525, G90 galvanized steel may have primer omitted in concealed locations. Finish screws and nuts with zinc coating.
5. Fabricate snap-in closure plates to fit and close exposed channel openings of not more than 0.3 mm (0.0125 inch) thick stainless steel.

E. Grout: ASTM C1107, pourable type.

2.3 HARDWARE

A. Rough Hardware:

1. Furnish rough hardware with a standard plating, applied after punching, forming and assembly of parts; galvanized, cadmium plated, or zinc-coated by electro-galvanizing process. Galvanized G-90 where specified.
2. Use G90 galvanized coating on ferrous metal for exterior work unless non-ferrous metal or stainless is used.

B. Fasteners:

1. Bolts with Nuts:
   a. ASME B18.2.2.
   b. ASTM A307 for 415 MPa (60,000 psi) tensile strength bolts.
   c. ASTM F468 for nonferrous bolts.
   d. ASTM F593 for stainless steel.
2. Screws: ASME B18.6.1.
3. Washers: ASTM F436, type to suit material and anchorage.
4. Nails: ASTM F1667, Type I, style 6 or 14 for finish work.

2.4 FABRICATION GENERAL

A. Material

1. Use material as specified. Use material of commercial quality and suitable for intended purpose for material that is not named or its standard of quality not specified.
2. Use material free of defects which could affect the appearance or service ability of the finished product.

B. Size:
1. Size and thickness of members as shown.
2. When size and thickness is not specified or shown for an individual part, use size and thickness not less than that used for the same component on similar standard commercial items or in accordance with established shop methods.

C. Connections
1. Except as otherwise specified, connections may be made by welding, riveting or bolting.
2. Field riveting will not be approved.
3. Design size, number and placement of fasteners, to develop a joint strength of not less than the design value.
4. Holes, for rivets and bolts: Accurately punched or drilled and burrs removed.
5. Size and shape welds to develop the full design strength of the parts connected by welds and to transmit imposed stresses without permanent deformation or failure when subject to service loadings.
6. Use Rivets and bolts of material selected to prevent corrosion (electrolysis) at bimetallic contacts. Plated or coated material will not be approved.
7. Use stainless steel connectors for removable members machine screws or bolts.

D. Fasteners and Anchors
1. Use methods for fastening or anchoring metal fabrications to building construction as shown or specified.
2. Where fasteners and anchors are not shown, design the type, size, location and spacing to resist the loads imposed without deformation of the members or causing failure of the anchor or fastener, and suit the sequence of installation.
3. Use material and finish of the fasteners compatible with the kinds of materials which are fastened together and their location in the finished work.

4. Fasteners for securing metal fabrications to new construction only, may be by use of threaded or wedge type inserts or by anchors for welding to the metal fabrication for installation before the concrete is placed or as masonry is laid.
5. Fasteners for securing metal fabrication to existing construction or new construction may be expansion bolts, toggle bolts, power actuated drive pins, welding, self drilling and tapping screws or bolts.

E. Workmanship

1. General:
   a. Fabricate items to design shown.
   b. Furnish members in longest lengths commercially available within the limits shown and specified.
   c. Fabricate straight, true, free from warp and twist, and where applicable square and in same plane.
   d. Provide holes, sinkages and reinforcement shown and required for fasteners and anchorage items.
   e. Provide openings, cut-outs, and tapped holes for attachment and clearances required for work of other trades.
   f. Prepare members for the installation and fitting of hardware.
   g. Cut openings in gratings and floor plates for the passage of ducts, sumps, pipes, conduits and similar items. Provide reinforcement to support cut edges.
   h. Fabricate surfaces and edges free from sharp edges, burrs and projections which may cause injury.
2. Welding:
   a. Weld in accordance with AWS.
   b. Welds shall show good fusion, be free from cracks and porosity and accomplish secure and rigid joints in proper alignment.
   c. Where exposed in the finished work, continuous weld for the full length of the members joined and have depressed areas filled and protruding welds finished smooth and flush with adjacent surfaces.
   d. Finish welded joints to match finish of adjacent surface.
3. Joining:
   a. Miter or butt members at corners.

b. Where frames members are butted at corners, cut leg of frame member perpendicular to surface, as required for clearance.

4. Anchors:
   a. Where metal fabrications are shown to be preset in concrete, weld 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 150 mm (6 inches) long with 25 mm (one inch) hooked end, to back of member at 600 mm (2 feet) on center, unless otherwise shown.
   b. Where metal fabrications are shown to be built into masonry use 32 x 3 mm (1-1/4 by 1/8 inch) steel strap anchors, 250 mm (10 inches) long with 50 mm (2 inch) hooked end, welded to back of member at 600 mm (2 feet) on center, unless otherwise shown.
5. Cutting and Fitting:
   a. Accurately cut, machine and fit joints, corners, copes, and miters.
   b. Fit removable members to be easily removed.
   c. Design and construct field connections in the most practical place for appearance and ease of installation.
   d. Fit pieces together as required.
   e. Fabricate connections for ease of assembly and disassembly without use of special tools.
   f. Joints firm when assembled.
   g. Conceal joining, fitting and welding on exposed work as far as practical.
   h. Do not show rivets and screws prominently on the exposed face.
   i. The fit of components and the alignment of holes shall eliminate the need to modify component or to use exceptional force in the assembly of item and eliminate the need to use other than common tools.

F. Finish:
1. Finish exposed surfaces in accordance with NAAMM AMP 500 Metal Finishes Manual.
2. Steel and Iron: NAAMM AMP 504.
   a. Zinc coated (Galvanized, at exterior locations): ASTM A123, G90 unless noted otherwise.
   b. Surfaces exposed in the finished work:
      1) Finish smooth rough surfaces and remove projections.

2) Fill holes, dents and similar voids and depressions with epoxy type patching compound.

c. Shop Prime Painting (at interior, non-galvanized locations):

1) Surfaces of Ferrous metal:

a) Items not specified to have other coatings.

b) Galvanized surfaces specified to have prime paint.

c) Remove all loose mill scale, rust, and paint, by hand or power tool cleaning as defined in SSPC-SP2 and SP3.

d) Clean of oil, grease, soil and other detrimental matter by use of solvents or cleaning compounds as defined in SSPC-SP1.

e) After cleaning and finishing apply one coat of primer as specified in Section 09 91 00, PAINTING.

2) Non ferrous metals: Comply with MAAMM-500 series.

G. Protection:

1. Insulate aluminum surfaces that will come in contact with concrete, masonry, plaster, or metals other than stainless steel, zinc or white bronze by giving a coat of heavy-bodied alkali resisting bituminous paint or other approved paint in shop.

2. Spot prime all abraded and damaged areas of zinc coating which expose the bare metal, using zinc rich paint on hot-dip zinc coat items and zinc dust primer on all other zinc coated items.

2.5 FRAMES

A. Provide holes for anchors.

B. Weld head to jamb members.

C. Channel door frames:

1. Fabricate of structural steel channels of size shown.

2. Miter and weld frames at corners.

3. Where anchored to masonry or embedded in concrete, weld to back of frame at each jamb, 5 mm (3/16 inch) thick by 44 mm (1-3/4 inch) wide steel strap anchors with ends turned 50 mm (2 inches), and of sufficient length to extend at least 300 mm (12 inches) into wall. Space anchors 600 mm (24 inches) above bottom of frame and 600 mm (24 inches) O.C. to top of jamb. Weld clip angles to bottom of jambs and provide holes for expansion bolts.

4. Where anchored to concrete or masonry in prepared openings, drill holes at jambs for anchoring with expansion bolts. Weld clip angles

to bottom of frame and provide holes for expansion bolt anchors as shown. Drill holes starting 600 mm (24 inches) above bottom of frame and 600 mm (24 inches) O.C. to top of jamb and at top of jamb. Provide pipe spacers at holes welded to channel.

5. Where closure plates are shown, continuously weld them to the channel flanges.
6. Weld continuous 19 x 19 x 3 mm (3/4 x 3/4 x 1/8 inch) thick steel angles to the interior side of each channel leg at the head and jambs to form a caulking groove.
7. Prepare frame for installation of hardware specified in section 08 71 00, door hardware.

2.6 LOOSE LINTELS

A. Furnish lintels of sizes shown. Where size of lintels is not shown, provide the sizes specified.

B. Fabricate lintels with not less than 150 mm (6 inch) bearing at each end for nonbearing masonry walls, and 200 mm (8 inch) bearing at each end for bearing walls.

C. Provide one angle lintel for each 100 mm (4 inches) of masonry thickness as follows except as otherwise specified or shown.

1. Openings 750 mm to 1800 mm (2-1/2 feet to 6 feet) - 100 x 90 x 8 mm (4 x 3-1/2 x 5/16 inch).
2. Openings 1800 mm to 3000 mm (6 feet to 10 feet) - 150 x 90 x 9 mm (6 x 3-1/2 x 3/8 inch).

D. For 150 mm (6 inch) thick masonry openings 750 mm to 3000 mm (2-1/2 feet to 10 feet) or where lintel spans rigid insulation and 4-inch brick, use one angle 150 x 100 x 9 mm (6 x 4 x 3/8 inch).

E. Provide bearing plates for lintels where shown.

F. Weld or bolt upstanding legs of double angle lintels together with 19 mm (3/4 inch bolts) spaced at 300 mm (12 inches) on centers.

G. Insert spreaders at bolt points to separate the angles for insertion of metal windows, louver, and other anchorage.

H. Where shown or specified, punch upstanding legs of single lintels to suit size and spacing of anchor bolts.

2.7 RAILINGS

A. In addition to the dead load design railing assembly to support live load specified.

B. Fabrication General:

1. Provide continuous welded joints, dressed smooth and flush.
2. Standard flush fittings, designed to be welded, may be used.
3. Exposed threads will not be approved.
4. Form handrail brackets to size and design shown.
5. Exterior Post Anchors.
   a. Fabricate tube or pipe sleeves with closed ends or plates as shown.
   b. Where inserts interfere with reinforcing bars, provide flanged fittings welded or threaded to posts for securing to concrete with expansion bolts.
   c. Provide heavy pattern sliding flange base plate with set screws at base of pipe or tube posts.
6. Interior Post Anchors:
   a. Provide flanged fittings for securing fixed posts to floor with expansion bolts, unless shown otherwise.
   b. Weld or thread flanged fitting to posts at base.
   c. For securing removable posts to floor, provide close fitting sleeve insert or inverted flange base plate with stud bolts or rivets concrete anchor welded to the base plate.
   d. Provide sliding flange base plate on posts secured with set screws.
   e. Weld flange base plate to removable posts set in sleeves.

C. Handrails:
1. Close free ends of rail with flush metal caps welded in place except where flanges for securing to walls with bolts are shown.
2. Make provisions for attaching handrail brackets to wall, posts, and handrail as shown.

D. 1-1/2” Galvanized Steel Pipe Railings:
1. Fabricate of steel pipe with welded joints.
2. Number and space of rails as shown.
3. Space posts for railings not over 1800 mm (6 feet) on centers between end posts.
4. Form handrail brackets from malleable iron.
5. Fabricate removable sections with posts at end of section.
6. Removable Rails:

a. Provide "U" shape brackets at each end to hold removable rail as shown. Use for top and bottom horizontal rail when rails are joined together with vertical members.
b. Secure rail to brackets with 9 mm (3/8 inch) stainless steel through bolts and nuts at top rail only when rails joined with vertical members.
c. Continuously weld brackets to post.
d. Provide slotted bolt holes in rail bracket.
e. Weld bolt heads flush with top of rail.
f. Weld flanged fitting to post where posts are installed in sleeves.

7. Opening Guard Rails:
   a. Fabricate rails with flanged fitting at each end to fit between wall opening jambs.
   b. Design flange fittings for fastening with machine screws to steel plate anchored to jambs.
   c. Fabricate rails for floor openings for anchorage in sleeves.

2.8 STEEL PIPE BOLLARD

Provide bollard in accordance with ASTM A53 with dimensions as shown in VA standard detail SD320523-04. Anchor posts in concrete and fill solidly with concrete with a minimum compressive strength of 17 MPa 2500psi.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Set work accurately, in alignment and where shown, plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.
B. Items set into concrete or masonry.
   1. Provide temporary bracing for such items until concrete or masonry is set.
   2. Place in accordance with setting drawings and instructions.
   3. Build strap anchors, into masonry as work progresses.
C. Set frames of gratings, covers, corner guards, trap doors and similar items flush with finish floor or wall surface and, where applicable, flush with side of opening.
D. Field weld in accordance with AWS.
   1. Design and finish as specified for shop welding.
   2. Use continuous weld unless specified otherwise.

E. Install anchoring devices and fasteners as shown and as necessary for securing metal fabrications to building construction as specified. Power actuated drive pins may be used except for removable items and where members would be deformed or substrate damaged by their use.

F. Spot prime all abraded and damaged areas of zinc coating as specified and all abraded and damaged areas of shop prime coat with same kind of paint used for shop priming.

G. Isolate aluminum from dissimilar metals and from contact with concrete and masonry materials as required to prevent electrolysis and corrosion.

H. Secure escutcheon plate with set screw.

3.2 DOOR FRAMES

A. Secure clip angles at bottom of frames to concrete slab with expansion bolts as shown.

B. Level and plumb frame; brace in position required.

C. At masonry, set frames in walls so anchors are built-in as the work progresses unless shown otherwise.

D. Set frames in formwork for frames cast into concrete.

E. Where frames are set in prepared openings, bolt to wall with spacers and expansion bolts.

3.3 STEEL LINTELS

A. Use lintel sizes and combinations shown or specified.

B. Install lintels with longest leg upstanding, except for openings in 150 mm (6 inch) masonry walls install lintels with longest leg horizontal.

C. Install lintels to have not less than 150 mm (6 inch) bearing at each end for nonbearing walls, and 200 mm (8 inch) bearing at each end for bearing walls.

3.4 RAILINGS

A. Steel posts:

1. Secure fixed posts to concrete with expansion bolts through flanged fittings except where sleeves are shown with pourable grout.
2. Install sleeves in concrete formwork.
3. Set post in sleeve and pour grout to surface. Apply beveled bead of urethane sealant at perimeter of post or under flange fitting as specified in section 07 92 00, joint sealants on exterior posts.
4. Secure removable posts to concrete with either machine screws through flanged fittings which are secured to inverted flanges

embedded in and set flush with finished floor, or set posts in close fitting pipe sleeves without grout.

5. Secure sliding flanged fittings to posts at base with set screws.
6. Secure fixed flanged fittings to concrete with expansion bolts.
7. Secure posts to steel with welds.

B. Removable rails:

1. Rest rails in brackets at each end and secure to bracket with stainless steel bolts and nuts where part of a continuous railing.
2. Rest rail posts in sleeves where not part of a continuous railing. Do not grout posts.

3.5 INSTALLATION OF STEEL PIPE BOLLARD

Set bollards vertically in concrete piers. Compressive strength of concrete piers shall be 21MPa 3000psi. For dimensions of concrete piers See VA standard detail SD320523-04.

3.6 CLEAN AND ADJUSTING

A. Adjust movable parts including hardware to operate as designed without binding or deformation of the members centered in the opening or frame and, where applicable, contact surfaces fit tight and even without forcing or warping the components.

B. Clean after installation exposed prefinished and plated items and items fabricated from stainless steel, aluminum and copper alloys, as recommended by the metal manufacture and protected from damage until completion of the project.

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10-01-17

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies wood blocking, framing, sheathing, furring, nailers, sub-flooring, rough hardware, and light wood construction.

1.2 RELATED WORK:

A. None

1.3 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings showing framing connection details, fasteners, connections and dimensions.

C. Manufacturer’s Literature and Data:

1. Submit data for lumber, panels, hardware and adhesives.
2. Submit data for wood-preservative treatment from chemical treatment manufacturer and certification from treating plants that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
3. Submit data for fire retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
4. For products receiving a waterborne treatment, submit statement that moisture content of treated materials was reduced to levels specified before shipment to project site.

D. Manufacturer’s certificate for unmarked lumber.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

A. Protect lumber and other products from dampness both during and after delivery at site.

B. Pile lumber in stacks in such manner as to provide air circulation around surfaces of each piece.

C. Stack plywood and other board products so as to prevent warping.

D. Locate stacks on well drained areas, supported at least 152 mm (6 inches) above grade and cover with well-ventilated sheds having

firmly constructed over hanging roof with sufficient end wall to protect lumber from driving rain.

1.5 QUALITY ASSURANCE:

A. Installer: A firm with a minimum of three (3) years' experience in the type of work required by this section.

1.6 GRADING AND MARKINGS:

A. Any unmarked lumber or plywood panel for its grade and species will not be allowed on VA Construction sites for lumber and material not normally grade marked, provide manufacturer's certificates (approved by an American Lumber Standards approved agency) attesting that lumber and material meet the specified the specified requirements.

1.7 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in the text by basic designation only.

B. American Forest and Paper Association (AFPA):

NDS-15.....National Design Specification for Wood Construction

WCD1-01.....Details for Conventional Wood Frame Construction

C. American Institute of Timber Construction (AITC):

A190.1-07.....Structural Glued Laminated Timber

D. American Society of Mechanical Engineers (ASME):

B18.2.1-12(R2013).....Square and Hex Bolts and Screws

B18.2.2-10.....Square and Hex Nuts

B18.6.1-81(R2008).....Wood Screws

E. American Plywood Association (APA):

E30-11.....Engineered Wood Construction Guide

F. ASTM International (ASTM):

A653/A653M-13.....Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process

C954-11.....Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Studs from 0.033 inch (2.24 mm) to 0.112-inch (2.84 mm) in thickness

C1002-14.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Metal Studs

D198-14.....Test Methods of Static Tests of Lumber in Structural Sizes

D2344/D2344M-13.....Test Method for Short-Beam Strength of Polymer Matrix Composite Materials and Their Laminates

D2559-12a.....Adhesives for Structural Laminated Wood Products for Use Under Exterior (Wet Use) Exposure Conditions

D3498-03(R2011).....Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems

D6108-13.....Test Method for Compressive Properties of Plastic Lumber and Shapes

D6109-13.....Test Methods for Flexural Properties of Unreinforced and Reinforced Plastic Lumber and Related Products

D6111-13a.....Test Method for Bulk Density and Specific Gravity of Plastic Lumber and Shapes by Displacement

D6112-13.....Test Methods for Compressive and Flexural Creep and Creep-Rupture of Plastic Lumber and Shapes

F844-07a(R2013).....Washers, Steel, Plan (Flat) Unhardened for General Use

F1667-13.....Nails, Spikes, and Staples

G. American Wood Protection Association (AWPA):

AWPA Book of Standards

H. Commercial Item Description (CID):

A-A-55615.....Shield, Expansion (Wood Screw and Lag Bolt Self Threading Anchors)

I. Forest Stewardship Council (FSC):

FSC-STD-01-001(Ver. 4-0)FSC Principles and Criteria for Forest Stewardship

J. Military Specification (Mil. Spec.):

MIL-L-19140E.....Lumber and Plywood, Fire-Retardant Treated

K. Environmental Protection Agency (EPA):

40 CFR 59(2014).....National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

L. Truss Plate Institute (TPI):

TPI-85.....Metal Plate Connected Wood Trusses

M. U.S. Department of Commerce Product Standard (PS)

PS 1-95.....Construction and Industrial Plywood

PS 20-10.....American Softwood Lumber Standard

N. ICC Evaluation Service (ICC ES):

AC09.....Quality Control of Wood Shakes and Shingles

AC174.....Deck Board Span Ratings and Guardrail Systems (Guards and Handrails)

PART 2 - PRODUCTS

2.1 LUMBER:

A. Unless otherwise specified, each piece of lumber must bear grade mark, stamp, or other identifying marks indicating grades of material, and rules or standards under which produced.

1. Identifying marks are to be in accordance with rule or standard under which material is produced, including requirements for qualifications and authority of the inspection organization, usage of authorized identification, and information included in the identification.
2. Inspection agency for lumber approved by the Board of Review, American Lumber Standards Committee, to grade species used.

B. Structural Members: Species and grade as listed in the AFPA NDS having design stresses as shown.

C. Lumber Other Than Structural:

1. Unless otherwise specified, species graded under the grading rules of an inspection agency approved by Board of Review, American Lumber Standards Committee.
2. Framing lumber: Minimum extreme fiber stress in bending of 7584 kPa (1100 PSI).
3. Furring, blocking, nailers and similar items 101 mm (4 inches) and narrower Standard Grade; and, members 152 mm (6 inches) and wider, Number 2 Grade.
4. Board Sub-flooring: Shiplap edge, 25 mm (1 inch) thick, not less than 203 mm (8 inches) wide.

D. Sizes:
   1. Conforming to PS 20.
   2. Size references are nominal sizes, unless otherwise specified, actual sizes within manufacturing tolerances allowed by standard under which produced.

E. Moisture Content:
   1. Maximum moisture content of wood products is to be as follows at the time of delivery to site.
      a. Boards and lumber 50 mm (2 inches) and less in thickness: 19 percent or less.
      b. Lumber over 50 mm (2 inches) thick: 25 percent or less.

F. Fire Retardant Treatment:
   1. Comply with Mil Spec. MIL-L-19140.
   2. Treatment and performance inspection, by an independent and qualified testing agency that establishes performance ratings.

G. Preservative Treatment:
   1. Do not treat Heart Redwood and Western Red Cedar.
   2. Treat wood members and plywood exposed to weather or in contact with plaster, masonry or concrete, including framing of open roofed structures; sills, sole plates, furring, and sleepers that are less than 610 mm (24 inches) from ground; nailers, edge strips, blocking, crickets, curbs, cant, vent strips and other members provided in connection with roofing and flashing materials.
   3. Treat other members specified as preservative treated (PT).
   4. Preservative treat by the pressure method complying with AWPA Book use category system standards U1 and T1, except any process involving the use of Chromated Copper Arsenate (CCA) or other agents classified as carcinogenic for pressure treating wood is not permitted.

2.2 PLYWOOD:

A. Comply with PS 1.

B. Bear the mark of a recognized association or independent inspection agency that maintains continuing control over quality of plywood which identifies compliance by veneer grade, group number, span rating where applicable, and glue type.

C. Sheathing:
   1. APA rated Exposure 1 or Exterior; panel grade CD or better.

2. Wall sheathing:
   a. Minimum 9 mm (11/32 inch) thick with supports 406 mm (16 inches) on center and 12 mm (15/32 inch) thick with supports 610 mm (24 inches) on center unless specified otherwise.
   b. Minimum 1200 mm (48 inches) wide at corners without corner bracing of framing.
3. Roof sheathing:
   a. Minimum 9 mm (11/32 inch) thick with span rating 24/0 or 12 mm (15/32 inch) thick with span rating for supports 406 mm (16 inches) on center unless specified otherwise.
   b. Minimum 15 mm (19/32 inch) thick or span rating of 40/20 or 18 mm (23/32 inch) thick or span rating of 48/24 for supports 610 mm (24 inches) on center.

D. Subflooring:
1. Under finish wood flooring or underlayment:
   a. APA Rated sheathing, Exposure 1. panel grade CD.
   b. Minimum 15 mm (19/32 inch) thick with span rating 32/16 or greater for supports at 406 mm (16 inches) on center and 18.25 mm (23/32 inch) thick with span rating 48/24 for supports at 610 mm (24 inches) on center.
2. Combination subflooring-underlayment under resilient flooring or carpet:
   a. APA Rated Stud-I-Floor Exterior or Exposure 1, T and G.
   b. Minimum 15 mm (19/32 inch) thick or greater, span rating 16, for supports at 406 mm (16 inches) on center; 18 mm (23/32 inch) thick or greater, span rating 24, for supports at 610 mm (24 inches) on center.

E. Underlayment:
1. APA rated Exposure 1 or Exterior, panel grade C-C Plugged.
2. Minimum 6 mm (1/4 inch) thick or greater over plywood subflooring and 9 mm (3/8 inch) thick or greater over board subflooring, unless otherwise shown.

2.3 ROUGH HARDWARE AND ADHESIVES:

A. Anchor Bolts:
1. ASME B18.2.1 and ASME B18.2.2 galvanized, 13 mm (1/2 inch) unless shown otherwise.

2. Extend at least 203 mm (8 inches) into masonry or concrete with ends bent 50 mm (2 inches).

B. Miscellaneous Bolts: Expansion Bolts: C1D A-A-55615; lag bolt, long enough to extend at least 65 mm (2-1/2 inches) into masonry or concrete. Provide 13 mm (1/2 inch) bolt unless shown otherwise.

C. Washers
1. ASTM F844.
2. Provide zinc or cadmium coated steel or cast iron for washers exposed to weather.

D. Screws:
1. Wood to Wood: ASME B18.6.1 or ASTM C1002.
2. Wood to Steel: ASTM C954, or ASTM C1002.

E. Nails:
1. Size and type best suited for purpose unless noted otherwise. Provide aluminum-alloy nails, plated nails, or zinc-coated nails, for nailing wood work exposed to weather and on roof blocking.
2. ASTM F1667:
a. Common: Type I, Style 10.
b. Concrete: Type I, Style 11.
c. Barbed: Type I, Style 26.
d. Underlayment: Type I, Style 25.
e. Masonry: Type I, Style 27.
f. Provide special nails designed for use with ties, strap anchors, framing connectors, joists hangers, and similar items. Nails not less than 32 mm (1-1/4 inches) long, 8d and deformed or annular ring shank.

F. Framing and Timber Connectors:
1. Fabricate of ASTM A653/A653M, Grade A; steel sheet not less than 1.3 mm (0.052 inch) thick unless specified otherwise. Apply standard plating to steel timber connectors after punching, forming and assembly of parts.
2. Framing Angles: Angle designed with bendable legs to provide three (3) way anchors.
3. Straps:
a. Designed to provide wind and seismic ties with sizes as shown or specified.
b. Strap ties not less than 32 mm (1-1/4 inches) wide.

c. Punched for fastener.

4. Metal Bridging:
   a. V shape deformed strap with not less than two (2) nail holes at ends, designed to nail to top and side of framing member and bottom and side of opposite member.
   b. Not less than 19 by 127 mm (3/4 by 5 inches) bendable nailing flange on ends.
   c. Fabricated of 1 mm (0.04 inch) minimum thick sheet.
5. Joist Hangers:
   a. Fabricated of 1.6 mm (0.063 inch) minimum thick sheet, U design unless shown otherwise.
   b. Heavy duty hangers fabricated of minimum 2.7 mm (0.108 inch) thick sheet, U design with bent top flange to lap over beam.
6. Not used.
7. Joist Ties: Mild steel flats, 5 mm by 32 mm (3/16 inch by 1-1/4 inch) size with ends bent about 30 degrees from horizontal, and extending at least 406 mm (16 inches) onto framing. Punch each end for three (3) spikes.
8. Wall Anchors for Joists and Rafters:
   a. Mild steel strap, 5 mm by 32 mm (3/16 inch by 1-1/4 inch) with wall ends bent 50 mm (2 inches), or provide 9 mm by 130 mm (3/8 inch by 5 inch) pin through strap end built into masonry.
   b. Strap long enough to extend onto three joists or rafters, and punched for spiking at each bearing.
   c. Strap not less than 101 mm (4 inches) embedded end.
9. Joint Plates:
   a. Steel plate punched for nails.
   b. Steel plates formed with teeth or prongs for mechanically clamping plates to wood.
   c. Size for axial eccentricity, and fastener loads.

G. Adhesives:
   1. For field-gluing plywood to lumber framing floor or roof systems: ASTM D3498.
   2. For structural laminated Wood: ASTM D2559.

PART 3 - EXECUTION

3.1 INSTALLATION OF FRAMING AND MISCELLANEOUS WOOD MEMBERS:

A. Conform to applicable requirements of the following:

1. AFPA NDS for timber connectors.
2. AITC A190.1 Timber Construction Manual for heavy timber construction.
3. AFPA WCD1 for nailing and framing unless specified otherwise.
4. APA for installation of plywood or structural use panels.
5. TPI for metal plate connected wood trusses.

B. Fasteners:

1. Nails.
   a. Nail in accordance with the Recommended Nailing Schedule as specified in AFPA WCD1 where detailed nailing requirements are not specified in nailing schedule. Select nail size and nail spacing sufficient to develop adequate strength for the connection without splitting the members.
   b. Use special nails with framing connectors.
   c. For sheathing and subflooring, select length of nails sufficient to extend 25 mm (1 inch) into supports.
   d. Use 8d or larger nails for nailing through 25 mm (1 inch) thick lumber and for toe nailing 50 mm (2 inch) thick lumber.
   e. Use 16d or larger nails for nailing through 50 mm (2 inch) thick lumber.
   f. Select the size and number of nails in accordance with the Nailing Schedule except for special nails with framing anchors.
   g. Nailing Schedule; Using Common Nails:
      1) Joist bearing on sill or girder, toe nail three (3) 8d nails or framing anchor.
      2) Bridging to joist, toe nail each end two (2) 8d nails.
      3) Ledger strip to beam or girder three (3) 16d nails under each joint.
      4) Subflooring or Sheathing:
         a) 152 mm (6 inch) wide or less to each joist face nail two (2) 8d nails.
         b) Subflooring, more than 152 mm (6 inches) wide, to each stud or joint, face nail three (3) 8d nails.
         c) Plywood or structural use panel to each stud or joist face nail 8d, at supported edges 152 mm (6 inches) on center and at intermediate supports 254 mm (10 inches) on center. When gluing plywood to joint framing increase nail spacing to

305 mm (12 inches) at supported edges and 508 mm (20 inches) o.c. at intermediate supports.

5) Sole plate to joist or blocking, through sub floor face nail 20d nails, 406 mm (16 inches) on center.
6) Top plate to stud, end nail two (2) 16d nails.
7) Stud to sole plate, toe nail or framing anchor. Four (4) 8d nails.
8) Doubled studs, face nail 16d at 610 mm (24 inches) on center.
9) Built-up corner studs 16d at 610 mm (24 inches) (24 inches) on center.
10) Doubled top plates, face nails 16d at 406 mm (16 inches) on center.
11) Top plates, laps, and intersections, face nail two (2) 16d.
12) Continuous header, two pieces 16d at 406 mm (16 inches) on center along each edge.
13) Ceiling joists to plate, toenail three (3) 8d or framing anchor.
14) Continuous header to stud, four (4) 16d.
15) Ceiling joists, laps over partitions, face nail three (3) 16d or framing anchor.
16) Ceiling joists, to parallel rafters, face nail three (3) 16d.
17) Rafter to plate, toe nail three (3) 8d or framing anchor. Brace 25 mm (1 inch) thick board to each stud and plate, face nail three (3) 8d.
18) Built-up girders and beams 20d at 812 mm (32 inches) on center along each edge.

2. Bolts:
   a. Fit bolt heads and nuts bearing on wood with washers.
   b. Countersink bolt heads flush with the surface of nailers.
   c. Embed in concrete and solid masonry or provide expansion bolts. Special bolts or screws designed for anchor to solid masonry or concrete in drilled holes may be used.
   d. Provide toggle bolts to hollow masonry or sheet metal.
   e. Provide bolts to steel over 2.84 mm (0.112 inch, 11 gage) in thickness. Secure wood nailers to vertical structural steel members with bolts, placed one at ends of nailer and 610 mm

(24 inch) intervals between end bolts. Provide clips to beam flanges.

3. Drill Screws to steel less than 2.84 mm (0.112 inch) thick.
   a. ASTM C1002 for steel less than 0.84 mm (0.033 inch) thick.
   b. ASTM C954 for steel over 0.84 mm (0.033 inch) thick.
4. Power actuated drive pins may be provided where practical to anchor to solid masonry, concrete, or steel.
5. Do not anchor to wood plugs or nailing blocks in masonry or concrete. Provide metal plugs, inserts or similar fastening.
6. Screws to Join Wood:
   a. Where shown or option to nails.
   b. ASTM C1002, sized to provide not less than 25 mm (1 inch) penetration into anchorage member.
   c. Spaced same as nails.
7. Installation of Timber Connectors:
   a. Conform to applicable requirements of the AFPA NDS.
   b. Fit wood to connectors and drill holes for fasteners so wood is not split.

C. Set sills or plates level in full bed of mortar on masonry or concrete walls.
   1. Space anchor bolts 1219 mm (4 feet) on centers between ends and within 152 mm (6 inches) of end. Stagger bolts from side to side on plates over 178 mm (7 inches) in width.
   2. Provide shims of slate, tile or similar approved material to level wood members resting on concrete or masonry. Do not use wood shims or wedges.
   3. Closely fit, and set to required lines.

D. Cut notch, or bore in accordance with AFPA WCD1 passage of ducts wires, bolts, pipes, conduits and to accommodate other work. Repair or replace miscut, misfit or damaged work.

E. Blocking Nailers, and Furring:
   1. Install furring, blocking, nailers, and grounds where shown.
   2. Provide longest lengths practicable.
   3. Provide fire retardant treated wood blocking where shown at openings and where shown or specified.
   4. Layers of Blocking or Plates:
      a. Stagger end joints between upper and lower pieces.

b. Nail at ends and not over 610 mm (24 inches) between ends.

c. Stagger nails from side to side of wood member over 127 mm (5 inches) in width.

F. Partition and Wall Framing:

1. Provide 50 mm by 101 mm (2 inch by 4 inch) studs spaced 406 mm (16 inches) on centers; unless otherwise indicated on contract documents.
2. Install double studs at openings and triple studs at corners.
3. Installation of sole plate:
   a. Anchor plates of walls or partitions resting on concrete floors in place with expansion bolts, one (1) near ends of piece and at intermediate intervals of not more than 1219 mm (4 feet) or with power actuated drive pins with threaded ends of suitable type and size, spaced 610 mm (2 feet) on center unless shown otherwise.
   b. Nail plates to wood framing through subfloor as specified in nailing schedule.
4. Headers or Lintels:
   a. Make headers for openings of two (2) pieces of 50 mm (2 inch) thick lumber of size shown with plywood filler to finish flush with face of studs or solid lumber of equivalent size.
   b. Support ends of headers on top of stud cut for height of opening. Spike cut stud to adjacent stud. Spike adjacent stud to header.
5. Provide double top plates, with members lapped at least 610 mm (2-feet) spiked together.
6. Install intermediate cut studs over headers and under sills to maintain uniformity of stud spacing.
7. Provide single sill plates at bottom of opening unless otherwise indicated in contract documents. Toe nail to end stud, face nail to intermediate studs.
8. Install 50 mm (2 inch) blocking for firestopping so that maximum dimension of any concealed space is not over 2438 mm (8 feet) in accordance with AFPA WCD1.
9. Install corner bracing when plywood or structured use panel sheathing is not used.
   a. Let corner bracing into exterior surfaces of studs at an angle of approximately 45 degrees, extended completely over walls plates, and secured at bearing with two (2) nails.

b. Provide 25 mm by 101 mm (1 inch by 4 inch) corner bracing.

G. Rough Bucks:

1. Install rough wood bucks at opening in masonry or concrete where wood frames or trim occur.
2. Brace and maintain bucks plumb and true until masonry has been built around them or concrete cast in place.
3. Cut rough bucks from 50 mm (2 inch) thick stock, of same width as partitions in which they occur and of width shown in exterior walls.
4. Extend bucks full height of openings and across head of openings; fasten securely with anchors specified.

- - - E N D - - -

SECTION 07 21 13
THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Thermal insulation.
   a. Spray-applied polyurethane.
   b. Batt or board insulation.
2. Acoustical insulation.
   a. Batt and blanket insulation at interior framed partitions and ceilings.

1.2 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. ASTM International (ASTM):

1. C516-08(2013)e1 - Vermiculite Loose Fill Thermal Insulation.
2. C549-06(2012) - Perlite Loose Fill Insulation.
3. C552-15 - Cellular Glass Thermal Insulation.
4. C553-13 - Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
5. C578-15 - Rigid, Cellular Polystyrene Thermal Insulation.
6. C591-15 - Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.
7. C612-14 - Mineral Fiber Block and Board Thermal Insulation.
8. C665-12 - Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
9. C728-15 - Perlite Thermal Insulation Board.
10. C954-15 - Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Base to Steel Studs From 0.033 (0.84 mm) inch to 0.112 inch (2.84 mm) in thickness.
11. C1002-14 - Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
12. D312/D312M-15 - Asphalt Used in Roofing.
13. E84-15a - Surface Burning Characteristics of Building Materials.
14. F1667-15 - Driven Fasteners: Nails, Spikes, and Staples.

1.3 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:

1. Show insulation type, thickness, and R-value for each location.

C. Manufacturer's Literature and Data:

1. Description of each product.
2. Adhesive indicating manufacturer recommendation for each application.

1.4 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.5 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

C. Protect foam plastic insulation from UV exposure.

1.6 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 INSULATION - GENERAL

A. Insulation Thickness:

1. Provide thickness required by R-value shown on drawings.
2. Provide thickness indicated when R-value is not shown on drawings.

B. Insulation Types:

1. Provide one insulation type for each application.

C. Sustainable Construction Requirements:

1. Insulation Recycled Content:
   a. Polyisocyanurate/polyurethane foam-in-place: 5 percent recovered material.
   b. Glass fiber reinforced: 6 percent recovered material.

c. Rock wool material: 75 percent recovered material.

2.2 THERMAL INSULATION

A. Spray polyurethane foam:

1. ASTM C518, thermal resistance Minimum R6.1/inch – 140 degree F /90 day, Aged R-Value measured at 75 degrees F mean Temp.;
2. Flame Spread ASTM E84: 25 or less;
3. Smoke Developed 450 or less;
4. Core Density ASTM D1622: minimum 2 pcf;
5. Compressive Strength ASTM D 1621, 10% parallel to rise: 20 psi;
6. Closed Cell content: ASTM D2856, minimum 90 percent;
7. Water Absorption by volume maximum: ASTM D2842: 5.0 percent;
8. Water Vapor Permeability maximum ASTM E96: 3.0 perm-inches.

B. Polyurethane foam gap air infiltration filler: ASTM E2112.

C. Polyurethane foam gap air infiltration filler: ASTM E84 / UL 723, Flame Spread rating of 25 or less Smoke Developed rating of 350 or less.

1. Mineral Fiber: ASTM C665, Type II, Class C, Category I where concealed by thermal barrier.
2. Mineral Fiber: ASTM C665, Type III, Class A at other locations.

2.3 ACOUSTICAL INSULATION

A. Batts and Blankets:

1. Widths and lengths to fit tight against framing.
2. Mineral Fiber Batt or Blankets: ASTM C665 unfaced.
3. Maximum Surface Burning Characteristics: ASTM E84.
   a. Flame Spread Rating: 25.
   b. Smoke Developed Rating: 450.

2.4 ACCESSORIES

A. Fasteners:

1. Staples or Nails: ASTM F1667, zinc-coated, size and type to suit application.
2. Screws: ASTM C954 or ASTM C1002, size and length to suit application with washer minimum 50 mm (2 inches) diameter.
3. Impaling Pins: Steel pins with head minimum 50 mm (2 inches) diameter.
   a. Length: As required to extend beyond insulation and retain cap washer when washer is placed on pin.

b. Adhesive: Type recommended by manufacturer to suit application.

B. Insulation Adhesive:

1. Nonflammable type recommended by insulation manufacturer to suit application.

C. Tape:

1. Pressure sensitive adhesive on one face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.

3.2 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.

1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.

B. Install insulation with vapor barrier facing the heated side, unless indicated otherwise.

C. Install board insulation with joints close and flush, in regular courses, and with end joints staggered.

D. Install batt and blanket insulation with joints tight. Fill framing voids completely. Seal penetrations, terminations, facing joints, facing cuts, tears, and unlapped joints with tape.

E. Fit insulation tight against adjoining construction and penetrations, unless indicated otherwise.

3.3 THERMAL INSULATION

A. Spray-Applied Insulation at Inside Face of Exterior Wall Insulation:

1. Location: On interior face of solid masonry and concrete walls, beams, beam soffits, underside of floors, and to face of studs to support interior wall finish where indicated.

2. Comply with requirements and recommendations of the insulation manufacturer.

3. Spray foam insulation on the prepared surface in 13 mm (1/2-inch) lifts. Time between lifts shall not exceed timeframe recommended by the manufacturer. Where the manufacturer does not make such recommendation, time between lifts shall not exceed 4 hours.
4. The finished surface shall be smooth, free of voids blisters and crevices and free draining.
5. Extend foam up walls and around roof projections to form cants and flashings that terminate at least 50 mm (2 inches) above finished roof surface.
6. Cured foam: Free from water, dust, oils and other materials which would impair adhesion of the protective coating.
7. Correct locations of non-adherence of foam to substrate and finish pinholes flush with an approved sealant before final coating is applied.
8. Do not overspray to correct an unacceptable surface condition.
9. The finished surface shall not vary more than 13 mm (1/2 inch).
10. Remove and replace polyurethane foam insulation not complying with specified limitation. Remove defective thickness, prepare, and reapply foam insulation with acceptable, uniform results.

3.4 ACOUSTICAL INSULATION

A. General:
   1. Install insulation without voids.
   2. Pack insulation around door frames and windows, in building expansion joints, door soffits, and other voids.
   3. Pack behind outlets, around pipes, ducts, and services encased in walls.
   4. Hold insulation in place with pressure sensitive tape.
   5. Lap facer flanges together over framing for continuous surface. Seal all penetrations through the insulation and facers.
   6. Do not compress insulation below required thickness except where embedded items prevent required thickness.

B. Batts and Blankets:
   1. When insulation is not full thickness of cavity, adhere insulation to one side of cavity, maintaining continuity of insulation and covering penetrations or embedments.
      a. Wood Framing:

1) Fasten blanket insulation between wood framing and joists with nails or staples through flanged edges of insulation.
2) Space fastenings maximum 150 mm (6 inches) on center.

b. Metal Framing:
1) Fasten insulation between metal framing with pressure sensitive tape continuous along flanged edges.
2) At metal framing or ceilings suspension systems, install blanket insulation above suspended ceilings or metal framing at right angles to the main runners or framing.
3) Tape insulation tightly together so no gaps occur and metal framing members are covered by insulation.

3.5 SPRAY INSULATION EQUIPMENT CALIBRATION

A. Spray equipment for two-component system:
1. Calibrated each day at start of operations and;
a. After each restart if spraying operations have been terminated for more than one (1) hour.
b. Whenever there is a change in fan pattern or pressure.
c. Whenever slow curing areas are noticed.
d. Whenever a change is made in hose length or working height and after change-over between materials.

B. Calibration to consist of demonstrating to COR that the equipment is adjusted to deliver component in the proper proportions.

3.6 CLEANING

A. Remove excess adhesive before adhesive sets.

3.7 PROTECTION

A. Protect insulation from construction operations.
B. Repair damage.

- - E N D - -

SECTION 07 60 00
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 DESCRIPTION

Formed sheet metal work for wall and roof flashing, copings, roof edge metal, fasciae, drainage specialties, and formed expansion joint covers are specified in this section.

1.2 RELATED WORK

A. Joint Sealants: Section 07 92 00, JOINT SEALANTS.

B. Paint materials and application: Section 09 91 00, PAINTING.

1.3 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only. Editions of applicable publications current on date of issue of bidding documents apply unless otherwise indicated.

B. Aluminum Association (AA):

AA-C22A41.....Aluminum Chemically etched medium matte, with clear anodic coating, Class I Architectural, 0.7-mil thick

AA-C22A42.....Chemically etched medium matte, with integrally colored anodic coating, Class I Architectural, 0.7 mils thick

AA-C22A44.....Chemically etched medium matte with electrolytically deposited metallic compound, integrally colored coating Class I Architectural, 0.7-mil thick finish

C. American National Standards Institute/Single-Ply Roofing Institute (ANSI/SPRI):

ANSI/SPRI ES-1-03.....Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems

D. American Architectural Manufacturers Association (AAMA):

AAMA 620.....Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural Aluminum

AAMA 621.....Voluntary Specification for High Performance Organic Coatings on Coil Coated Architectural

Hot Dipped Galvanized (HDG) and Zinc-Aluminum Coated Steel Substrates

E. ASTM International (ASTM):

A240/A240M-14.....Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications.

A653/A653M-11.....Steel Sheet Zinc-Coated (Galvanized) or Zinc Alloy Coated (Galvanized) by the Hot- Dip Process

B32-08.....Solder Metal

B209-10.....Aluminum and Aluminum-Alloy Sheet and Plate

B370-12.....Copper Sheet and Strip for Building Construction

D173-03(R2011).....Bitumen-Saturated Cotton Fabrics Used in Roofing and Waterproofing

D412-06(R2013).....Vulcanized Rubber and Thermoplastic Elastomers-Tension

D1187-97(R2011).....Asphalt Base Emulsions for Use as Protective Coatings for Metal

D1784-11.....Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds

D3656-07.....Insect Screening and Louver Cloth Woven from Vinyl-Coated Glass Yarns

D4586-07.....Asphalt Roof Cement, Asbestos Free

F. Sheet Metal and Air Conditioning Contractors National Association (SMACNA): Architectural Sheet Metal Manual.

G. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500-06.....Metal Finishes Manual

H. Federal Specification (Fed. Spec):

A-A-1925A.....Shield, Expansion; (Nail Anchors)

UU-B-790A.....Building Paper, Vegetable Fiber

I. International Code Commission (ICC): International Building Code, Current Edition

1.4 PERFORMANCE REQUIREMENTS

A. Wind Uplift Forces: Resist the following forces per FM Approvals 1-49:

1. Wind Zone 1: 0.48 to 0.96 kPa (10 to 20 lbf/sq. ft.): 1.92-kPa (40-lbf/sq. ft.) perimeter uplift force, 2.87-kPa (60-lbf/sq. ft.) corner uplift force, and 0.96-kPa (20-lbf/sq. ft.) outward force.
2. Wind Zone 1: 1.00 to 1.44 kPa (21 to 30 lbf/sq. ft.): 2.87-kPa (60-lbf/sq. ft.) perimeter uplift force, 4.31-kPa (90-lbf/sq. ft.) corner uplift force, and 1.44-kPa (30-lbf/sq. ft.) outward force.
3. Wind Zone 2: 1.48 to 2.15 kPa (31 to 45 lbf/sq. ft.): 4.31-kPa (90-lbf/sq. ft.) perimeter uplift force, 5.74-kPa (120-lbf/sq. ft.) corner uplift force, and 2.15-kPa (45-lbf/sq. ft.) outward force.
4. Wind Zone 3: 2.20 to 4.98 kPa (46 to 104 lbf/sq. ft.): 9.96-kPa (208-lbf/sq. ft.) perimeter uplift force, 14.94-kPa (312-lbf/sq. ft.) corner uplift force, and 4.98-kPa (104-lbf/sq. ft.) outward force.

1.5 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Shop Drawings: For all specified items, including:
   1. Flashings
   2. Copings
C. Manufacturer's Literature and Data: For all specified items, including:
   1. Thru wall flashing
D. Certificates: Indicating compliance with specified finishing requirements, from applicator and contractor.

PART 2 - PRODUCTS

2.1 FLASHING AND SHEET METAL MATERIALS

A. Stainless Steel: ASTM A240, Type 302B, dead soft temper.

2.2 FLASHING ACCESSORIES

A. Solder: ASTM B32; flux type and alloy composition as required for use with metals to be soldered.
B. Rosin Paper: Fed-Spec. UU-B-790, Type I, Grade D, Style 1b, Rosin-sized sheathing paper, weighing approximately 3 Kg/10 m^2(6 lbs/100 sf).
C. Bituminous Paint: ASTM D1187, Type I.
D. Fasteners:
   1. Use copper, copper alloy, bronze, brass, or stainless steel for copper and copper clad stainless steel, and stainless steel for

stainless steel and aluminum alloy. Use galvanized steel or stainless steel for galvanized steel.

2. Nails:
   a. Minimum diameter for copper nails: 3 mm (0.109 inch).
   b. Minimum diameter for aluminum nails 3 mm (0.105 inch).
   c. Minimum diameter for stainless steel nails: 2 mm (0.095 inch) and annular threaded.
   d. Length to provide not less than 22 mm (7/8 inch) penetration into anchorage.
3. Rivets: Not less than 3 mm (1/8 inch) diameter.
4. Expansion Shields: Fed Spec A-A-1925A.

E. Sealant: As specified in Section 07 92 00, JOINT SEALANTS for exterior locations.

F. Insect Screening: ASTM D3656, 18 by 18 regular mesh.

G. Roof Cement: ASTM D4586.

2.3 NOT USED

2.4 FABRICATION, GENERAL

A. Jointing:
1. In general, copper, stainless steel and copper clad stainless steel joints, except expansion and contraction joints, shall be locked and soldered.
2. Joints shall conform to following requirements:
   a. Flat-lock joints shall finish not less than 19 mm (3/4 inch) wide.
   b. Lap joints subject to stress shall finish not less than 25 mm (one inch) wide and shall be soldered and riveted.
   c. Unsoldered lap joints shall finish not less than 100 mm (4 inches) wide.
3. Flat and lap joints shall be made in direction of flow.
4. Edges of bituminous coated copper, copper covered paper, nonreinforced elastomeric sheeting and polyethylene coated copper shall be jointed by lapping not less than 100 mm (4 inches) in the direction of flow and cementing with asphalt roof cement or sealant as required by the manufacturer's printed instructions.
5. Soldering:

a. Pre tin both mating surfaces with solder for a width not less than 38 mm (1 1/2 inches) of uncoated copper, stainless steel, and copper clad stainless steel.
b. Wire brush to produce a bright surface before soldering lead coated copper.
c. Treat in accordance with metal producers recommendations other sheet metal required to be soldered.
d. Completely remove acid and flux after soldering is completed.

B. Drips:
1. Form drips at lower edge of sheet metal counter-flashings (cap flashings), fascias, gravel stops, wall copings, by folding edge back 13 mm (1/2 inch) and bending out 45 degrees from vertical to carry water away from the wall.
2. Form drip to provide hook to engage cleat or edge strip for fastening for not less than 19 mm (3/4 inch) loose lock where shown.

C. Edges:
1. Edges of flashings concealed in masonry joints opposite drain side shall be turned up 6 mm (1/4 inch) to form dam, unless otherwise specified or shown otherwise.
2. Finish exposed edges of flashing with a 6 mm (1/4 inch) hem formed by folding edge of flashing back on itself when not hooked to edge strip or cleat. Use 6 mm (1/4 inch) minimum penetration beyond wall face with drip for through-wall flashing exposed edge.
3. All metal roof edges shall meet requirements of IBC, current edition.

D. Metal Options:
1. Where options are permitted for different metals use only one metal throughout.
2. Stainless steel may be used in concealed locations for fasteners of other metals exposed to view.
3. Where copper gravel stops, copings and flashings will carry water onto cast stone, stone, or architectural concrete, or stainless steel.

2.5 FINISHES

A. Use same finish on adjacent metal or components and exposed metal surfaces unless specified or shown otherwise.

B. In accordance with NAAMM Metal Finishes Manual AMP 500, unless otherwise specified.

C. Finish exposed metal surfaces as follows, unless specified otherwise:

1. Copper: Mill finish.
2. Stainless Steel: Finish No. 2B or 2D.
3. Aluminum:
   a. Clear Finish: AA-C22A41 medium matte, clear anodic coating, Class 1 Architectural, 18 mm (0.7 mils) thick.
   b. Colored Finish: AA-C22A42 (anodized) or AA-C22A44 (electrolytically deposited metallic compound) medium matte, integrally colored coating, Class 1 Architectural, 18 mm (0.7 mils) thick. Dyes will not be accepted.
   c. Fluorocarbon Finish: AAMA 620, high performance organic coating.
   d. Mill finish.
4. Steel and Galvanized Steel:
   a. Finish painted under Section 09 91 00, PAINTING unless specified as prefinished item.
   b. Manufacturer's finish:
      1) Baked on prime coat over a phosphate coating.
      2) Baked-on prime and finish coat over a phosphate coating.
      3) Fluorocarbon Finish: AAMA 621, high performance organic coating.

2.6 THROUGH-WALL FLASHINGS

A. Form through-wall flashing to provide a mechanical bond or key against lateral movement in all directions. Install a sheet having 2 mm (1/16 inch) deep transverse channels spaced four to every 25 mm (one inch), or ribbed diagonal pattern, or having other deformation unless specified otherwise.

1. Fabricate in not less than 2400 mm (8 feet) lengths; 3000 mm (10 feet) maximum lengths.
2. Fabricate so keying nests at overlaps.

B. For Masonry Work When Concealed Except for Drip:

1. Either copper, stainless steel, or copper clad stainless steel.
2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
3. Form exposed portions of flashing with drip, approximately 6 mm (1/4 inch) projection beyond wall face.

C. For Masonry Work When Exposed Edge Forms a Receiver for Counter Flashing:
   1. Use same metal and thickness as counter flashing.
   2. Form an integral dam at least 5 mm (3/16 inch) high at back edge.
   3. Form exposed portion as snap lock receiver for counter flashing upper edge.
D. For Flashing at Architectural Precast Concrete Panels or Stone Panels.
   1. Use plan flat sheet of stainless steel.
   2. Form exposed portions with drip as specified or receiver.
E. Window Sill Flashing and Lintel Flashing:
   1. Use either copper, stainless steel, copper clad stainless steel plane flat sheet, or nonreinforced elastomeric sheeting, bituminous coated copper, copper covered paper, or polyethylene coated copper.
   2. Fabricate flashing at ends with folded corners to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening.
   3. Turn up back edge as shown.
   4. Form exposed portion with drip as specified or receiver.
F. Door Sill Flashing:
   1. Where concealed, use either 0.5 Kg (20 oz) copper, 0.5 mm (0.018 inch) thick stainless steel, or 0.5 mm (0.018 inch) thick copper clad stainless steel.
   2. Where shown on drawings as combined counter flashing under threshold, sill plate, door sill, or where subject to foot traffic, use either 0.6 Kg (24 ounce) copper, 0.6 mm (0.024 inch) stainless steel, or 0.6 mm (0.024 inch) thick stainless steel.
   3. Fabricate flashing at ends to turn up 5 mm (3/16 inch) in first vertical masonry joint beyond masonry opening with folded corners.

2.7 BASE FLASHING

A. Use metal base flashing at vertical surfaces intersecting built-up roofing without cant strips or where shown.
   1. Use either copper, or stainless steel, thickness specified unless specified otherwise.
   2. When flashing is over 250 mm (10 inches) in vertical height or horizontal width use either 0.5 Kg (20 oz) copper or 0.5 mm (0.018 inch) stainless steel.
   3. Use stainless steel at aluminum roof curbs where flashing contacts the aluminum.

4. Use either copper, or stainless steel at pipe flashings.

B. Fabricate metal base flashing up vertical surfaces not less than 200 mm (8 inch) nor more than 400 mm (16 inch).

C. Fabricate roof flange not less than 100 mm (4 inches) wide unless shown otherwise. When base flashing length exceeds 2400 mm (8 feet) form flange edge with 13 mm (1/2 inch) hem to receive cleats.

D. Form base flashing bent from strip except pipe flashing. Fabricate ends for riveted soldered lap seam joints. Fabricate expansion joint ends as specified.

E. Pipe Flashing: (Other than engine exhaust or flue stack)

1. Fabricate roof flange not less than 100 mm (4 inches) beyond sleeve on all sides.
2. Extend sleeve up and around pipe and flange out at bottom not less than 13 mm (1/2 inch) and solder to flange and sleeve seam to make watertight.
3. At low pipes 200 mm (8 inch) to 450 mm (18 inch) above roof:
   a. Form top of sleeve to turn down into the pipe at least 25 mm (one inch).
   b. Allow for loose fit around and into the pipe.
4. At high pipes and pipes with goosenecks or other obstructions which would prevent turning the flashing down into the pipe:
   a. Extend sleeve up not less than 300 mm (12 inch) above roofing.
   b. Allow for loose fit around pipe.

2.8 COUNTERFLASHING (CAP FLASHING OR HOODS)

A. Either copper or stainless steel, unless specified otherwise.

B. Fabricate to lap base flashing a minimum of 100 mm (4 inches) with drip:

1. Form lock seams for outside corners. Allow for lap joints at ends and inside corners.
2. In general, form flashing in lengths not less than 2400 mm (8 feet) and not more than 3000 mm (10 feet).
3. Two-piece, lock in type flashing may be used in-lieu-of one piece counter-flashing.
4. Manufactured assemblies may be used.
5. Where counterflashing is installed at new work use an integral flange at the top designed to be extended into the masonry joint or reglet in concrete.

6. Where counterflashing is installed at existing work use surface applied type, formed to provide a space for the application of sealant at the top edge.

C. One-piece Counterflashing:
1. Back edge turned up and fabricate to lock into reglet in concrete.
2. Upper edge formed to extend full depth of masonry unit in mortar joint with back edge turned up 6 mm (1/4 inch).

D. Two-Piece Counterflashing:
1. Receiver to extend into masonry wall depth of masonry unit with back edge turned up 6 mm (1/4 inch) and exposed edge designed to receive and lock counterflashing upper edge when inserted.
2. Counterflashing upper edge designed to snap lock into receiver.

E. Surface Mounted Counterflashing; one or two piece:
1. Use at existing or new surfaces where flashing can not be inserted in vertical surface.
2. One piece fabricate upper edge folded double for 65 mm (2 1/2 inches) with top 19 mm (3/4 inch) bent out to form "V" joint sealant pocket with vertical surface. Perforate flat double area against vertical surface with horizontally slotted fastener holes at 400 mm (16 inch) centers between end holes. Option: One piece surface mounted counter-flashing (cap flashing) may be used. Fabricate as detailed on Plate 51 of SMACNA Architectural Sheet Metal Manual.
3. Two pieces: Fabricate upper edge to lock into surface mounted receiver. Fabricate receiver joint sealant pocket on upper edge and lower edge to receive counterflashing, with slotted fastener holes at 400 mm (16 inch) centers between upper and lower edge.

F. Pipe Counterflashing:
1. Form flashing for water-tight umbrella with upper portion against pipe to receive a draw band and upper edge to form a "V" joint sealant receiver approximately 19 mm (3/4 inch) deep.
2. Fabricate 100 mm (4 inch) over lap at end.
3. Fabricate draw band of same metal as counter flashing. Use 0.6 Kg (24 oz) copper or 0.33 mm (0.013 inch) thick stainless steel or copper coated stainless steel.
4. Use stainless steel bolt on draw band tightening assembly.
5. Vent pipe counter flashing may be fabricated to omit draw band and turn down 25 mm (one inch) inside vent pipe.

G. Where vented edge decks intersect vertical surfaces, form in one piece, shape to slope down to a point level with and in front of edge-set notched plank; then, down vertically, overlapping base flashing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Install flashing and sheet metal items as shown in Sheet Metal and Air Conditioning Contractors National Association, Inc., publication, ARCHITECTURAL SHEET METAL MANUAL, except as otherwise shown or specified.
2. Apply Sealant as specified in Section 07 92 00, JOINT SEALANTS.
3. Apply sheet metal and other flashing material to surfaces which are smooth, sound, clean, dry and free from defects that might affect the application.
4. Remove projections which would puncture the materials and fill holes and depressions with material compatible with the substrate. Cover holes or cracks in wood wider than 6 mm (1/4 inch) with sheet metal compatible with the roofing and flashing material used.
5. Coordinate with masonry work for the application of a skim coat of mortar to surfaces of unit masonry to receive flashing material before the application of flashing.
6. Apply a layer of 7 Kg (15 pound) saturated felt followed by a layer of rosin paper to wood surfaces to be covered with copper. Lap each ply 50 mm (2 inch) with the slope and nail with large headed copper nails.
7. Confine direct nailing of sheet metal to strips 300 mm (12 inch) or less wide. Nail flashing along one edge only. Space nail not over 100 mm (4 inches) on center unless specified otherwise.
8. Install bolts, rivets, and screws where indicated, specified, or required in accordance with the SMACNA Sheet Metal Manual. Space rivets at 75 mm (3 inch) on centers in two rows in a staggered position. Use neoprene washers under fastener heads when fastener head is exposed.
9. Coordinate with roofing work for the installation of metal base flashings and other metal items having roof flanges for anchorage and watertight installation.

10. Nail continuous cleats on 75 mm (3 inch) on centers in two rows in a staggered position.
11. Nail individual cleats with two nails and bend end tab over nail heads. Lock other end of cleat into hemmed edge.
12. Install flashings in conjunction with other trades so that flashings are inserted in other materials and joined together to provide a water tight installation.
13. Where required to prevent galvanic action between dissimilar metal isolate the contact areas of dissimilar metal with sheet lead, waterproof building paper, or a coat of bituminous paint.
14. Isolate aluminum in contact with dissimilar metals others than stainless steel, white bronze or other metal compatible with aluminum by:
    a. Paint dissimilar metal with a prime coat of zinc-chromate or other suitable primer, followed by two coats of aluminum paint.
    b. Paint dissimilar metal with a coat of bituminous paint.
    c. Apply an approved caulking material between aluminum and dissimilar metal.
15. Paint aluminum in contact with or built into mortar, concrete, plaster, or other masonry materials with a coat of bituminous paint.
16. Paint aluminum in contact with absorptive materials that may become repeatedly wet with two coats of bituminous paint or two coats of aluminum paint.
17. Bitumen Stops:
    a. Install bitumen stops for built-up roof opening penetrations through deck and at formed sheet metal gravel stops.
    b. Nail leg of bitumen stop at 300 mm (12 inch) intervals to nailing strip at roof edge before roofing material is installed.

3.2 THROUGH-WALL FLASHING

A. General:
1. Install continuous through-wall flashing between top of concrete foundation walls and bottom of masonry building walls; at top of concrete floors; under masonry, concrete, or stone copings and elsewhere as shown.
2. Where exposed portions are used as a counterflashings, lap base flashings at least 100 mm (4 inches)and use thickness of metal as specified for exposed locations.

3. Exposed edge of flashing may be formed as a receiver for two piece counter flashing as specified.
4. Terminate exterior edge beyond face of wall approximately 6 mm (1/4 inch) with drip edge where not part of counter flashing.
5. Turn back edge up 6 mm (1/4 inch) unless noted otherwise where flashing terminates in mortar joint or hollow masonry unit joint.
6. Terminate interior raised edge in masonry backup unit approximately 38 mm (1 1/2 inch) into unit unless shown otherwise.
7. Under copings terminate both edges beyond face of wall approximately 6 mm (1/4 inch) with drip edge.
8. Lap end joints at least two corrugations, but not less than 100 mm (4 inches). Seal laps with sealant.
9. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound. Sealing compound is specified in Section 07 92 00, JOINT SEALANTS.
10. Coordinate with other work to set in a bed of mortar above and below flashing so that total thickness of the two layers of mortar and flashing are same as regular mortar joint.
11. Where ends of flashing terminate turn ends up 25 mm (1 inch) and fold corners to form dam extending to wall face in vertical mortar or veneer joint.
12. Turn flashing up not less than 200 mm (8 inch) between masonry or behind exterior veneer.
13. When flashing terminates in reglet extend flashing full depth into reglet and secure with lead or plastic wedges spaced 150 mm (6 inch) on center.
14. Continue flashing around columns:
    a. Where flashing cannot be inserted in column reglet hold flashing vertical leg against column.
    b. Counterflash top edge with 75 mm (3 inch) wide strip of saturated cotton unless shown otherwise. Secure cotton strip with roof cement to column. Lap base flashing with cotton strip 38 mm (1 1/2 inch).

B. Flashing at Top of Concrete Foundation Walls Where concrete is exposed. Turn up not less than 200 mm (8 inch) high and into masonry backup mortar joint or reglet in concrete backup as specified.

C. Flashing at Top of Concrete Floors (except where shelf angles occur): Place flashing in horizontal masonry joint not less than 200 mm (8 inch) below floor slab and extend into backup masonry joint at floor slab 38 mm (1 1/2 inch).

D. Flashing at Cavity Wall Construction: Where flashing occurs in cavity walls turn vertical portion up against backup under waterproofing, if any, into mortar joint. Turn up over insulation, if any, and horizontally through insulation into mortar joint.

E. Flashing at Veneer Walls:
   1. Install near line of finish floors over shelf angles or where shown.
   2. Turn up against sheathing.
   3. At stud framing, hem top edge 19 mm (3/4 inch) and secure to each stud with stainless steel fasteners through sheathing.
   4. At concrete backing, extend flashing into reglet as specified.
   5. Coordinate with installation of waterproofing or asphalt felt for lap over top of flashing.

F. Lintel Flashing when not part of shelf angle flashing:
   1. Install flashing full length of lintel to nearest vertical joint in masonry over veneer.
   2. Turn ends up 25 mm (one inch) and fold corners to form dam and extend end to face of wall.
   3. Turn back edge up to top of lintel; terminate back edge as specified for back-up wall.

G. Window Sill Flashing:
   1. Install flashing to extend not less than 100 mm (4 inch) beyond ends of sill into vertical joint of masonry or veneer.
   2. Turn back edge up to terminate under window frame.
   3. Turn ends up 25 mm (one inch) and fold corners to form dam and extend to face of wall.

H. Door Sill Flashing:
   1. Install flashing under bottom of plate sills of doors over curbs opening onto roofs. Extend flashing out to form counter flashing or receiver for counter flashing over base flashing. Set in sealant.
   2. Extend sill flashing 200 mm (8 inch) beyond jamb opening. Turn ends up one inch in vertical masonry joint, extend end to face of wall. Join to counter flashing for water tight joint.

3. Where doors thresholds cover over waterproof membranes install sill flashing over water proof membrane under thresholds. Extend beyond opening to cover exposed portion of waterproof membrane and not less than 150 mm (6 inch) beyond door jamb opening at ends. Turn up approximately 6 mm (1/4 inch) under threshold.

I. Flashing at Masonry, Stone, or Precast Concrete Copings:

1. Install flashing with drips on both wall faces unless shown otherwise.
2. Form penetration openings to fit tight against dowel or other item with edge turned up. Seal penetrations with sealant.

3.3 BASE FLASHING

A. Install where roof membrane type base flashing is not used and where shown.

1. Install flashing at intersections of roofs with vertical surfaces or at penetrations through roofs, to provide watertight construction.
2. Install metal flashings and accessories having flanges extending out on top of the built-up roofing before final bituminous coat and roof aggregate is applied.
3. Set flanges in heavy trowel coat of roof cement and nail through flanges into wood nailers over bituminous roofing.
4. Secure flange by nailing through roofing into wood blocking with nails spaced 75 mm (3 inch) on centers or, when flange over 100 mm (4 inch) wide terminate in a 13 mm (1/2 inch) folded edge anchored with cleats spaced 200 mm (8 inch) on center. Secure one end of cleat over nail heads. Lock other end into the seam.

B. For long runs of base flashings install in lengths of not less than 2400 mm (8 feet) nor more than 3000 mm (ten feet). Install a 75 mm (3 inch) wide slip type, loose lock expansion joint filled with sealant in joints of base flashing sections over 2400 mm (8 feet) in length. Lock and solder corner joints at corners.

C. Extend base flashing up under counter flashing of roof specialties and accessories or equipment not less than 75 mm (3 inch).

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SECTION 07 84 00
FIRESTOPPING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Provide UL or equivalent approved firestopping system for the closures of openings in walls, floors, and roof decks against penetration of flame, heat, and smoke or gases in fire resistant rated construction.

B. Provide UL or equivalent approved firestopping system for the closure of openings in walls against penetration of gases or smoke in smoke partitions.

1.2 RELATED WORK:

A. Expansion and seismic joint firestopping: Section 07 95 13, EXPANSION JOINT COVER ASSEMBLIES.

B. Sealants and application: Section 07 92 00, JOINT SEALANTS.

1.3 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Not used

C. Installer qualifications.

D. Inspector qualifications.

E. Manufacturers literature, data, and installation instructions for types of firestopping and smoke stopping used.

F. List of FM, UL, or WH classification number of systems installed.

G. Certified laboratory test reports for ASTM E814 tests for systems not listed by FM, UL, or WH proposed for use.

H. Submit certificates from manufacturer attesting that firestopping materials comply with the specified requirements.

1.4 DELIVERY AND STORAGE:

A. Deliver materials in their original unopened containers with manufacturer’s name and product identification.

B. Store in a location providing protection from damage and exposure to the elements.

1.5 QUALITY ASSURANCE:

A. FM, UL, or WH or other approved laboratory tested products will be acceptable.

B. Installer Qualifications: A firm that has been approved by FM Global according to FM Global 4991 or been evaluated by UL and found to comply

with UL's "Qualified Firestop Contractor Program Requirements." Submit qualification data.

C. Inspector Qualifications: Contractor to engage a qualified inspector to perform inspections and final reports. The inspector to meet the criteria contained in ASTM E699 for agencies involved in quality assurance and to have a minimum of two years' experience in construction field inspections of firestopping systems, products, and assemblies. The inspector to be completely independent of, and divested from, the Contractor, the installer, the manufacturer, and the supplier of material or item being inspected. Submit inspector qualifications.

1.6 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. ASTM International (ASTM):

E84-14.....Surface Burning Characteristics of Building Materials

E699-09.....Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components

E814-13a.....Fire Tests of Through-Penetration Fire Stops

E2174-14.....Standard Practice for On-Site Inspection of Installed Firestops

E2393-10a.....Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers

C. FM Global (FM):

Annual Issue Approval Guide Building Materials

4991-13.....Approval of Firestop Contractors

D. Underwriters Laboratories, Inc. (UL):

Annual Issue Building Materials Directory

Annual Issue Fire Resistance Directory

723-10(2008).....Standard for Test for Surface Burning Characteristics of Building Materials

1479-04(R2014).....Fire Tests of Through-Penetration Firestops

E. Intertek Testing Services - Warnock Hersey (ITS-WH):

Annual Issue Certification Listings

F. Environmental Protection Agency (EPA):

40 CFR 59(2014).....National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

PART 2 - PRODUCTS

2.1 FIRESTOP SYSTEMS:

A. Provide either factory built (Firestop Devices) or field erected (through-Penetration Firestop Systems) to form a specific building system maintaining required integrity of the fire barrier and stop the passage of gases or smoke. Firestop systems to accommodate building movements without impairing their integrity.

B. Through-penetration firestop systems and firestop devices tested in accordance with ASTM E814 or UL 1479 using the "F" or "T" rating to maintain the same rating and integrity as the fire barrier being sealed. "T" ratings are not required for penetrations smaller than or equal to 101 mm (4 in.) nominal pipe or 0.01 sq. m (16 sq. in.) in overall cross sectional area.

C. Firestop sealants used for firestopping or smoke sealing to have the following properties:

1. Contain no flammable or toxic solvents.
2. Release no dangerous or flammable out gassing during the drying or curing of products.
3. Water-resistant after drying or curing and unaffected by high humidity, condensation or transient water exposure.
4. When installed in exposed areas, capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

D. Firestopping system or devices used for penetrations by glass pipe, plastic pipe or conduits, unenclosed cables, or other non-metallic materials to have following properties:

1. Classified for use with the particular type of penetrating material used.
2. Penetrations containing loose electrical cables, computer data cables, and communications cables protected using firestopping systems that allow unrestricted cable changes without damage to the seal.

E. Maximum flame spread of 25 and smoke development of 50 when tested in accordance with ASTM E84 or UL 723. Material to be an approved

firestopping material as listed in UL Fire Resistance Directory or by a nationally recognized testing laboratory.

F. FM, UL, or WH rated or tested by an approved laboratory in accordance with ASTM E814.

G. Materials to be nontoxic and noncarcinogen at all stages of application or during fire conditions and to not contain hazardous chemicals. Provide firestop material that is free from Ethylene Glycol, PCB, MEK, and asbestos.

H. For firestopping exposed to view, traffic, moisture, and physical damage, provide products that do not deteriorate when exposed to these conditions.

1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
2. For floor penetrations with annular spaces exceeding 101 mm (4 in.) or more in width and exposed to possible loading and traffic, provide firestop systems capable of supporting the floor loads involved either by installing floor plates or by other means acceptable to the firestop manufacturer.
3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

2.2 SMOKE STOPPING IN SMOKE PARTITIONS:

A. Provide silicone sealant in smoke partitions as specified in Section 07 92 00, JOINT SEALANTS.

B. Provide mineral fiber filler and bond breaker behind sealant.

C. Sealants to have a maximum flame spread of 25 and smoke developed of 50 when tested in accordance with ASTM E84.

D. When used in exposed areas capable of being sanded and finished with similar surface treatments as used on the surrounding wall or floor surface.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Submit product data and installation instructions, as required by article, submittals, after an on-site examination of areas to receive firestopping.

B. Examine substrates and conditions with installer present for compliance with requirements for opening configuration, penetrating items, substrates, and other conditions affecting performance of firestopping.

Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION:

A. Remove dirt, grease, oil, laitance and form-release agents from concrete, loose materials, or other substances that prevent adherence and bonding or application of the firestopping or smoke stopping materials.

B. Remove insulation on insulated pipe for a distance of 150 mm (6 inches) on each side of the fire rated assembly prior to applying the firestopping materials unless the firestopping materials are tested and approved for use on insulated pipes.

C. Prime substrates where required by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

D. Masking Tape: Apply masking tape to prevent firestopping from contacting adjoining surfaces that will remain exposed upon completion of work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestopping materials. Remove tape as soon as it is possible to do so without disturbing seal of firestopping with substrates.

3.3 INSTALLATION:

A. Do not begin firestopping work until the specified material data and installation instructions of the proposed firestopping systems have been submitted and approved.

B. Install firestopping systems with smoke stopping in accordance with FM, UL, WH, or other approved system details and installation instructions.

C. Install smoke stopping seals in smoke partitions.

3.4 CLEAN-UP:

A. As work on each floor is completed, remove materials, litter, and debris.

B. Clean up spills of liquid type materials.

C. Clean off excess fill materials and sealants adjacent to openings and joints as work progresses by methods and with cleaning materials approved by manufacturers of firestopping products and of products in which opening and joints occur.

D. Protect firestopping during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated firestopping immediately and install new materials to provide firestopping complying with specified requirements.

3.5 INSPECTIONS AND ACCEPTANCE OF WORK:

A. Do not conceal or enclose firestop assemblies until inspection is complete and approved by the Contracting Officer Representative (COR).

B. Furnish service of approved inspector to inspect firestopping in accordance with ASTM E2393 and ASTM E2174 for firestop inspection, and document inspection results. Submit written reports indicating locations of and types of penetrations and type of firestopping used at each location; type is to be recorded by UL listed printed numbers.

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10-01-17

SECTION 07 92 00
JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section covers interior and exterior sealant and their application, wherever required for complete installation of building materials or systems.

1.2 RELATED WORK (INCLUDING BUT NOT LIMITED TO THE FOLLOWING):

A. Masonry Control and Expansion Joint: Section 04 20 00, UNIT MASONRY.

B. Firestopping Penetrations: Section 07 84 00, FIRESTOPPING.

C. Mechanical Work:
Section 21 05 11, COMMON WORK RESULTS FOR FIRE SUPPRESSION
Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING
Section 23 05 11, COMMON WORK RESULTS FOR HVAC AND STEAM GENERATION

1.3 QUALITY ASSURANCE:

A. Installer Qualifications: An experienced installer with a minimum of three (3) years' experience and who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance. Submit qualification.

B. Source Limitations: Obtain each type of joint sealant through one (1) source from a single manufacturer.

C. Product Testing: Obtain test results from a qualified testing agency based on testing current sealant formulations within a 12-month period.
   1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021.
   2. Test elastomeric joint sealants for compliance with requirements specified by reference to ASTM C920, and where applicable, to other standard test methods.
   3. Test other joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

1.4 CERTIFICATION:

A. Contractor is to submit to the COR written certification that joints are of the proper size and design, that the materials supplied are compatible with adjacent materials and backing, that the materials will properly perform to provide permanent watertight, airtight or vapor

tight seals (as applicable), and that materials supplied meet specified performance requirements.

1.5 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Not used

C. Installer qualifications.

D. Contractor certification.

E. Manufacturer's installation instructions for each product used.

F. Cured samples of exposed sealants for each color.

G. Manufacturer's Literature and Data:

1. Primers
2. Sealing compound, each type, including compatibility when different sealants are in contact with each other.

H. Manufacturer warranty.

1.6 PROJECT CONDITIONS:

A. Environmental Limitations:

1. Do not proceed with installation of joint sealants under following conditions:
   a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C (40 degrees F).
   b. When joint substrates are wet.

B. Joint-Width Conditions:

1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Joint-Substrate Conditions:

1. Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.7 DELIVERY, HANDLING, AND STORAGE:

A. Deliver materials in manufacturers' original unopened containers, with brand names, date of manufacture, shelf life, and material designation clearly marked thereon.

B. Carefully handle and store to prevent inclusion of foreign materials.

C. Do not subject to sustained temperatures exceeding 32 degrees C (90 degrees F) or less than 5 degrees C (40 degrees F).

1.8 DEFINITIONS:

A. Definitions of terms in accordance with ASTM C717 and as specified.

B. Backing Rod: A type of sealant backing.

C. Bond Breakers: A type of sealant backing.

D. Filler: A sealant backing used behind a back-up rod.

1.9 WARRANTY:

A. Construction Warranty: Comply with FAR clause 52.246-21 "Warranty of Construction".

B. Manufacturer Warranty: Manufacturer shall warranty their sealant for a minimum of five (5) years from the date of installation and final acceptance by the Government. Submit manufacturer warranty.

1.10 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. ASTM International (ASTM):

C509-06.....Elastomeric Cellular Preformed Gasket and Sealing Material

C612-14.....Mineral Fiber Block and Board Thermal Insulation

C717-14a.....Standard Terminology of Building Seals and Sealants

C734-06(R2012).....Test Method for Low-Temperature Flexibility of Latex Sealants after Artificial Weathering

C794-10.....Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants

C919-12.....Use of Sealants in Acoustical Applications.

C920-14a.....Elastomeric Joint Sealants.

C1021-08(R2014).....Laboratories Engaged in Testing of Building Sealants

C1193-13.....Standard Guide for Use of Joint Sealants.

C1248-08(R2012).....Test Method for Staining of Porous Substrate by Joint Sealants

C1330-02(R2013).....Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants

C1521-13.....Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints

D217-10.....Test Methods for Cone Penetration of Lubricating Grease

D1056-14.....Specification for Flexible Cellular Materials—Sponge or Expanded Rubber

E84-09.....Surface Burning Characteristics of Building Materials

C. Sealant, Waterproofing and Restoration Institute (SWRI).
The Professionals' Guide

D. Environmental Protection Agency (EPA):
40 CFR 59(2014).....National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

PART 2 - PRODUCTS

2.1 SEALANTS:

A. Exterior Sealants:

1. Vertical surfaces, provide non-staining ASTM C920, Type S or M, Grade NS, Class 25, Use NT.
2. Horizontal surfaces, provide ASTM C920, Type S or M, Grade P, Class 25, Use T.
3. Provide location(s) of exterior sealant as follows:
   a. Joints formed where frames and subsills of windows, doors, louvers, and vents adjoin masonry, concrete, or metal frames. Provide sealant at exterior surfaces of exterior wall penetrations.
   b. Metal to metal.
   c. Masonry to masonry or stone.
   d. Stone to stone.
   e. Cast stone to cast stone.
   f. Masonry expansion and control joints.
   g. Wood to masonry.
   h. Masonry joints where shelf angles occur.
   i. Voids where items penetrate exterior walls.
   j. Metal reglets, where flashing is inserted into masonry joints, and where flashing is penetrated by coping dowels.

B. Not used.

C. Interior Sealants:

1. Not used
2. Vertical and Horizontal Surfaces: ASTM C920, Type S or M, Grade NS, Class 25, Use NT.
3. Food Service: Use a Vinyl Acetate Homopolymer, or other low VOC, non-toxic sealant approved for use in food preparation areas.
4. Provide location(s) of interior sealant as follows:
   a. Typical narrow joint 6 mm, (1/4 inch) or less at walls and adjacent components.
   b. Perimeter of doors, windows, access panels which adjoin concrete or masonry surfaces.
   c. Interior surfaces of exterior wall penetrations.
   d. Joints at masonry walls and columns, piers, concrete walls or exterior walls.
   e. Perimeter of lead faced control windows and plaster or gypsum wallboard walls.
   f. Exposed isolation joints at top of full height walls.
   g. Joints between bathtubs and ceramic tile; joints between shower receptors and ceramic tile; joints formed where nonplanar tile surfaces meet.
   h. Joints formed between tile floors and tile base cove; joints between tile and dissimilar materials; joints occurring where substrates change.
   i. Behind escutcheon plates at valve pipe penetrations and showerheads in showers.

D. Acoustical Sealant:
1. Conforming to ASTM C919; flame spread of 25 or less; and a smoke developed rating of 50 or less when tested in accordance with ASTM E84. Acoustical sealant have a consistency of 250 to 310 when tested in accordance with ASTM D217; remain flexible and adhesive after 500 hours of accelerated weathering as specified in ASTM C734; and be non-staining.
2. Provide location(s) of acoustical sealant as follows:
   a. Exposed acoustical joint at sound rated partitions.
   b. Concealed acoustic joints at sound rated partitions.
   c. Joints where item pass-through sound rated partitions.

2.2 COLOR:

A. Sealants used with exposed masonry are to match color of mortar joints.

B. Sealants used with unpainted concrete are to match color of adjacent concrete.

C. Color of sealants for other locations to be light gray or aluminum, unless otherwise indicated in construction documents.

2.3 JOINT SEALANT BACKING:

A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, of type indicated below and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance:

1. Type C: Closed-cell material with a surface skin.

C. Elastomeric Tubing Sealant Backings: Neoprene, butyl, EPDM, or silicone tubing complying with ASTM D1056 or synthetic rubber (ASTM C509), nonabsorbent to water and gas, and capable of remaining resilient at temperatures down to minus 32 degrees C (minus 26 degrees F). Provide products with low compression set and of size and shape to provide a secondary seal, to control sealant depth, and otherwise contribute to optimum sealant performance.

D. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.4 FILLER:

A. Mineral fiberboard: ASTM C612, Class 1.

B. Thickness same as joint width.

C. Depth to fill void completely behind back-up rod.

2.5 PRIMER:

A. As recommended by manufacturer of caulking or sealant material.

B. Stain free type.

2.6 CLEANERS-NON POROUS SURFACES:

A. Chemical cleaners compatible with sealant and acceptable to manufacturer of sealants and sealant backing material. Cleaners to be free of oily residues and other substances capable of staining or

harming joint substrates and adjacent non-porous surfaces and formulated to promote adhesion of sealant and substrates.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Inspect substrate surface for bond breaker contamination and unsound materials at adherent faces of sealant.

B. Coordinate for repair and resolution of unsound substrate materials.

C. Inspect for uniform joint widths and that dimensions are within tolerance established by sealant manufacturer.

3.2 PREPARATIONS:

A. Prepare joints in accordance with manufacturer's instructions and SWRI (The Professionals' Guide).

B. Clean surfaces of joint to receive caulking or sealants leaving joint dry to the touch, free from frost, moisture, grease, oil, wax, lacquer paint, or other foreign matter that would tend to destroy or impair adhesion.

1. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants.
2. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air. Porous joint surfaces include but are not limited to the following:
   a. Concrete.
   b. Masonry.
   c. Unglazed surfaces of ceramic tile.
3. Remove laitance and form-release agents from concrete.
4. Clean nonporous surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous surfaces include but are not limited to the following:
   a. Metal.
   b. Glass.
   c. Porcelain enamel.
   d. Glazed surfaces of ceramic tile.

C. Do not cut or damage joint edges.

D. Apply non-staining masking tape to face of surfaces adjacent to joints before applying primers, caulking, or sealing compounds.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear sealant backings.
   3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

E. Apply primer to sides of joints wherever required by compound manufacturer's printed instructions or as indicated by pre-construction joint sealant substrate test.
   1. Apply primer prior to installation of back-up rod or bond breaker tape.
   2. Use brush or other approved means that will reach all parts of joints. Avoid application to or spillage onto adjacent substrate surfaces.

3.3 BACKING INSTALLATION:

A. Install backing material, to form joints enclosed on three sides as required for specified depth of sealant.

B. Where deep joints occur, install filler to fill space behind the backing rod and position the rod at proper depth.

C. Cut fillers installed by others to proper depth for installation of backing rod and sealants.

D. Install backing rod, without puncturing the material, to a uniform depth, within plus or minus 3 mm (1/8 inch) for sealant depths specified.

E. Where space for backing rod does not exist, install bond breaker tape strip at bottom (or back) of joint so sealant bonds only to two opposing surfaces.

3.4 SEALANT DEPTHS AND GEOMETRY:

A. At widths up to 6 mm (1/4 inch), sealant depth equal to width.

B. At widths over 6 mm (1/4 inch), sealant depth 1/2 of width up to 13 mm (1/2 inch) maximum depth at center of joint with sealant thickness at center of joint approximately 1/2 of depth at adhesion surface.

3.5 INSTALLATION:

A. General:
   1. Apply sealants and caulking only when ambient temperature is between 5 degrees C and 38 degrees C (40 degrees and 100 degrees F).

2. Do not install polysulfide base sealants where sealant may be exposed to fumes from bituminous materials, or where water vapor in continuous contact with cementitious materials may be present.
3. Do not install sealant type listed by manufacture as not suitable for use in locations specified.
4. Apply caulking and sealing compound in accordance with manufacturer's printed instructions.
5. Avoid dropping or smearing compound on adjacent surfaces.
6. Fill joints solidly with compound and finish compound smooth.
7. Tool exposed joints to form smooth and uniform beds, with slightly concave surface conforming to joint configuration per Figure 5A in ASTM C1193 unless shown or specified otherwise in construction documents. Remove masking tape immediately after tooling of sealant and before sealant face starts to “skin” over. Remove any excess sealant from adjacent surfaces of joint, leaving the working in a clean finished condition.
8. Finish paving or floor joints flush unless joint is otherwise detailed.
9. Apply compounds with nozzle size to fit joint width.
10. Test sealants for compatibility with each other and substrate. Use only compatible sealant. Submit test reports.
11. Replace sealant which is damaged during construction process.

B. Not used

C. For application of sealants, follow requirements of ASTM C1193 unless specified otherwise. Take all necessary steps to prevent three-sided adhesion of sealants.

D. Interior Sealants: Where gypsum board partitions are of sound rated, fire rated, or smoke barrier construction, follow requirements of ASTM C919 only to seal all cut-outs and intersections with the adjoining construction unless specified otherwise.

1. Apply a 6 mm (1/4 inch) minimum bead of sealant each side of runners (tracks), including those used at partition intersections with dissimilar wall construction.
2. Coordinate with application of gypsum board to install sealant immediately prior to application of gypsum board.

3. Partition intersections: Seal edges of face layer of gypsum board abutting intersecting partitions, before taping and finishing or application of veneer plaster-joint reinforcing.
4. Openings: Apply a 6 mm (1/4 inch) bead of sealant around all cutouts to seal openings of electrical boxes, ducts, pipes and similar penetrations. To seal electrical boxes, seal sides and backs.
5. Control Joints: Before control joints are installed, apply sealant in back of control joint to reduce flanking path for sound through control joint.

3.6 FIELD QUALITY CONTROL:

A. Field-Adhesion Testing: Field-test joint-sealant adhesion to joint substrates according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
   1. Extent of Testing: Test completed elastomeric sealant joints as follows:
      a. Perform 10 tests for first 305 m (1000 feet) of joint length for each type of elastomeric sealant and joint substrate.
      b. Perform one test for each 305 m (1000 feet) of joint length thereafter or one test per each floor per elevation.

B. Inspect joints for complete fill, for absence of voids, and for joint configuration complying with specified requirements. Record results in a field adhesion test log.

C. Inspect tested joints and report on following:
   1. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each type of product and joint substrate.
   2. Compare these results to determine if adhesion passes sealant manufacturer’s field-adhesion hand-pull test criteria.
   3. Whether sealants filled joint cavities and are free from voids.
   4. Whether sealant dimensions and configurations comply with specified requirements.

D. Record test results in a field adhesion test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant fill, sealant configuration, and sealant dimensions.

E. Repair sealants pulled from test area by applying new sealants following same procedures used to originally seal joints. Ensure that original sealant surfaces are clean and new sealant contacts original sealant.

F. Evaluation of Field-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements, will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.7 CLEANING:

A. Fresh compound accidentally smeared on adjoining surfaces: Scrape off immediately and rub clean with a solvent as recommended by manufacturer of the adjacent material or if not otherwise indicated by the caulking or sealant manufacturer.

B. Leave adjacent surfaces in a clean and unstained condition.

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SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Hollow metal doors hung in hollow metal frames at interior and exterior locations.

1.2 RELATED REQUIREMENTS

A. Frames fabricated of structural steel: Section 05 50 00, METAL FABRICATIONS.

B. Door Hardware: Section 08 71 00, DOOR HARDWARE.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American National Standard Institute (ANSI):

1. A250.8-2014 - Standard Steel Doors and Frames.

C. ASTM International (ASTM):

1. A240/A240M-15b - Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
2. A653/A653M-15 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip.
3. A1008/A1008M-15 - Steel, Sheet, Cold-Rolled, Carbon, Structural, High Strength Low Alloy and High Strength Low Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
4. B209-14 - Aluminum and Aluminum-Alloy Sheet and Plate.
5. B209M-14 - Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
6. B221-14 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
7. B221M-13 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).
8. D3656/D3656M-13 - Insect Screening and Louver Cloth Woven from Vinyl Coated Glass Yarns.
9. E90-09 - Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

D. Federal Specifications (Fed. Spec.):

1. L-S-125B - Screening, Insect, Nonmetallic.

E. Master Painters Institute (MPI):

1. No. 18 - Primer, Zinc Rich, Organic.

F. National Association of Architectural Metal Manufacturers (NAAMM):
1. AMP 500-06 - Metal Finishes Manual.

G. National Fire Protection Association (NFPA):
1. 80-16 - Fire Doors and Other Opening Protectives.

H. UL LLC (UL):
1. 10C-09 - Positive Pressure Fire Tests of Door Assemblies.
2. 1784-15 - Air Leakage Tests of Door Assemblies and Other Opening Protectives.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:
1. Show size, configuration, and fabrication and installation details.

C. Manufacturer's Literature and Data:
1. Description of each product.
2. Include schedule showing each door and frame requirements, fire label, and smoke control label for openings.
3. Installation instructions.

D. Test reports: Certify products comply with specifications.

E. Qualifications: Substantiate qualifications comply with specifications.
1. Manufacturer with project experience list.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. Regularly manufactures specified products.
2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.

1.6 DELIVERY

A. Fasten temporary steel spreaders across the bottom of each door frame before shipment.

B. Deliver products in manufacturer's original sealed packaging.

C. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.

D. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Design hollow metal doors and frames complying with specified performance:

1. Fire Doors and Frames: UL 10C; NFPA 80 labeled.
   a. Fire Ratings: See drawings.
2. Stair Doors: Temperature rise rated fire doors.
3. Smoke Control Doors and Frames: UL 1784; NFPA 80 labeled, maximum 0.15424 cu. m/s/sq. m (3.0 cfm/sf) at 24.9 Pa (0.10 inches water gage) pressure differential.
4. Sound Rated Doors and Frames: Minimum 45 sound transmission class (STC) when tested according to ASTM E90.

2.2 MATERIALS

A. Stainless Steel: ASTM A240/A240M; Type 304.

B. Sheet Steel: ASTM A1008/A1008M, cold-rolled.

C. Galvanized Sheet Steel: ASTM A653.

D. Insect Screening: ASTM D3656/D3656M, 18 by 18 aluminum wire mesh.

E. Aluminum Sheet: ASTM B209M (ASTM B209).

F. Aluminum Extrusions: ASTM B221M (ASTM B221).

2.3 PRODUCTS - GENERAL

A. Basis of Design – match existing finishes.

B. Provide hollow metal doors and frames from one manufacturer.

2.4 HOLLOW METAL DOORS

A. Hollow Metal Doors: ANSI A250.8; 44 mm (1-3/4 inches) thick.

B. Interior Doors: Level 1 and Physical Performance Level C, standard duty; Model 2, seamless at all locations.

C. Door Faces:

1. Interior Doors: Z120 or ZF120 (G40 or A40) coating.

2. Exterior Doors: Z120 or ZF120 (G40 or A40) coating.

D. Door Cores:

1. Interior Doors: Kraft paper honeycomb.
2. Exterior Doors: Polystyrene or polyurethane.
3. Fire Doors: Manufacturer's standard complying with specified fire rating performance.

2.5 HOLLOW METAL FRAMES

A. Hollow Metal Frames: ANSI A250.8; face welded. See drawings for sizes and designs.

1. Interior Frames:
   a. Level 1 Hollow Metal Doors: 1.0 mm (0.042 inch) thick.
   b. Level 2 and Level 3 Hollow Metal Doors: 1.3 mm (0.053 inch) thick.
   c. Level 1 Hollow Metal Doors: 1.0 mm (0.042 inch) thick.

B. Frame Materials:

1. Interior Frames: Galvanized sheet steel minimum Z180 or ZF180 (G60 or A60) coating.
2. Exterior Frames: Z180 or ZF180 (G60 or A60).

2.6 LOUVERS

A. Louver Style: permitting free ventilation.

1. Provide insect screen and wire guards at exterior doors.

2.7 FABRICATION

A. Hardware Preparation: ANSI A250.8; for hardware specified in Section 08 71 00, DOOR HARDWARE.

B. Hollow Metal Door Fabrication:

1. Close top edge of exterior doors flush and seal to prevent water intrusion.
2. Fill spaces between vertical steel stiffeners with insulation.

C. Fire Doors:

1. Close top and vertical edges flush.
2. Apply steel astragal to active leaf at pair and double egress doors.
   a. Exception: Where vertical rod exit devices are specified for both leaves swinging in same direction.

D. Hollow Metal Frame Fabrication:

1. Fasten mortar guards to back of hardware reinforcements, except on lead-lined frames.

2. Concealed Closers in Head Frame: Provide 1 mm (0.042 inch) thick steel removable stop sections for access to concealed face plates and control valves, except when cover plates are furnished with closer.
3. Terminated Stops: ANSI A250.8.
4. Borrowed Light and Panel Opening Frames:
   a. Provide integral stop on exterior, corridor, or secure side of door.
   b. Design rabbet width and depth to receive glazing material or panel shown on drawings.
5. Frame Anchors:
   a. Floor anchors:
      1) Provide extension type floor anchors to compensate for depth of floor fills.
      2) Provide 1.3 mm (0.053 inch) thick steel clip angles welded to jamb and drilled to receive floor fasteners.
      3) Provide 50 mm by 50 mm by 9 mm (2 inch by 2 inch by 3/8 inch) clip angle for lead lined frames, drilled for floor fasteners.
      4) Provide mullion 2.3 mm (0.093 inch) thick steel channel anchors, drilled for two floor fasteners and frame anchor screws.
      5) Provide continuous 1 mm (0.042 inch) thick steel rough bucks drilled for floor fasteners and frame anchor screws for sill sections.
         a) Space floor bolts50 mm (24 inches) on center.
   b. Jamb anchors:
      1) Place anchors on jambs:
         a) Near top and bottom of each frame.
         b) At intermediate points at maximum 600 mm (24 inches) spacing.
      2) Form jamb anchors from steel minimum 1 mm (0.042 inch) thick.
      3) Anchors set in masonry: Provide adjustable anchors designed for friction fit against frame and extended into masonry minimum 250 mm (10 inches). Provide one of following types:
         a) Wire Loop Type: 5 mm (3/16 inch) diameter wire.
         b) T-Shape type.

c) Strap and stirrup type: Corrugated or perforated sheet steel.

4) Anchors for stud partitions: Provide tabs for securing anchor to sides of studs. Provide one of the following:
   a) Welded type.
   b) Lock-in snap-in type.

5) Anchors for frames set in prepared openings:
   a) Steel pipe spacers 6 mm (1/4 inch) inside diameter, welded to plate reinforcing at jamb stops, or hat shaped formed strap spacers 50 mm (2 inches) wide, welded to jamb near stop.
   b) Drill jamb stop and strap spacers for 6 mm (1/4 inch) flat head bolts to pass through frame and spacers.
   c) Two piece frames: Subframe or rough buck drilled for 6 mm (1/4 inch) bolts.

6) Anchors for observation windows and other continuous frames set in stud partitions.
   a) Weld clip anchors to sills and heads of continuous frames over 1200 mm (4 feet) long.
   b) Space maximum 600 mm (24 inches) on centers.

7) Modify frame anchors to fit special frame and wall construction.

8) Provide special anchors where shown on drawings and where required to suit application.

E. Sound Rated Door Frames:
   1. Seals: Integral continuous gaskets on frames.

F. Louver Fabrication:
   1. Fabricate louvers as complete units.
   2. Weld stationary blades to frames.
   3. Factory install louvers in door cutouts, welded to door.

G. Louver Screen Fabrication:
   1. Fabricate frame to hold wire fabric in channel with retaining bar anchor and to mount on surface of door with screws.
   2. Do not lap frame over louver opening.
   3. Miter frame corners and join by concealed mechanical fastenings extending about 57 mm (2-1/4 inches) into ends of each member.
   4. Drill frame and doors for screw attachment:

a. Space screws 50 mm (2 inches) from end of each leg of frame and maximum 300 mm (12 inches) on center.

5. Insect Screens: Fasten insect screens to interior side of doors with retaining bar against door and not exposed to view.
6. Wire Guards: Fasten wire guard to exterior side of door with retaining bar against door and not exposed to view.

2.8 FINISHES

A. Galvanized Steel: ANSI A250.8; shop primed.
B. Stainless Steel: NAAMM AMP 500; No. 4 polished finish.
   1. Blend welds to match adjacent finish.
C. Finish exposed surfaces after fabrication.
D. Aluminum Anodized Finish: NAAMM AMP 500.
   1. Clear Anodized Finish: AA-C22A41; Class I Architectural, 0.018 mm (0.7 mil) thick.
   2. Color Anodized Finish: AA-C22A42 or AA-C22A44; Class I Architectural, 0.018 mm (0.7 mil) thick.
   3. Clear Anodized Finish: AA-C22A31; Class II Architectural, 0.01 mm (0.4 mil) thick.
   4. Color Anodized Finish: AA-C22A32 or AA-C22A34; Class II Architectural, 0.01 mm (0.4 mil) thick.

2.9 ACCESSORIES

A. Primers: ANSI A250.8.
B. Barrier Coating: ASTM D1187/D1187M.
C. Welding Materials: AWS D1.1/D1.1M, type to suit application.
D. Clips Connecting Members and Sleeves: Match door faces.
E. Fasteners: Galvanized steel.
   1. Metal Framing: Steel drill screws.
   2. Masonry and Concrete: Expansion bolts.
F. Anchors: Galvanized steel.
G. Galvanizing Repair Paint: MPI No. 18.
H. Insulation: Unfaced mineral wool.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.
B. Protect existing construction and completed work from damage.

C. Apply barrier coating to metal surfaces in contact with cementitious materials to minimum 0.7 mm (30 mils) dry film thickness.

3.2 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.
   1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
   2. Install fire doors and frames according to NFPA 80.
   3. Install smoke control doors and frames according to NFPA 105.

3.3 FRAME INSTALLATION

A. Apply barrier coating to concealed surfaces of frames built into masonry.
B. Plumb, align, and brace frames until permanent anchors are set.
   1. Use triangular bracing near each corner on both sides of frames with temporary wood spreaders at midpoint.
   2. Use wood spreaders at bottom of frame when shipping spreader is removed.
   3. Where construction permits concealment, leave shipping spreaders in place after installation, otherwise remove spreaders when frames are set and anchored.
   4. Remove wood spreaders and braces when walls are built and jamb anchors are secured.
C. Floor Anchors:
   1. Anchor frame jambs to floor with two expansion bolts.
      a. Lead Lined Frames: Use 9 mm (3/8 inch) diameter bolts.
      b. Other Frames: Use 6 mm (1/4 inch) diameter bolts.
   2. Power actuated drive pins are acceptable to secure frame anchors to concrete floors.
D. Jamb Anchors:
   1. Masonry Walls:
      a. Embed anchors in mortar.
      b. Fill space between frame and masonry with grout or mortar as walls are built.
   2. Metal Framed Walls: Secure anchors to sides of studs with two fasteners through anchor tabs.
   3. Prepared Masonry and Concrete Openings:

a. Direct Securement: 6 mm (1/4 inch) diameter expansion bolts through spacers.

b. Subframe or Rough Buck Securement:

1) 6 mm (1/4 inch) diameter expansion bolts on 600 mm (24 inch) centers.

2) Power activated drive pins on 600 mm (24 inches) centers.

c. Secure two-piece frames to subframe or rough buck with machine screws on both faces.

E. Touch up damaged factory finishes.

1. Repair galvanized surfaces with galvanized repair paint.

2. Repair painted surfaces with touch up primer.

3.4 DOOR INSTALLATION

A. Install doors plumb and level.

B. Adjust doors for smooth operation.

C. Touch up damaged factory finishes.

1. Repair galvanized surfaces with galvanized repair paint.

2. Repair painted surfaces with touch up primer.

3.5 CLEANING

A. Clean exposed door and frame surfaces. Remove contaminants and stains.

3.6 PROTECTION

A. Protect doors and frames from construction operations.

B. Remove protective materials immediately before acceptance.

C. Repair damage.

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SECTION 08 31 13
ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Access doors and panels installed in walls and ceilings.

1.2 RELATED REQUIREMENTS

A. Lock Cylinders: Section 08 71 00, DOOR HARDWARE.

B. Field Painting: Section 09 91 00, PAINTING.

C. Finish Color: match existing

D. Access Doors for Plumbing Valves: Section 21 40 00, PLUMBING FIXTURES.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American Welding Society (AWS):

1. D1.3/D1.3M-08 - Structural Welding Code - Sheet Steel.

C. ASTM International (ASTM):

1. A653/A653M-15 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Sip Process.
2. A1008/A1008M-15 - Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Baked Hardenable.
3. A666-15 - Annealed or Cold-Worked Austenitic Stainless Steel sheet, Strip, Plate, and Flat Bar.
4. E119-15 - Fire Test of Building Construction and Materials.

D. National Fire Protection Association (NFPA):

1. 80-16 - Fire Doors and Other Opening Protectives.
2. 251-12 - Fire Tests of Door Assemblies.

E. National Association of Architectural Metal Manufacturers (NAAMM):

1. AMP 500-06 - Metal Finishes Manual.

F. UL LLC (UL):

1. Listed - Online Certifications Directory.
2. 10B-08 - Standard for Fire Tests of Door Assemblies.
3. 263-11 - Fire Tests of Building Construction and Materials.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:

1. Show size, configuration, and fabrication and installation details.

C. Manufacturer's Literature and Data:

1. Description of each product.
2. Installation instructions.

1.5 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.6 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify field conditions affecting access door fabrication and installation. Show field measurements on Submittal Drawings.

1. Coordinate field measurement and fabrication schedule to avoid delay.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel Sheet: ASTM A1008/A1008M.

B. Galvanized Steel: ASTM A 653/A 653M.

C. Stainless Steel: ASTM A666; Type 302 or Type 304.

2.2 PRODUCTS - GENERAL

A. Provide each product from one manufacturer.

2.3 ACCESS DOORS, FIRE-RATED (IN FIRE RATED WALLS)

A. Door Construction:
   1. Ceiling Access Door Construction: ASTM E119 or UL 263.
   2. Wall Access Doors: NFPA 252 or UL 10B.
B. Label: Class B opening according to UL 10B or test by another nationally recognized laboratory. 1 hour fire-rated with maximum temperature rise of 120 degrees C (216 degrees F).
C. Door Panel: Minimum 0.9 mm (0.0359 inch) thick steel sheet, with mineral-fiber insulation core, insulated sandwich type construction.
D. Frame: Minimum 1.5 mm (0.0598 inch) thick steel sheet, depth and configuration to suit material and construction type where installed.
   1. Frame Flange: Provide at units installed in concrete, masonry, or gypsum board.
   2. Exposed Joints in Flange: Weld and grind smooth.
   3. Provide expanded galvanized metal lath perimeter wings when installed in plaster, except veneer plaster.
E. Provide automatic closing device.
F. Hinge: Continuous stainless steel hinge with stainless steel pin.
G. Lock: Self-latching, mortise type with provision for fitting flush a standard screw-in type lock cylinder.
   1. Lock cylinder specified in Section 08 71 00, DOOR HARDWARE.
   2. Latch release device operable from inside of door.
H. Anchors for Fire-Rated Access Doors: Comply with requirements of applicable fire test.

2.4 ACCESS DOORS, FLUSH PANEL, NON-RATED

A. Door Panel:
   1. 1.5 mm (0.06 inch) thick steel sheet.
   2. Reinforce to maintain flat surface.
B. Frame:
   1. 1.5 mm (0.06 inch) thick stainless steel sheet, depth and configuration to suit material and construction type where installed.
   2. Frame Flange: Provide at units installed in concrete, masonry, and gypsum board.
   3. Exposed Joints in Flange: Weld and grind smooth.
C. Hinge:

1. Concealed spring hinge, 175 degrees of opening.

D. Lock:

1. Flush, screwdriver-operated cam lock.
2. Tamper proof screws (spanner head locks) for access panels in Behavioral / Mental Health Areas.
3. Provide anti-ligature locks in all Behavioral / Mental Health areas. See drawings for location.

2.5 FABRICATION - GENERAL

A. Size: Minimum 600 mm (24 inches) square door unless otherwise shown or required to suit opening in suspension system of ceiling.

B. Component Fabrication: Straight, square, flat and in same plane where required.

1. Exposed Edges: Slightly rounded, without burrs, snags and sharp edges.
2. Exposed Welds: Continuous, ground smooth.
3. Welding: AWS D1.3/D1.3M.

C. Locks and Non-Continuous Hinges: Provide in numbers required to maintain alignment of door panel with frame. For fire-rated doors, provide hinges and locks as required by fire test.

D. Anchoring: Make provisions in frame for anchoring to adjacent construction. Provide anchors in size, number and location on four sides to secure access door to substrate. Provide anchors as required by fire test.

2.6 FINISHES

A. Steel Paint Finish:

1. Powder-Coat Finish: Manufacturer's standard two-coat finish system consisting of the following:
   a. One coat primer.
   b. One coat thermosetting topcoat.
   c. Dry-film Thickness: 0.05 mm (2 mils) minimum.
   d. Color: Match existing or adjacent surfaces.

2.7 ACCESSORIES

A. Fasteners: Type and size recommended by access door manufacturer, to suit application.

1. Stainless Steel Access Doors: Stainless steel fasteners.

2. Other Access Doors: Stainless steel fasteners.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.
   1. Verify access door locations and sizes provide required maintenance access to installed building services components.
B. Protect existing construction and completed work from damage.

3.2 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.
   1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
B. Install access doors and panels permitting access to service valves, traps, dampers, cleanouts, and other mechanical, electrical and conveyor control items concealed in walls and partitions, and concealed above gypsum board and plaster ceilings.
C. Install fire rated access door according to NFPA 80.
D. Install fire-rated doors in fire-rated partitions and ceilings.
E. Install flush access panels in partitions and in gypsum board and plaster ceilings.

3.3 ACCESS DOOR AND FRAME INSTALLATION

A. Wall Installations: Install access doors in openings with sides vertical.
B. Ceiling Installations: Install access doors parallel to ceiling suspension grid or room partitions.
C. Frames without Flanges: Install frame flush with surrounding finish surfaces.
D. Frames with Flanges: Overlap opening, with face uniformly spaced from finish surface.
E. Recessed Panel Access Doors: Install with face of surrounding materials flush with door panel installed finish.
F. Secure frames to adjacent construction with fasteners.

G. Install type, size and quantity of anchoring device suitable for material surrounding opening to maintain alignment, and resist displacement, during normal use of access door.

H. Field Painting Primed Access Doors: Comply with the requirements of Section 09 91 00, PAINTING.

3.4 ADJUSTMENT

A. Adjust hardware so door panel opens freely.

B. Adjust door when closed so door panel is centered in frame.

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SECTION 08 41 13
ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed windows.

1.2 RELATED REQUIREMENTS

A. Glass and Glazing: Section 08 80 00, GLAZING.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American Architectural Manufacturers Associations (AAMA):

2603-22.....Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels

2604-22.....Performance Requirements and Test Procedures or High Performance Organic Coatings on Architectural Extrusions and Panels

2605-22.....Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels

C. American Welding Society (AWS):

D1.2/D1.2M-14.....Structural Welding Code - Aluminum

D. ASTM International (ASTM):

A240/A240M-22b.....Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

B209-21a.....Aluminum and Aluminum-Alloy Sheet and Plate.

B221-21.....Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

Profiles, and Tubes (Metric)

D1187/D1187M-97(2018)...Asphalt-Base Emulsions for Use as Protective Coatings for Metal

E283/E283M-19.....Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen

E330/E330M-14(2021).....Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference

E331-00(2016).....Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

E1886-19.....Performance of Exterior Windows, Curtain Walls, Doors, and Impact Protective Systems Impacted by Missiles and Exposes to Cyclic Pressure Differentials

E1996-17.....Performance of Exterior Windows, Curtain Walls, Doors, and impact Protective Systems Impacted by Windborne Debris in Hurricanes

F468-16.....Nonferrous Bolts, Hex Cap Screws, and Studs for General Use

F593-22.....Stainless Steel Bolts, Hex Cap Screws, and Studs

E. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500-06.....Metal Finishes Manual

F. National Fenestration Rating Council (NFRC):

500-14(E1A0).....Determining Fenestration Product Condensation Resistance Values

1.4 PREINSTALLATION MEETINGS

A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.

1. Required Participants:
   a. Contracting Officer's Representative.
   b. Contractor.
   c. Installer.
2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
   a. Installation schedule.
   b. Installation sequence.
   c. Preparatory work.
   d. Protection before, during, and after installation.
   e. Installation.
   f. Terminations.

g. Transitions and connections to other work.

h. Other items affecting successful completion.

3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:

1. Show size, configuration, and fabrication and installation details.
2. Show anchorage and reinforcement.
3. Show interface and relationship to adjacent work, including thermal, air, and water barrier continuity.

C. Manufacturer's Literature and Data:

1. Description of each product.
2. Window construction.
3. Installation instructions.
4. Warranty.

D. Sustainable Construction Submittals:

1. Recycled Content: Identify post-consumer and pre-consumer recycled content percentage by weight.

E. Test reports: Certify products comply with specifications.

F. Certificates: Certify products comply with specifications.

1. Certify anodized finish thickness.

G. Qualifications: Substantiate qualifications comply with specifications.

1. Manufacturer.
2. Installer with project experience list.
3. Welders and welding procedures.

H. Operation and Maintenance Data:

1. Care instructions for each exposed finish product.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Regularly manufactures specified products.

B. Installer Qualifications:

1. Regularly installs specified products.
2. Installed specified products with satisfactory service on five similar installations for minimum three years.

a. Project Experience List: Provide contact names and addresses for completed projects.

C. Welders and Welding Procedures Qualifications: AWS D1.2/D1.2M.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

D. Store products indoors in dry, weathertight conditioned facility.

E. Protect products from damage during handling and construction operations.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Manufacturer's Warranty: Warrant painted finish against material and manufacturing defects.

1. Warranty Period: 20 years.

PART 2 - PRODUCTS

2.1 SYSTEM PERFORMANCE

A. Design aluminum framed windows complying with specified performance:

a. Maximum Deflection: 1/175 of span, maximum with minimum 1.65 safety factor.

2. Thermal Movement: Accommodate ambient temperature range of 67 degrees C (120 degrees Fahrenheit).

3. Water Resistance: ASTM E331; No uncontrolled penetration at380 Pa (8 pounds/square foot), minimum, pressure differential.

4. Fixed Framing Air Infiltration Resistance: ASTM E283; 0.30 liter/second/square meter (0.06 cubic foot/minute/square foot), maximum at 300 Pa (6.24 pounds/square foot), minimum, pressure differential.

2.2 MATERIALS

A. Aluminum:

1. Sheet Metal: ASTM B209M (ASTM B209), minimum 1.6 mm (0.063 inch) thick.

2. Extrusions: ASTM B221M (ASTM B221).

a. Framing: Minimum 3 mm (0.125 inch) wall thickness.

b. Glazing Beads, Moldings, and Trim: Minimum 1.25 mm (0.050 inch) thick.

c. Color Anodized Aluminum: Provide aluminum alloy required to produce specified color.

2.3 PRODUCTS - GENERAL

A. Provide aluminum framed windows from one manufacturer.

B. Sustainable Construction Requirements:

1. Aluminum Recycled Content: 50 percent total recycled content, minimum.

2.4 FRAMES

A. Framing Members: Extruded aluminum.

B. Stops: Provide integral fixed stops and glass rebates and snap-on removable stops.

C. Provide concealed screws, bolts and other fasteners.

D. Secure cover boxes to frames in back of lock strike cutouts.

2.5 FABRICATION

A. Form metal parts and fit and assemble joints, except joints designed to accommodate movement. Seal joints to resist air infiltration and water penetration.

B. Welding:

1. Make welds without distorting and discoloring exposed surfaces.

2. Clean and dress welds. Remove welding flux and weld spatter.

2.6 FINISHES

A. Aluminum Anodized Finish: NAAMM AMP 500.

1. Clear Anodized Finish: AA-C22A41; Class I Architectural, 0.018 mm (0.7 mil) thick.

2.7 ACCESSORIES

A. Dielectric Tape: Plastic, non-absorptive, with pressure sensitive adhesive; 0.18 to 0.25 mm (7 to 10 mils) thick.

B. Barrier Coating: ASTM D1187/D1187M.

C. Welding Materials: AWS D1.2/D1.2M, type to suit application.

D. Fasteners:

1. Aluminum: ASTM F468, Alloy 2024.

E. Anchors: Aluminum or stainless steel; type to suit application.

F. Galvanizing Repair Paint: MPI No. 18.

G. Touch-Up Paint: Match shop finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.
   1. Coordinate floor closer installation recessed into concrete slabs.
   2. Coordinate anchor installation built into masonry and concrete.
B. Protect existing construction and completed work from damage.
C. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.
D. Apply dielectric tape or barrier coating to aluminum surfaces in contact with dissimilar metals to minimum 0.7 mm (30 mils) dry film thickness.

3.2 INSTALLATION - GENERAL

A. Install products according to manufacturer's instructions and approved submittal drawings.
   1. When manufacturer's instructions deviate from specifications, submit proposed resolution for Contracting Officer's Representative consideration.
B. Install aluminum framed windows plumb and true, in alignment and to lines shown on drawings.
C. Anchor frames to adjoining construction at heads, jambs and sills.
D. Provide concealed aluminum clips to connect adjoining frame sections.
E. Touch up damaged factory finishes.
   1. Repair galvanized surfaces with galvanized repair paint.
   2. Repair painted surfaces with touch up primer.
F. Tolerances:
   1. Variation from Plumb, Level, Warp, and Bow: Maximum 3 mm in 3 meters (1/8 inch in 10 feet).
   2. Variation from Plane: Maximum3 mm in 3.65 meters (1/8 inch in 12 feet); 6 mm (1/4 inch) over total length.
   3. Variation from Alignment: Maximum 1.5 mm (1/16 inch) in-line offset and maximum3 mm (1/8 inch) corner offset.
   4. Variation from Square: Maximum 3 mm (1/8 inch) diagonal measurement differential.

3.3 PROTECTION, CLEANING AND REPAIRING

A. Clean exposed aluminum and glass surfaces. Remove contaminants and stains.
B. Protect aluminum-framed windows from construction operations.

C. Remove protective materials immediately before acceptance.

D. Repair damage.

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SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Door hardware and related items necessary for complete installation and operation of doors.

1.2 RELATED WORK

A. Caulking: Section 07 92 00 JOINT SEALANTS.

B. Application of Hardware:
Section 08 11 13, HOLLOW METAL DOORS AND FRAMES

C. Painting: Section 09 91 00, PAINTING.

1.3 GENERAL

A. All hardware shall comply with UFAS, (Uniform Federal Accessible Standards) unless specified otherwise.

B. Provide rated door hardware assemblies where required by most current version of the International Building Code (IBC).

C. Hardware for Labeled Fire Doors and Exit Doors: Conform to requirements of NFPA 80 for labeled fire doors and to NFPA 101 for exit doors, as well as to other requirements specified. Provide hardware listed by UL, except where heavier materials, large size, or better grades are specified herein under paragraph HARDWARE SETS. In lieu of UL labeling and listing, test reports from a nationally recognized testing agency may be submitted showing that hardware has been tested in accordance with UL test methods and that it conforms to NFPA requirements.

D. Hardware for application on metal and wood doors and frames shall be made to standard templates. Furnish templates to the fabricator of these items in sufficient time so as not to delay the construction.

E. The following items shall be of the same manufacturer, except as otherwise specified:
   1. Mortise locksets.
   2. Hinges for hollow metal and wood doors.
   3. Surface applied overhead door closers.
   4. Exit devices.
   5. Floor closers.

1.4 WARRANTY

A. Automatic door operators shall be subject to the terms of FAR Clause 52.246-21, except that the Warranty period shall be two years in lieu of one year for all items except as noted below:
   1. Locks, latchsets, and panic hardware: 5 years.
   2. Door closers and continuous hinges: 10 years.

1.5 MAINTENANCE MANUALS

A. In accordance with Section 01 00 00, GENERAL REQUIREMENTS Article titled "INSTRUCTIONS", furnish maintenance manuals and instructions on all door hardware. Provide installation instructions with the submittal documentation.

1.6 SUBMITTALS

A. Submittals shall be in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Submit 6 copies of the schedule per Section 01 33 23. Submit 2 final copies of the final approved schedules to VAMC Locksmith as record copies (VISN Locksmith if the VAMC does not have a locksmith).

B. Hardware Schedule: Prepare and submit hardware schedule in the following form:

Hardware Item	Quantity	Size	Reference Publication Type No.	Finish	Mfr. Name and Catalog No.	Key Control Symbols	UL Mark (if fire rated and listed)	ANSI/BHMA Finish Designation

C. Samples and Manufacturers' Literature:
   1. Samples: All hardware items (proposed for the project) that have not been previously approved by Builders Hardware Manufacturers Association shall be submitted for approval. Tag and mark all items with manufacturer's name, catalog number and project number.
   2. Samples are not required for hardware listed in the specifications by manufacturer's catalog number, if the contractor proposes to use the manufacturer's product specified.

D. Certificate of Compliance and Test Reports: Submit certificates that hardware conforms to the requirements specified herein. Certificates shall be accompanied by copies of reports as referenced. The testing shall have been conducted either in the manufacturer's plant and certified by an independent testing laboratory or conducted in an independent laboratory, within four years of submittal of reports for approval.

1.7 DELIVERY AND MARKING

A. Deliver items of hardware to job site in their original containers, complete with necessary appurtenances including screws, keys, and instructions. Tag one of each different item of hardware and deliver to COR for reference purposes. Tag shall identify items by Project Specification number and manufacturer's catalog number. These items shall remain on file in COR's office until all other similar items have been installed in project, at which time the COR will deliver items on file to Contractor for installation in predetermined locations on the project.

1.8 PREINSTALLATION MEETING

A. Convene a preinstallation meeting not less than 30 days before start of installation of door hardware. Require attendance of parties directly affecting work of this section, including Contractor and Installer, Architect, Project Engineer and VA Locksmith, Hardware Consultant, and Hardware Manufacturer’s Representative. Review the following:

1. Inspection of door hardware.
2. Job and surface readiness.
3. Coordination with other work.
4. Protection of hardware surfaces.
5. Substrate surface protection.
6. Installation.
7. Adjusting.
8. Repair.
9. Field quality control.
10. Cleaning.

1.9 INSTRUCTIONS

A. Hardware Set Symbols on Drawings: Except for protective plates, door stops, mutes, thresholds and the like specified herein, hardware requirements for each door are indicated on drawings by symbols.

Symbols for hardware sets consist of letters (e.g., "HW") followed by a number. Each number designates a set of hardware items applicable to a door type.

B. Keying: All cylinders shall be keyed into existing Great. Provide removable core cylinders that are removable only with a special key or tool without disassembly of knob or lockset. Cylinders shall be 7 pin type. Keying information shall be furnished at a later date by the COR.

C. Keying: A new Great Grandmaster key shall be established for this project. The key system shall be small format (Best size and profile) removable core type as previously described. The key blanks shall be protected by a utility patent with a minimum seven years remaining on the patent from the start of construction, and protected by contract-controlled distribution. The manufacturer shall furnish code pattern listings in both paper and electronic formats so keys may be reproduced by code.; provide electronic format in file type required by project's key control software. The manufacturer shall design the new key system with the capacity to rekey the existing system and also provide for 25 percent expansion capability beyond this requirement. Submit a keying chart for approval showing proposed keying layout and listing expansion capacity.

1. Keying information will be furnished to the Contractor by the COR.
2. Supply information regarding key control of cylinder locks to manufacturers of equipment having cylinder type locks. Notify COR immediately when and to whom keys or keying information is supplied. Return all such keys to the COR.

1.10 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. In text, hardware items are referred to by series, types, etc., listed in such specifications and standards, except as otherwise specified.

B. American Society for Testing and Materials (ASTM):

F883-04.....Padlocks

E2180-07.....Standard Test Method for Determining the Activity of Incorporated Antimicrobial Agent(s) In Polymeric or Hydrophobic Materials

C. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA):

A156.1-06.....Butts and Hinges

A156.2-03.....Bored and Pre-assembled Locks and Latches

A156.3-08.....Exit Devices, Coordinators, and Auto Flush Bolts

A156.4-08.....Door Controls (Closers)

A156.5-14.....Cylinders and Input Devices for Locks.

A156.6-05.....Architectural Door Trim

A156.8-05.....Door Controls-Overhead Stops and Holders

A156.11-14.....Cabinet Locks

A156.12-05 .....Interconnected Locks and Latches

A156.13-05.....Mortise Locks and Latches Series 1000

A156.14-07 .....Sliding and Folding Door Hardware

A156.15-06.....Release Devices-Closer Holder, Electromagnetic and Electromechanical

A156.16-08.....Auxiliary Hardware

A156.17-04 .....Self-Closing Hinges and Pivots

A156.18-06.....Materials and Finishes

A156.20-06 .....Strap and Tee Hinges, and Hasps

A156.21-09.....Thresholds

A156.22-05.....Door Gasketing and Edge Seal Systems

A156.23-04.....Electromagnetic Locks

A156.24-03.....Delayed Egress Locking Systems

A156.25-07 .....Electrified Locking Devices

A156.26-06.....Continuous Hinges

A156.28-07 .....Master Keying Systems

A156.29-07 .....Exit Locks and Alarms

A156.30-03 .....High Security Cylinders

A156.31-07 .....Electric Strikes and Frame Mounted Actuators

A156.36-10.....Auxiliary Locks

A250.8-03.....Standard Steel Doors and Frames

D. National Fire Protection Association (NFPA):

80-10.....Fire Doors and Other Opening Protectives

101-09.....Life Safety Code

E. Underwriters Laboratories, Inc. (UL):

Building Materials Directory (2008)

PART 2 - PRODUCTS

2.1 BUTT HINGES

A. ANSI A156.1. Provide only three-knuckle hinges, except five-knuckle where the required hinge type is not available in a three-knuckle version (e.g., some types of swing-clear hinges). The following types of butt hinges shall be used for the types of doors listed, except where otherwise specified:

1. Exterior Doors: Type A2112/A5112 for doors 900 mm (3 feet) wide or less and Type A2111/A5111 for doors over 900 mm (3 feet) wide. Hinges for exterior outswing doors shall have non-removable pins. Hinges for exterior fire-rated doors shall be of stainless steel material.
2. Interior Doors: Type A8112/A5112 for doors 900 mm (3 feet) wide or less and Type A8111/A5111 for doors over 900 mm (3 feet) wide. Hinges for doors exposed to high humidity areas (shower rooms, toilet rooms, kitchens, janitor rooms, etc. shall be of stainless steel material.

B. Provide quantity and size of hinges per door leaf as follows:

1. Doors up to 1210 mm (4 feet) high: 2 hinges.
2. Doors 1210 mm (4 feet) to 2260 mm (7 feet 5 inches) high: 3 hinges minimum.
3. Doors greater than 2260 mm (7 feet 5 inches) high: 4 hinges.
4. Doors up to 900 mm (3 feet) wide, standard weight: 114 mm x 114 mm (4-1/2 inches x 4-1/2 inches) hinges.
5. Doors over 900 mm (3 feet) to 1065 mm (3 feet 6 inches) wide, standard weight: 127 mm x 114 mm (5 inches x 4-1/2 inches).
6. Doors over 1065 mm (3 feet 6 inches) to 1210 mm (4 feet), heavy weight: 127 mm x 114 mm (5 inches x 4-1/2 inches).
7. Provide heavy-weight hinges where specified.
8. At doors weighing 330 kg (150 lbs.) or more, furnish 127 mm (5 inch) high hinges.

C. See Articles "MISCELLANEOUS HARDWARE" and "HARDWARE SETS" for pivots and hinges other than butts specified above and continuous hinges specified below.

2.2 CONTINUOUS HINGES

A. ANSI/BHMA A156.26, Grade 1-600.

1. Listed under Category N in BHMA's "Certified Product Directory."

B. General: Minimum 0.120-inch- (3.0-mm-) thick, hinge leaves with minimum overall width of 4 inches (102 mm); fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete

C. Continuous, Barrel-Type Hinges: Hinge with knuckles formed around a Teflon-coated 6.35mm (0.25-inch) minimum diameter pin that extends entire length of hinge.

1. Base Metal for Exterior Hinges: Stainless steel.
2. Base Metal for Interior Hinges: Steel.
3. Base Metal for Hinges for Fire-Rated Assemblies: Steel.
4. Provide with non-removable pin (hospital tip option) at lockable outswing doors.
5. Where required to clear adjacent casing, trim, and wall conditions and allow full door swing, provide wide throw hinges of minimum width required.
6. Provide with manufacturer’s cut-outs for separate mortised power transfers and/or mortised automatic door bottoms where they occur.
7. Where thru-wire power transfers are integral to the hinge, provide hinge with easily removable portion to allow easy access to wiring connections.
8. Where models are specified that provide an integral wrap-around edge guard for the hinge edge of the door, provide manufacturer’s adjustable threaded stud and machine screw mechanism to allow the door to be adjusted within the wrap-around edge guard.

2.3 DOOR CLOSING DEVICES

A. Closing devices shall be products of one manufacturer for each type specified.

2.4 OVERHEAD CLOSERS

A. Conform to ANSI A156.4, Grade 1.

B. Closers shall conform to the following:

1. The closer shall have minimum 50 percent adjustable closing force over minimum value for that closer and have adjustable hydraulic back check effective between 60 degrees and 85 degrees of door opening.
2. Where specified, closer shall have hold-open feature.

3. Size Requirements: Provide multi-size closers, sizes 1 through 6, except where multi-size closer is not available for the required application.
4. Material of closer body shall be forged or cast.
5. Arm and brackets for closers shall be steel, malleable iron or high strength ductile cast iron.
6. Where closers are exposed to the exterior or are mounted in rooms that experience high humidity, provide closer body and arm assembly of stainless steel material.
7. Closers shall have full size metal cover; plastic covers will not be accepted.
8. Closers shall have adjustable hydraulic back-check, separate valves for closing and latching speed, adjustable back-check positioning valve, and adjustable delayed action valve.
9. Provide closers with any accessories required for the mounting application, including (but not limited to) drop plates, special soffit plates, spacers for heavy-duty parallel arm fifth screws, bull-nose or other regular arm brackets, longer or shorter arm assemblies, and special factory templating. Provide special arms, drop plates, and templating as needed to allow mounting at doors with overhead stops and/or holders.
10. Closer arms or backcheck valve shall not be used to stop the door from overswing, except in applications where a separate wall, floor, or overhead stop cannot be used.
11. Provide parallel arm closers with heavy duty rigid arm.
12. Where closers are to be installed on the push side of the door, provide parallel arm type except where conditions require use of top jamb arm.
13. Provide all surface closers with the same body attachment screw pattern for ease of replacement and maintenance.
14. All closers shall have a 1 ½" (38mm) minimum piston diameter.

2.5 DOOR STOPS

A. Conform to ANSI A156.16.

B. Provide door stops wherever an opened door or any item of hardware thereon would strike a wall, column, equipment or other parts of building construction. For concrete, masonry or quarry tile construction, use lead expansion shields for mounting door stops.

C. Where cylindrical locks with turn pieces or pushbuttons occur, equip wall bumpers Type L02251 (rubber pads having concave face) to receive turn piece or button.

D. Provide floor stops (Type L02141 or L02161 in office areas; Type L02121 x 3 screws into floor elsewhere. Wall bumpers, where used, must be installed to impact the trim or the door within the leading half of its width. Floor stops, where used, must be installed within 4-inches of the wall face and impact the door within the leading half of its width.

E. Where drywall partitions occur, use floor stops, Type L02141 or L02161 in office areas, Type L02121 elsewhere.

F. Provide stop Type L02011, as applicable for exterior doors. At outswing doors where stop can be installed in concrete, provide stop mated to concrete anchor set in 76mm (3-inch) core-drilled hole and filled with quick-setting cement.

G. Omit stops where floor mounted door holders are required and where automatic operated doors occur.

H. Provide appropriate roller bumper for each set of doors (except where closet doors occur) where two doors would interfere with each other in swinging.

I. Provide appropriate door mounted stop on doors in individual toilets where floor or wall mounted stops cannot be used.

J. Provide overhead surface applied stop Type C02541, ANSI A156.8 on patient toilet doors in bedrooms where toilet door could come in contact with the bedroom door.

K. Provide door stops on doors where combination closer magnetic holders are specified, except where wall stops cannot be used or where floor stops cannot be installed within 4-inches of the wall.

L. Where the specified wall or floor stop cannot be used, provide concealed overhead stops (surface-mounted where concealed cannot be used).

2.6 OVERHEAD DOOR STOPS AND HOLDERS

A. Conform to ANSI Standard A156.8. Overhead holders shall be of sizes recommended by holder manufacturer for each width of door. Set overhead holders for 110 degree opening, unless limited by building construction or equipment. Provide Grade 1 overhead concealed slide type: stop-only at rated doors and security doors, hold-open type with exposed hold-open on/off control at all other doors requiring overhead door stops.

2.7 FLOOR DOOR HOLDERS

A. Conform to ANSI Standard A156.16. Provide extension strikes for Types L01301 and L01311 holders where necessary.

2.8 LOCKS AND LATCHES

A. Conform to ANSI A156.2. Locks and latches for doors 45 mm (1-3/4 inch) thick or over shall have beveled fronts. Lock cylinders shall have not less than seven pins. Cylinders for all locksets shall be removable core type. Cylinders shall be furnished with construction removable cores and construction master keys. Cylinder shall be removable by special key or tool. Construct all cores so that they will be interchangeable into the core housings of all mortise locks, rim locks, cylindrical locks, and any other type lock included in the Great Grand Master Key System. Disassembly of lever or lockset shall not be required to remove core from lockset. All locksets or latches on double doors with fire label shall have latch bolt with 19 mm (3/4 inch) throw, unless shorter throw allowed by the door manufacturer’s fire label. Provide temporary keying device or construction core to allow opening and closing during construction and prior to the installation of final cores.

B. In addition to above requirements, locks and latches shall comply with following requirements:

1. Mortise Lock and Latch Sets: Conform to ANSI/BHMA A156.13. Mortise locksets shall be series 1000, minimum Grade 2. All locksets and latchsets, except on designated doors in Psychiatric (Mental Health) areas, shall have lever handles fabricated from cast stainless steel. Provide sectional (lever x rose) lever design matching existing hardware. No substitute lever material shall be accepted. All locks and latchsets shall be furnished with 122.55 mm (4-7/8-inch) curved lip strike and wrought box. At outswing pairs with overlapping astragals, provide flat lip strip with 21mm (7/8-inch) lip-to-center dimension. Lock function F02 shall be furnished with emergency tools/keys for emergency entrance. All lock cases installed on lead lined doors shall be lead lined before applying final hardware finish. Furnish armored fronts for all mortise locks. Where mortise locks are installed in high-humidity locations or where exposed to the exterior on both sides of the opening, provide non-ferrous mortise lock case.

2. Cylindrical Lock and Latch Sets: levers shall meet ADA (Americans with Disabilities Act) requirements. Cylindrical locksets shall be series 4000 Grade I. All locks and latchsets shall be furnished with 122.55 mm (4-7/8-inch) curved lip strike and wrought box. At outswing pairs with overlapping astragals, provide flat lip strip with 21mm (7/8-inch) lip-to-center dimension. Provide lever design to match design selected by Architect or to match existing lever design. Where two turn pieces are specified for lock F76, turn piece on inside knob shall lock and unlock inside knob, and turn piece on outside knob shall unlock outside knob when inside knob is in the locked position. (This function is intended to allow emergency entry into these rooms without an emergency key or any special tool.)
3. Auxiliary locks shall be as specified under hardware sets and conform to ANSI A156.36.
4. Locks on designated doors in Psychiatric (Mental Health) areas shall be paddle type with arrow projection covers and be UL Listed. Provide these locks with paddle in the down position on both sides of the door. Locks shall be fabricated of wrought stainless steel.
5. Privacy locks in non-mental-health patient rooms shall have an inside thumbturn for privacy and an outside thumbturn for emergency entrance. Single occupancy patient privacy doors shall typically swing out; where such doors cannot swing out, provide center-pivoted doors with rescue hardware (see HW-2B)

2.9 ARMOR PLATES, KICK PLATES, MOP PLATES AND DOOR EDGING

A. Conform to ANSI Standard A156.6.
B. Provide protective plates and door edging as specified below:
1. Kick plates, mop plates and armor plates of metal, Type J100 series.
2. Provide kick plates and mop plates where specified. Kick plates shall be 254 mm (10 inches) or 305 mm (12 inches) high. Mop plates shall be 152 mm (6 inches) high. Both kick and mop plates shall be minimum 1.27 mm (0.050 inches) thick. Provide kick and mop plates beveled on all 4 edges (B4E). On push side of doors where jamb stop extends to floor, make kick plates 38 mm (1-1/2 inches) less than width of door, except pairs of metal doors which shall have plates 25 mm (1 inch) less than width of each door. Extend all other kick

and mop plates to within 6 mm (1/4 inch) of each edge of doors. Kick and mop plates shall butt astragals. For jamb stop requirements, see specification sections pertaining to door frames.

3. Kick plates and/or mop plates are not required on following door sides:
   a. Armor plate side of doors;
   b. Exterior side of exterior doors;
   c. Closet side of closet doors;
   d. Both sides of aluminum entrance doors.
4. Armor plates for doors are listed under Article "Hardware Sets". Armor plates shall be thickness as noted in the hardware set, 875 mm (35 inches) high and 38 mm (1-1/2 inches) less than width of doors, except on pairs of metal doors. Provide armor plates beveled on all 4 edges (B4E). Plates on pairs of metal doors shall be 25 mm (1 inch) less than width of each door. Where top of intermediate rail of door is less than 875 mm (35 inches) from door bottom, extend armor plates to within 13 mm (1/2 inch) of top of intermediate rail. On doors equipped with panic devices, extend armor plates to within 13 mm (1/2 inch) of panic bolt push bar.
5. Where louver or grille occurs in lower portion of doors, substitute stretcher plate and kick plate in place of armor plate. Size of stretcher plate and kick plate shall be 254 mm (10 inches) high.
6. Provide stainless steel edge guards where so specified at wood doors. Provide mortised type instead of surface type except where door construction and/or ratings will not allow. Provide edge guards of bevel and thickness to match wood door. Provide edge guards with factory cut-outs for door hardware that must be installed through or extend through the edge guard. Provide full-height edge guards except where door rating does not allow; in such cases, provide edge guards to height of bottom of typical lockset armor front. Forward edge guards to wood door manufacturer for factory installation on doors.

2.10 EXIT DEVICES

A. Conform to ANSI Standard A156.3. Exit devices shall be Grade 1; type and function are specified in hardware sets. Provide flush with finished floor strikes for vertical rod exit devices in interior of building. Trim shall have cast satin stainless steel lever handles of

design similar to locksets, unless otherwise specified. Provide key cylinders for keyed operating trim and, where specified, cylinder dogging.

B. Surface vertical rod panics shall only be provided less bottom rod; provide fire pins as required by exit device and door fire labels. Do not provide surface vertical rod panics at exterior doors.

C. Concealed vertical rod panics shall be provided less bottom rod at interior doors, unless lockable or otherwise specified; provide fire pins as required by exit device and door fire labels. Where concealed vertical rod panics are specified at exterior doors, provide with both top and bottom rods.

D. Where removable mullions are specified at pairs with rim panic devices, provide mullion with key-removable feature.

E. At non-rated openings with panic hardware, provide panic hardware with key cylinder dogging feature.

F. Exit devices for fire doors shall comply with Underwriters Laboratories, Inc., requirements for Fire Exit Hardware. Submit proof of compliance.

2.11 FLUSH BOLTS (LEVER EXTENSION)

A. Conform to ANSI A156.16. Flush bolts shall be Type L24081 unless otherwise specified. Furnish proper dustproof strikes conforming to ANSI A156.16, for flush bolts required on lower part of doors.

B. Lever extension manual flush bolts shall only be used at non-fire-rated pairs for rooms only accessed by maintenance personnel.

C. Face plates for cylindrical strikes shall be rectangular and not less than 25 mm by 63 mm (1 inch by 2-1/2 inches).

D. Friction-fit cylindrical dustproof strikes with circular face plate may be used only where metal thresholds occur.

E. Provide extension rods for top bolt where door height exceeds 2184 mm (7 feet 2 inches).

2.12 DOOR PULLS WITH PLATES

A. Conform to ANSI A156.6. Pull Type J401, 152 mm CTC (6 inches CTC) length by 19 mm (3/4 inches) diameter minimum with plate Type J302, 90 mm by 381 mm (3-1/2 inches by 15 inches), unless otherwise specified. Provide pull with projection of 57.2 mm (2 1/4 inches) minimum and a clearance of 38.1 mm (1 1/2 inches) minimum. Cut plates of door pull plate for cylinders, or turn pieces where required.

2.13 THRESHOLDS

A. Conform to ANSI A156.21, mill finish extruded aluminum, except as otherwise specified. In existing construction, thresholds shall be installed in a bed of sealant with ¼-20 stainless steel machine screws and expansion shields. In new construction, embed aluminum anchors coated with epoxy in concrete to secure thresholds. Furnish thresholds for the full width of the openings.

B. For thresholds at elevators entrances see other sections of specifications.

C. At exterior doors and any interior doors exposed to moisture, provide threshold with non-slip abrasive finish.

D. Provide with miter returns where threshold extends more than 12 mm (0.5 inch) beyond face of frame.

2.14 WEATHERSTRIPS (FOR EXTERIOR DOORS)

A. Conform to ANSI A156.22. Air leakage shall not to exceed 0.50 CFM per foot of crack length (0.000774m^3/s/m).

2.15 MISCELLANEOUS HARDWARE

A. Access Doors (including Sheet Metal, Screen and Woven Wire Mesh Types): Except for fire-rated doors and doors to Temperature Control Cabinets, equip each single or double metal access door with Lock Type E07213, conforming to ANSI A156.11. Key locks as directed. Ship lock prepaid to the door manufacturer. Hinges shall be provided by door manufacturer.

B. Cylinders for Various Partitions and Doors: Key cylinders same as entrance doors of area in which partitions and door occur, except as otherwise specified. Provide cylinders to operate locking devices where specified for following partitions and doors:

1. Folding doors and partitions.
2. Wicket door (in roll-up door assemblies).
3. Slide-up doors.
4. Swing-up doors.
5. Fire-rated access doors-Engineer's key set.
6. Doors from corridor to electromagnetic shielded room.
7. Day gate on vault door.

C. Mutes: Conform to ANSI A156.16. Provide door mutes or door silencers Type L03011 or L03021, depending on frame material, of white or light gray color, on each steel or wood door frame, except at fire-rated frames, lead-lined frames and frames for sound-resistant, lightproof

and electromagnetically shielded doors. Furnish 3 mutes for single doors and 2 mutes for each pair of doors, except double-acting doors. Provide 4 mutes or silencers for frames for each Dutch type door. Provide 2 mutes for each edge of sliding door which would contact door frame.

2.16 PADLOCKS FOR VARIOUS DOORS, GATES AND HATCHES

A. ASTM E883, size 50 mm (2 inch) wide chain; furnish extended shackles as required by job conditions. Provide padlocks, with key cylinders, for each door in following areas as noted.

B. Key padlocks as follows:

1. Constant Temperature Rooms in Research Departments: Research Laboratory Set.
2. Cold Room in Morgue Department: Autopsy Set.
3. Refrigerators in Canteen Department: Canteen Storage Set.
4. All Refrigerator Rooms in Main Kitchen Department: Kitchen Storage Set.
5. Chain Link Fence Gates for Electrical Substation and other Fenced Buildings or Areas: Engineer's set, except as otherwise specified.
6. Chain Link Fence Gates for Oxygen Storage Buildings: Maintenance supply set.
7. Roof Access and Scuttles: Engineer's set.
8. Hinged Wicket in Post Office Partitions: Post Office set.

C. Omit padlocks on communicating refrigerator doors.

2.17 FINISHES

A. Exposed surfaces of hardware shall have ANSI A156.18, finishes as specified below. Finishes on all hinges, pivots, closers, thresholds, etc., shall be as specified below under "Miscellaneous Finishes." For field painting (final coat) of ferrous hardware, see Section 09 91 00, PAINTING.

B. 626 or 630: All surfaces on exterior and interior of buildings, except where other finishes are specified.

C. Miscellaneous Finishes:

1. Hinges --exterior doors: 626 or 630.
2. Hinges --interior doors: 652 or 630.
3. Pivots: Match door trim.
4. Door Closers: Factory applied paint finish. Dull or Satin Aluminum color.

5. Thresholds: Mill finish aluminum.
6. Cover plates for floor hinges and pivots: 630.
7. Other primed steel hardware: 600.

D. Hardware Finishes for Existing Buildings: U.S. Standard finishes shall match finishes of hardware in (similar) existing spaces.

E. Special Finish: Exposed surfaces of hardware for dark bronze anodized aluminum doors shall have oxidized oil rubbed bronze finish (dark bronze) finish on door closers shall closely match doors.

2.18 BASE METALS

A. Apply specified U.S. Standard finishes on different base metals as following:

Finish	**Base Metal**
652	Steel
626	Brass or bronze
630	Stainless steel

PART 3 - EXECUTION

3.1 HARDWARE HEIGHTS

A. For existing buildings locate hardware on doors at heights to match existing hardware. The Contractor shall visit the site, verify location of existing hardware and submit locations to VA COR for approval.

B. Hardware Heights from Finished Floor:

1. Exit devices centerline of strike (where applicable) 1024 mm (40-5/16 inches).
2. Locksets and latch sets centerline of strike 1024 mm (40-5/16 inches).
3. Deadlocks centerline of strike 1219 mm (48 inches).
4. Hospital arm pull 1168 mm (46 inches) to centerline of bottom supporting bracket.
5. Centerline of door pulls to be 1016 mm (40 inches).
6. Push plates and push-pull shall be 1270 mm (50 inches) to top of plate.
7. Push-pull latch to be 1024 mm (40-5/16 inches) to centerline of strike.
8. Locate other hardware at standard commercial heights. Locate push and pull plates to prevent conflict with other hardware.

3.2 INSTALLATION

A. Closer devices, including those with hold-open features, shall be equipped and mounted to provide maximum door opening permitted by building construction or equipment. Closers shall be mounted on side of door inside rooms, inside stairs, and away from corridors. At exterior doors, closers shall be mounted on interior side. Where closers are mounted on doors they shall be mounted with hex nuts and bolts; foot shall be fastened to frame with machine screws.

B. Hinge Size Requirements:

Door Thickness	**Door Width**	**Hinge Height**
45 mm (1-3/4 inch)	900 mm (3 feet) and less	113 mm (4-1/2 inches)
45 mm (1-3/4 inch)	Over 900 mm (3 feet) but not more than 1200 mm (4 feet)	125 mm (5 inches)
35 mm (1-3/8 inch) (hollow core wood doors)	Not over 1200 mm (4 feet)	113 mm (4-1/2 inches)

C. Hinge leaves shall be sufficiently wide to allow doors to swing clear of door frame trim and surrounding conditions.

D. Where new hinges are specified for new doors in existing frames or existing doors in new frames, sizes of new hinges shall match sizes of existing hinges; or, contractor may reuse existing hinges provided hinges are restored to satisfactory operating condition as approved by COR. Existing hinges shall not be reused on door openings having new doors and new frames. Coordinate preparation for hinge cut-outs and screw-hole locations on doors and frames.

E. Hinges Required Per Door:

Doors 1500 mm (5 ft) or less in height	2 butts
Doors over 1500 mm (5 ft) high and not over 2280 mm (7 ft 6 in) high	3 butts
Doors over 2280 mm (7 feet 6 inches) high	4 butts
Dutch type doors	4 butts
Doors with spring hinges 1370 mm (4 feet 6 inches) high or less	2 butts
Doors with spring hinges over 1370 mm (4 feet 6 inches)	3 butts

F. Fastenings: Suitable size and type and shall harmonize with hardware as to material and finish. Provide machine screws and lead expansion shields to secure hardware to concrete, ceramic or quarry floor tile, or solid masonry. Fiber or rawl plugs and adhesives are not permitted. All fastenings exposed to weather shall be of nonferrous metal.

G. After locks have been installed; show in presence of COR that keys operate their respective locks in accordance with keying requirements. (All keys, Master Key level and above shall be sent Registered Mail to the Medical Center Director along with the bitting list. Also a copy of the invoice shall be sent to the COR for his records.) Installation of locks which do not meet specified keying requirements shall be considered sufficient justification for rejection and replacement of all locks installed on project.

3.3 FINAL INSPECTION

A. Installer to provide letter to VA Resident/Project Engineer that upon completion, installer has visited the Project and has accomplished the following:
   1. Re-adjust hardware.
   2. Evaluate maintenance procedures and recommend changes or additions, and instruct VA personnel.
   3. Identify items that have deteriorated or failed.
   4. Submit written report identifying problems.

3.4 DEMONSTRATION

A. Demonstrate efficacy of mechanical hardware and electrical, and electronic hardware systems, including adjustment and maintenance procedures, to satisfaction of Resident/Project Engineer and VA Locksmith.

3.5 HARDWARE SETS

A. Following sets of hardware correspond to hardware symbols shown on drawings. Only those hardware sets that are shown on drawings will be required. Disregard hardware sets listed in specifications but not shown on drawings.

B. Hardware Consultant working on a project will be responsible for providing additional information regarding these hardware sets. The numbers shown in the following sets come from BHMA standards.

ELECTRIC HARDWARE ABBREVIATIONS LEGEND:

ADO = Automatic Door Operator

EMCH = Electro-Mechanical Closer-Holder

MHO = Magnetic Hold-Open (wall- or floor-mounted)

EXTERIOR SINGLE DOORS

HW-E3

Each Door to Have: NON-RATED

1	Continuous Hinge	x INTEGRAL HINGE GUARD CHANNEL X ADJUSTA-SCREWS
1	Storeroom Lock	F13-MOD x RIGID OUTSIDE LEVER x KEY RETRACTS DEADBOLT AND LATCHBOLT
1	Latch Protector (outswing dr)	
1	Closer	C02011/C02021
1	Edge Guard (@ Wood Doors)	J208M / J211 (VERIFY), CUT: HARDWARE
1	Armor Plate	J101 x 3.125 MM (0.125 INCH) THICKNESS
1	Overhead Holder	C01511-ADJUSTABLE
1	Threshold (outswing door)	J32120 x SILICONE GASKET
1	Threshold (inswing door)	ALUMINUM, PER ARCHITECTURAL DETAIL
1	Door Sweep	R0Y416
1	Set Frame Seals	R0Y164
1	Drip	R0Y976

HW-E5

Barn door to have Door to Have: NON-RATED

Barn door basis of design: National Hardware Farm & Commercial Sliding Door System.

1	Padlock	TYPE AS REQUIRED
2	Pulls	EXTERIOR GRADE 12”-18” HIGH MATTE BLACK FINISH

SECURITY HARDWARE ABBREVIATIONS LEGEND:

AC = Access Control Device (Card reader, biometric reader, keypad, etc.)

ADO = Automatic Door Operator

DEML = Delayed Egress Magnetic Lock

DEPH = Delayed Egress Panic Exit Device

DPS = Door Position Switch (Door or Alarm Contact)

EL = Electric Lock or Electric Lever Exit Device

PB = Push-button Combination Lock (stand-alone)

RR = Remote Release Button

ELR = Electric Latch Retraction Exit Device

REX = Request-to-Exit Switch in Latching Device Inside Trim

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SECTION 08 80 00
GLAZING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies the following:
   1. Glass.
   2. Glazing materials and accessories for both factory and field glazed assemblies.

1.2 RELATED WORK:

A. Sustainable Design Requirements: Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS.

1.3 LABELS:

A. Temporary labels:
   1. Provide temporary label on each light of glass identifying manufacturer or brand and glass type, quality and nominal thickness.
   2. Label in accordance with NFRC label requirements.
   3. Temporary labels shall remain intact until glass is approved by Contracting Officer Representative (COR).

B. Permanent labels:
   1. Locate in corner for each pane.
   2. Label in accordance with ANSI Z97.1 and SGCC label requirements.
      a. Tempered glass.
      b. Laminated glass or have certificate for panes without permanent label.
      c. Organic coated glass.

1.4 PERFORMANCE REQUIREMENTS:

A. General: Design glazing system consistent with guidance and practices presented in the GANA Glazing Manual, GANA Laminated Glazing Manual, and GANA Sealant Manual, as applicable to project. Installed glazing shall withstand applied loads, thermal stresses, thermal movements, building movements, permitted tolerances, and combinations of these conditions without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; unsafe engagement of the framing system; deflections beyond specified limits; or other defects in construction.

1.5 SUBMITTALS:

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Sustainable Design Submittals, as described below:

1. Volatile organic compounds per volume as specified in PART 2 - PRODUCTS.

C. Manufacturer Warranty (provide draft with Manuf. Literature & Data; provide final at closeout).

D. Manufacturer's Literature and Data:

1. Glass, each kind required.

E. Preconstruction Adhesion and Compatibility Test Report: Submit glazing sealant manufacturer’s test report indicating glazing sealants were tested for adhesion to glass and glazing channel substrates and for compatibility with glass and other glazing materials.

1.6 DELIVERY, STORAGE AND HANDLING:

A. Delivery: Schedule delivery to coincide with glazing schedules so minimum handling of crates is required. Do not open crates except as required for inspection for shipping damage.

B. Storage: Store cases according to printed instructions on case, in areas least subject to traffic or falling objects. Keep storage area clean and dry.

C. Handling: Unpack cases following printed instructions on case. Stack individual windows on edge leaned slightly against upright supports with separators between each.

D. Protect laminated security glazing units against face and edge damage during entire sequence of fabrication, handling, and delivery to installation location. Provide protective covering on exposed faces of glazing plastics, and mark inside as "INTERIOR FACE" or "PROTECTED FACE":

1. Treat security glazing as fragile merchandise and packaged and shipped in export wood cases with width end in upright position and blocked together in a mass. Storage and handling to comply with manufacturer's directions and as required to prevent edge damage or other damage to glazing resulting from effects of moisture, condensation, temperature changes, direct exposure to sun, other environmental conditions, and contact with chemical solvents.

2. Protect sealed-air-space insulating glazing units from exposure to abnormal pressure changes, as could result from substantial changes in altitude during delivery by air freight. Provide temporary breather tubes which do not nullify applicable warranties on hermetic seals.
3. Temporary protections: The glass front and polycarbonate back of glazing shall be temporarily protected with compatible, peelable, heat-resistant film which will be peeled for inspections and re-applied and finally removed after doors and windows are installed at destination. Since many adhesives will attack polycarbonate, the film used on exposed polycarbonate surfaces shall be approved and applied by manufacturer.
4. Edge protection: To cushion and protect glass clad, and polycarbonate edges from contamination or foreign matter, the four (4) edges shall be sealed the depth of glazing with continuous standard-thickness thermoplastic rubber tape. Alternatively, continuous channel shaped extrusion of thermoplastic rubber shall be used, with flanges extending into face sides of glazing.
5. Protect "Constant Temperature" units including every unit where glass sheet is directly laminated to or directly sealed with metal-tube type spacer bar to polycarbonate sheet, from exposures to ambient temperatures outside the range of 16 to 24 degrees C (60 to 75 degrees F), during the fabricating, handling, shipping, storing, installation, and subsequent protection of glazing.

1.7 PROJECT CONDITIONS:

Field Measurements: Field measure openings before ordering tempered glass products to assure for proper fit of field measured products.

1.8 WARRANTY:

A. Construction Warranty: Comply with the FAR clause 52.246-21 “Warranty of Construction”.

B. Manufacturer Warranty: Manufacturer shall warranty their glazing from the date of installation and final acceptance by the Government as follows. Submit manufacturer warranty.

1.9 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American Architectural Manufacturers Association (AAMA):

800.....Test Methods for Sealants

810.1-77.....Expanded Cellular Glazing Tape

C. American National Standards Institute (ANSI):

Z97.1-14.....Safety Glazing Material Used in Building - Safety Performance Specifications and Methods of Test

D. American Society of Civil Engineers (ASCE):

7-10.....Wind Load Provisions

E. ASTM International (ASTM):

C542-05(R2017).....Lock-Strip Gaskets

C716-06(2020).....Installing Lock-Strip Gaskets and Infill Glazing Materials

C794-18(2022).....Adhesion-in-Peel of Elastomeric Joint Sealants

C864-05(R2019).....Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers

C920-18.....Elastomeric Joint Sealants

C964-20.....Standard Guide for Lock-Strip Gasket Glazing

C1036-21.....Flat Glass

C1048-18.....Heat-Treated Flat Glass-Kind HS, Kind FT Coated and Uncoated Glass.

C1172-19.....Laminated Architectural Flat Glass

C1349-17.....Standard Specification for Architectural Flat Glass Clad Polycarbonate

C1376-21a.....Pyrolytic and Vacuum Deposition Coatings on Flat Glass

D635-22.....Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastic in a Horizontal Position

D4802-16.....Poly (Methyl Methacrylate) Acrylic Plastic Sheet

E84-26.....Surface Burning Characteristics of Building Materials

E119-22.....Standard Test Methods for Fire Test of Building Construction and Material

E1300-16.....Load Resistance of Glass in Buildings

E2141-21.....Test Methods for Assessing the Durability of Absorptive Electrochromic Coatings on Sealed Insulating Glass Units

E2190-19.....Insulating Glass Unit

E. Code of Federal Regulations (CFR):

16 CFR 1201-10.....Safety Standard for Architectural Glazing Materials

F. Glass Association of North America (GANA):

2010 Edition.....GANA Glazing Manual

2008 Edition.....GANA Sealant Manual

2009 Edition.....GANA Laminated Glazing Reference Manual

2010 Edition.....GANA Protective Glazing Reference Manual

G. International Code Council (ICC):

IBC.....International Building Code

H. Insulating Glass Certification Council (IGCC)

I. Insulating Glass Manufacturer Alliance (IGMA):

TB-3001-13.....Guidelines for Sloped Glazing

TM-3000.....North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use

J. Intertek Testing Services - Warnock Hersey (ITS-WHI)

K. National Fenestration Rating Council (NFRC)

L. Safety Glazing Certification Council (SGCC) 2012:

Certified Products Directory (Issued Semi-Annually).

M. Unified Facilities Criteria (UFC):

4-010-01-03(R2007).....DOD Minimum Antiterrorism Standards for Buildings

N. U.S. Veterans Administration:

Architectural Design Manual for VA Facilities (VASDM)

O. Environmental Protection Agency (EPA):

40 CFR 59(2014).....National Volatile Organic Compound Emission Standards for Consumer and Commercial Products

PART 2 - PRODUCT

2.1 GLASS:

A. Provide minimum thickness stated and as additionally required to meet performance requirements.

1. Provide minimum 6 mm (1/4 inch) thick glass units unless otherwise indicated.

B. Obtain glass units from single source from single manufacturer for each glass type.

C. Clear Glass:

1. ASTM C1036, Type I, Class 1, Quality q3.

2.3 GLAZING ACCESSORIES:

A. As required to supplement the accessories provided with the items to be glazed and to provide a complete installation. Ferrous metal accessories exposed in the finished work shall have a finish that will not corrode or stain while in service.

B. Setting Blocks: ASTM C864:

1. Silicone type.
2. Channel shape; having 6 mm (1/4 inch) internal depth.
3. Shore A hardness of 80 to 90 Durometer.
4. Block lengths: 50 mm (2 inches) except 100 to 150 mm (4 to 6 inches) for insulating glass.
5. Block width: Approximately 1.6 mm (1/16 inch) less than the full width of the rabbet.
6. Block thickness: Minimum 4.8 mm (3/16 inch). Thickness sized for rabbet depth as required.

C. Spacers: ASTM C864:

1. Channel shape having a 6 mm (1/4 inch) internal depth.
2. Flanges not less 2.4 mm (3/32 inch) thick and web 3 mm (1/8 inch) thick.
3. Lengths: 25 to 76 mm (1 to 3 inches).
4. Shore A hardness of 40 to 50 Durometer.

D. Glazing Tapes:

1. Semi-solid polymeric based closed cell material exhibiting pressure-sensitive adhesion and withstanding exposure to sunlight, moisture, heat, cold, and aging.
2. Shape, size and degree of softness and strength suitable for use in glazing application to prevent water infiltration.
3. Complying with AAMA 800 for the following types:
   a. AAMA 810.1, Type 1, for glazing applications in which tape acts as the primary sealant.

b. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

E. Spring Steel Spacer: Galvanized steel wire or strip designed to position glazing in channel or rabbeted sash with stops.

F. Glazing Clips: Galvanized steel spring wire designed to hold glass in position in rabbeted sash without stops.

G. Glazing Points (Sprigs): Pure zinc stock, thin, flat, triangular or diamond shaped pieces, 6 mm (1/4 inch) minimum size.

H. Glazing Gaskets: ASTM C864:

1. Firm dense wedge shape for locking in sash.
2. Soft, closed cell with locking key for sash key.
3. Flanges may terminate above the glazing-beads or terminate flush with top of beads.

I. Lock-Strip Glazing Gaskets: ASTM C542, shape, size, and mounting as indicated.

J. Glazing Sealants: ASTM C920, silicone neutral cure:

1. Type S.
2. Class 25 or 50 as recommended by manufacturer for application.
3. Grade NS.
4. Shore A hardness of 25 to 30 Durometer.
5. VOC Content: For sealants used inside the weatherproofing system, not more than 250 g/L or less when calculating according to 40 CFR 59, (EPA Method 24).

K. Neoprene, EPDM, or Vinyl Glazing Gasket: ASTM C864.

1. Channel shape; flanges may terminate above the glazing channel or flush with the top of the channel.
2. Designed for dry glazing.

L. Color:

1. Color of glazing compounds, gaskets, and sealants used for aluminum color frames to match color of the finished aluminum and be nonstaining.
2. Color of other glazing compounds, gaskets, and sealants which will be exposed in the finished work and unpainted shall be black, gray, or neutral color.

M. Smoke Removal Unit Targets: Adhesive targets affixed to glass to identify glass units intended for removal for smoke control. Comply with requirements of local Fire Department.

PART 3 - EXECUTION

3.1 EXAMINATION:

A. Verification of Conditions:
   1. Examine openings for glass and glazing units; determine they are proper size; plumb; square; and level before installation is started.
   2. Verify that glazing openings conform with details, dimensions and tolerances indicated on manufacturer is approved shop drawings.

B. Review for conditions which may adversely affect glass and glazing unit installation, prior to commencement of installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

C. Verify that wash down of adjacent masonry is completed prior to erection of glass and glazing units.

3.2 PREPARATION:

A. For sealant glazing, prepare glazing surfaces in accordance with GANA Sealant Manual.

B. Determine glazing unit size and edge clearances by measuring the actual unit to receive the glazing.

C. Shop fabricate and cut glass with smooth, straight edges of full size required by openings to provide GANA recommended edge clearances.

D. Verify that components used are compatible.

E. Clean and dry glazing surfaces.

F. Prime surfaces scheduled to receive sealants, as determined by preconstruction sealant-substrate testing.

3.3 INSTALLATION – GENERAL:

A. Install in accordance with GANA Glazing Manual, GANA Sealant Manual, IGMA TB-3001, and IGMA TM-3000 unless specified otherwise.

B. Glaze in accordance with recommendations of glazing and framing manufacturers, and as required to meet the Performance Test Requirements specified in other applicable sections of specifications.

C. Set glazing without bending, twisting, or forcing of units.

D. Do not allow glass to rest on or contact any framing member.

E. Glaze doors and operable sash, in a securely fixed or closed and locked position, until sealant, glazing compound, or putty has thoroughly set.

F. Tempered Glass: Install with roller distortions in horizontal position unless otherwise directed.

3.4 INSTALLATION - DRY METHOD (TAPE AND GASKET SPLINE GLAZING):

A. Cut glazing spline to length; install on glazing pane. Seal corners by butting and sealing junctions with butyl sealant.

B. Place setting blocks at 1/4 points with edge block no more than 150 mm (6 inches) from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.

D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Trim protruding tape edge.

3.5 INSTALLATION - WET/DRY METHOD (PREFORMED TAPE AND SEALANT)

A. Cut glazing tape to length and set against permanent stops, 5 mm (3/16 inch) below sight line. Seal corners by butting tape and dabbing with butyl sealant.

B. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.

C. Place setting blocks at 1/4 points with edge block no more than 152 mm (6 inches) from corners.

D. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to achieve full contact at perimeter of pane or glass unit.

E. Install removable stops, with spacer strips inserted between glazing and applied stops, 6 mm (1/4 inch) below sight line. Place glazing tape on glazing pane or unit with tape flush with sight line.

F. Fill gap between glazing and stop with sealant to depth equal to bite of frame on glazing, but not more than 9 mm (3/8 inch) below sight line. Sealant type shall be compatible with glazing tape.

G. Apply cap bead of sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.6 INSTALLATION - WET METHOD (SEALANT AND SEALANT):

A. Place setting blocks at 1/4 points and install glazing pane or unit.

B. Install removable stops with glazing centered in space by inserting spacer shims both sides at 600 mm (24 inch) intervals, 6 mm (1/4 inch) below sight line.

C. Fill gaps between glazing and stops with sealant to depth of bite on glazing, but not more than 9 mm (3/8 inch) below sight line to ensure full contact with glazing and continue the air and vapor seal.

D. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.7 INSTALLATION - INTERIOR WET/DRY METHOD (TAPE AND SEALANT):

A. Cut glazing tape to length and install against permanent stops, projecting 1.6 mm (1/16 inch) above sight line.

B. Place setting blocks at 1/4 points with edge block no more than 150 mm (6 inches) from corners.

C. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.

D. Install removable stops, spacer shims inserted between glazing and applied stops at 600 mm (24 inch) intervals, 6 mm (1/4 inch) below sight line.

E. Fill gaps between pane and applied stop with sealant to depth equal to bite on glazing, to uniform and level line. Sealant type shall be compatible with glazing tape.

F. Trim protruding tape edge.

3.8 INSTALLATION - INTERIOR WET METHOD (COMPOUND AND COMPOUND):

A. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 600 mm (24 inch) centers, kept 6 mm (1/4 inch) below sight line.

B. Locate and secure glazing pane using glazers' clips.

C. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

3.9 REPLACEMENT AND CLEANING:

A. Clean new glass surfaces removing temporary labels, paint spots, and defacement after approval by COR.

B. Replace cracked, broken, and imperfect glass, or glass which has been installed improperly.

C. Leave glass, putty, and other setting material in clean, whole, and acceptable condition.

3.10 PROTECTION:

A. Protect finished surfaces from damage during erection, and after completion of work. Strippable plastic coatings on colored anodized finish are not acceptable.

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SECTION 08 90 00
LOUVERS AND VENTS

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies fixed and operable wall louvers, and wall vents.

1.2 RELATED WORK:

A. None

1.3 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Shop Drawings:

1. Each type, showing material, finish, size of members, operating devices, method of assembly, and installation and anchorage details.

C. Manufacturer's Literature and Data:

1. Each type of louver and vent.

D. Color samples.

1.4 APPLICABLE PUBLICATIONS:

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

B. The Master Painters Institute (MPI):
Approved Product List - Updated Monthly

C. ASTM International (ASTM):

A240/A240M-14.....Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

A653/A653M-13.....Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot Dip Process

A1008/A1008M-13.....Steel, Sheet, Carbon, Cold Rolled, Structural, and High Strength Low-Alloy with Improved Formability

B209-14.....Aluminum and Aluminum Alloy, Sheet and Plate

B209M-14.....Aluminum and Aluminum Alloy, Sheet and Plate (Metric)

B221-14.....Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes

B221M-13.....Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes (Metric)

D1187/D1187M-97(R2011)..Asphalt-Base Emulsions for Use as Protective Coatings for Metal

D. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500-06.....Metal Finishes Manual

E. National Fire Protection Association (NFPA):

90A-15.....Installation of Air Conditioning and Ventilating Systems

F. American Architectural Manufacturers Association (AAMA):

2605-13.....High Performance Organic Coatings on Architectural Extrusions and Panels

G. Air Movement and Control Association, Inc. (AMCA):

500-L-07.....Testing Louvers

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Aluminum, Extruded: ASTM B221M (B221).

B. Stainless Steel: ASTM A240/A240M, Type 302B.

C. Galvanized Steel Sheet: ASTM A653/A653M; G90 min.

D. Carbon Steel and Sheet: ASTM A1008/A1008M (interior use louvers only).

E. Aluminum, Plate and Sheet: ASTM B209M (B209); alloy 3003 or 5005 with temper as required for forming.

F. Fasteners: Fasteners for securing louvers and wall vents to adjoining construction, except as otherwise specified or indicated in construction documents, to be toggle or expansion bolts of size and type as required for each specific type of installation and service condition.

1. Where type, size, or spacing of fasteners is not shown or specified, submit shop drawings showing proposed fasteners, and method of installation.
2. Fasteners for louvers, louver frames, and wire guards to be of stainless steel or aluminum with same finish as louvers.
3. Fasteners for louvers, louver frames and wire guards within mental health areas to be non-removable/tamper-proof type.

G. Inorganic Zinc Primer: MPI No. 19.

H. Bituminous Coating: ASTM D1187/D1187M; cold applied asphalt mastic emulsion.

2.2 EXTERIOR WALL LOUVERS:

A. General:
   1. Provide fixed and operable type louvers of size and design shown.
   2. Heads, sills and jamb sections are to have formed caulking slots or be designed to retain caulking. Head sections are to have exterior drip lip, and sill sections an integral water stop.
   3. Furnish louvers with sill extension or separate sill as shown.
   4. Frame is to be mechanically fastened or welded construction with welds dressed smooth and flush.

B. Performance Characteristics:
   1. Weather louvers are to have a minimum of 35% percent free area and to pass 500 fpm free area velocity at a pressure drop not exceeding 0.1 inch water gage. Louver shall be horizontal blade wind-driven rain type.
   2. Louvers are to bear AMCA certified rating seals for air performance and water penetration ratings.

C. Aluminum Louvers:
   1. General: Frames, blades, sills and mullions (sliding interlocking type); 2 mm (0.078-inch) thick extruded 6063-T5 or –T52 aluminum. Blades to be drainable type and have reinforcing bosses.
   2. Louvers, fixed: Make frame sizes 13 mm (1/2-inch) smaller than openings. Single louvers frames are not to exceed 1676 mm (66 inches) wide. When openings exceed 1676 mm (66 inches), provide twin louvers separated by mullion members.
   3. Louvers are to withstand the effects or gravity loads and the following wind loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors.
      a. Wind load acting inward or outward of not less than 25 lb. per sq. ft.

2.3 CLOSURE ANGLES AND CLOSURE PLATES:

A. Fabricate from 2 mm (0.078-inch) thick stainless steel or aluminum.

B. Provide continuous closure angles and closure plates on inside head, jambs and sill of exterior wall louvers.

C. Secure angles and plates to louver frames with screws, and to masonry or concrete with fasteners as indicated in construction documents.

2.4 WIRE GUARDS:

A. Provide wire guards on outside of all exterior louvers, except on exhaust air louvers.

B. Fabricate frames from 2 mm (0.078-inch) thick extruded or sheet aluminum designed to retain wire mesh.

C. Wire mesh to be woven from not less than 1.6 mm (0.063-inch) diameter aluminum wire in 13 mm (1/2-inch) square mesh.

D. Miter corners and join by concealed corner clips or locks extending not less than 57 mm (2-1/4 inches) into rails and stiles. Equip wire guards over 1219 mm (4 feet) in height with a mid-rail constructed as specified for frame components.

E. Fasten frames to outside of louvers with aluminum or stainless steel devices of same finish as louvers designed to allow removal and replacement without damage to the wire guard or the louver.

2.5 BLANK-OFF PANELS:

A. Uninsulated panels attached with clips or screws as follows: Panel finish is to be same finish applied to louvers.

1. Aluminum sheet for aluminum louvers, 1.27 mm (0.050 inch) minimum thickness.

B. Insulated laminated panels consisting of an insulating core surfaced on back and front with metal sheets and attached to back of louver with clips on screws and gasketed or sealant sealed perimeter. Panel finish is to be same finish applied to louvers.

1. Thickness: 25 mm (1 inch).
2. Aluminum sheet for aluminum louver 0.81 mm (0.032 inch) minimum.
3. Insulating Core: extruded-polystyrene foam.

2.6 FINISH:

A. In accordance with NAAMM Metal Finishes Manual: AMP 500-505

B. Aluminum Louvers:

1. Organic Finish: AAMA 2605 (Fluorocarbon coating) with total dry film thickness of not less than 0.03 mm (1.2 mil), color to be selected by COR from the standard color.

2.7 PROTECTION:

A. Provide protection for aluminum against galvanic action wherever dissimilar materials are in contact, by painting the contact surfaces

of the dissimilar material with a heavy coat of bituminous coating (complete coverage), or by separating the contact surfaces with a performed synthetic rubber tape having pressure sensitive adhesive coating on one side.

B. Isolate the aluminum from plaster, concrete and masonry by coating aluminum with zinc-chromate primer.

C. Protect finished surfaces from damage during fabrication, erection, and after completion of the work. Strippable plastic coating on colored organic finish is not approved.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Set work accurately, in alignment and where indicated in construction documents. Install plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.

B. Furnish setting drawings and instructions for installation of anchors and for the positioning of items having anchors to be built into masonry construction. Provide temporary bracing for such items until masonry is set.

C. Provide anchoring devices and fasteners as shown and as necessary for securing louvers to building construction as specified. Power actuated drive pins may be used, except for removal items and where members would be deformed or substrate damaged by their use.

D. Set wall louvers in masonry walls during progress of the work. If wall louvers are not delivered to job in time for installation in prepared openings, make provision for later installation. Set in cast-in-place concrete in prepared openings.

3.2 CLEANING AND ADJUSTING:

A. After installation, all exposed prefinished and plated items and all items fabricated from stainless steel and aluminum are to be cleaned as recommended by the manufacturer and protected from damage until completion of the project.

B. All movable parts, including hardware, are to be cleaned and adjusted to operate as designed without binding or deformation of the members, so as to be centered in the opening of frame, and where applicable, to have all contact surfaces fit tight and even without forcing or warping the components.

C. Restore louvers and vents damaged during installation and construction so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Contracting Officer Representative (COR) damaged units and replace with new units.

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SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies steel studs wall systems, shaft wall systems, ceiling or soffit suspended or furred framing, wall furring, fasteners, and accessories for the screw attachment of gypsum board, plaster bases or other building boards.

1.2 RELATED WORK

A. Support for wall mounted items: Section 05 50 00, METAL FABRICATIONS.

1.3 TERMINOLOGY

A. Description of terms shall be in accordance with ASTM C754, ASTM C11, ASTM C841 and as specified.

B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by beams, trusses, or bar joists. In interstitial spaces with walk-on floors the underside of the walk-on floor is the underside of structure overhead.

C. Thickness of steel specified is the minimum bare (uncoated) steel thickness.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Studs, runners and accessories.
2. Hanger inserts.
3. Channels (Rolled steel).
4. Furring channels.
5. Screws, clips and other fasteners.

C. Shop Drawings:

1. Typical ceiling suspension system.
2. Typical metal stud and furring construction system including details around openings and corner details.
3. Typical shaft wall assembly
4. Typical fire rated assembly and column fireproofing showing details of construction same as that used in fire rating test.

D. Test Results: Fire rating test designation, each fire rating required for each assembly.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

In accordance with the requirements of ASTM C754.

1.6 APPLICABLE PUBLICATIONS

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

B. American Society For Testing And Materials (ASTM)

A641-09.....Zinc-Coated (Galvanized) Carbon Steel Wire

A653/653M-11.....Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.

C11-10.....Terminology Relating to Gypsum and Related Building Materials and Systems

C635-07.....Manufacture, Performance, and Testing of Metal Suspension System for Acoustical Tile and Lay-in Panel Ceilings

C636-08.....Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels

C645-09.....Non-Structural Steel Framing Members

C754-11.....Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products

C841-03(R2008).....Installation of Interior Lathing and Furring

C954-10.....Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness

E580-11.....Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint.

PART 2 - PRODUCTS

2.1 PROTECTIVE COATING

Galvanize steel studs, runners (track), rigid (hat section) furring channels, "Z" shaped furring channels, and resilient furring channels, with coating designation of G40 or equivalent.

2.2 STEEL STUDS AND RUNNERS (TRACK)

A. ASTM C645, modified for thickness specified and sizes as shown.
   1. Use C 645 steel, 0.75 mm (0.0296-inch) minimum base-metal (30 mil).
   2. Runners same thickness as studs.
   3. Exception: Members that can show certified third party testing with gypsum board in accordance with ICC ES AC86 (Approved May 2012) need not meet the minimum thickness limitation or minimum section properties set forth in ASTM C 645. The submission of an evaluation report is acceptable to show conformance to this requirement. Use C 645 steel, 0.48mm (0.019 inch) minimum base-metal (19 mil).
B. Provide not less than two cutouts in web of each stud, approximately 300 mm (12 inches) from each end, and intermediate cutouts on approximately 600 mm (24-inch) centers.
C. Doubled studs for openings and studs for supporting concrete backer-board.
D. Studs 3600 mm (12 feet) or less in length shall be in one piece.
E. Shaft Wall Framing:
   1. Conform to rated wall construction.
   2. C-H Studs or C-T Studs.
   3. E Studs.
   4. J Runners.
   5. Steel Jamb-Strut.

2.3 FURRING CHANNELS

A. Rigid furring channels (hat shape): ASTM C645.
B. Resilient furring channels:
   1. Not less than 0.45 mm (0.0179-inch) thick bare metal.
   2. Semi-hat shape, only one flange for anchorage with channel web leg slotted on anchorage side, channel web leg on other side stiffens fastener surface but shall not contact anchorage surface other channel leg is attached to.
C. "Z" Furring Channels:
   1. Not less than 0.45 mm (0.0179-inch)-thick base metal, with 32 mm (1-1/4 inch) and 19 mm (3/4-inch) flanges.
   2. Web furring depth to suit thickness of insulation.
D. Rolled Steel Channels: ASTM C754, cold rolled; or, ASTM C841, cold rolled.

2.4 FASTENERS, CLIPS, AND OTHER METAL ACCESSORIES

A. ASTM C754, except as otherwise specified.

B. For fire rated construction: Type and size same as used in fire rating test.

C. Fasteners for steel studs thicker than 0.84 mm (0.033-inch) thick. Use ASTM C954 steel drill screws of size and type recommended by the manufacturer of the material being fastened.

D. Clips: ASTM C841 (paragraph 6.11), manufacturer's standard items. Clips used in lieu of tie wire shall have holding power equivalent to that provided by the tie wire for the specific application.

E. Concrete ceiling hanger inserts (anchorage for hanger wire and hanger straps): Steel, zinc-coated (galvanized), manufacturers standard items, designed to support twice the hanger loads imposed and the type of hanger used.

F. Tie Wire and Hanger Wire:

1. ASTM A641, soft temper, Class 1 coating.
2. Gage (diameter) as specified in ASTM C754 or ASTM C841.

G. Attachments for Wall Furring:

1. Manufacturers standard items fabricated from zinc-coated (galvanized) steel sheet.
2. For concrete or masonry walls: Metal slots with adjustable inserts or adjustable wall furring brackets. Spacers may be fabricated from 1 mm (0.0396-inch) thick galvanized steel with corrugated edges.

H. Power Actuated Fasteners: Type and size as recommended by the manufacturer of the material being fastened.

2.5 SUSPENDED CEILING SYSTEM FOR GYPSUM BOARD (OPTION)

A. Conform to ASTM C635, heavy duty, with not less than 35 mm (1-3/8 inch) wide knurled capped flange face designed for screw attachment of gypsum board.

B. Wall track channel with 35 mm (1-3/8 inch) wide flange.

PART 3 - EXECUTION

3.1 INSTALLATION CRITERIA

A. Where fire rated construction is required for walls, partitions, columns, beams and floor-ceiling assemblies, the construction shall be same as that used in fire rating test.

B. Construction requirements for fire rated assemblies and materials shall be as shown and specified, the provisions of the Scope paragraph (1.2)

of ASTM C754 and ASTM C841 regarding details of construction shall not apply.

3.2 INSTALLING STUDS

A. Install studs in accordance with ASTM C754, except as otherwise shown or specified.

B. Space studs not more than 610 mm (24 inches) on center.

C. Cut studs 6 mm to 9 mm (1/4 to 3/8-inch) less than floor to underside of structure overhead when extended to underside of structure overhead.

D. Where studs are shown to terminate above suspended ceilings, provide bracing as shown or extend studs to underside of structure overhead.

E. Extend studs to underside of structure overhead for fire, rated partitions, smoke partitions, shafts, and sound rated partitions and insulated exterior wall furring.

F. Openings:

1. Frame jambs of openings in stud partitions and furring with two studs placed back to back or as shown.
2. Fasten back to back studs together with 9 mm (3/8-inch) long Type S pan head screws at not less than 600 mm (two feet) on center, staggered along webs.
3. Studs fastened flange to flange shall have splice plates on both sides approximately 50 X 75 mm (2 by 3 inches) screwed to each stud with two screws in each stud. Locate splice plates at 600 mm (24 inches) on center between runner tracks.

G. Fastening Studs:

1. Fasten studs located adjacent to partition intersections, corners and studs at jambs of openings to flange of runner tracks with two screws through each end of each stud and flange of runner.
2. Do not fasten studs to top runner track when studs extend to underside of structure overhead.

H. Chase Wall Partitions:

1. Locate cross braces for chase wall partitions to permit the installation of pipes, conduits, carriers and similar items.
2. Use studs or runners as cross bracing not less than 63 mm (2-1/2 inches wide).

I. Form building seismic or expansion joints with double studs back to back spaced 75 mm (three inches) apart plus the width of the seismic or expansion joint.

J. Form control joint, with double studs spaced 13 mm (1/2-inch) apart.

3.3 INSTALLING WALL FURRING FOR FINISH APPLIED TO ONE SIDE ONLY

A. In accordance with ASTM C754, or ASTM C841 except as otherwise specified or shown.

B. Wall furring-Stud System:

1. Framed with 63 mm (2-1/2 inch) or narrower studs, 600 mm (24 inches) on center.
2. Brace as specified in ASTM C754 for Wall Furring-Stud System or brace with sections or runners or studs placed horizontally at not less than three foot vertical intervals on side without finish.
3. Securely fasten braces to each stud with two Type S pan head screws at each bearing.

C. Direct attachment to masonry or concrete; rigid channels or "Z" channels:

1. Install rigid (hat section) furring channels at 600 mm (24 inches) on center, horizontally or vertically.
2. Install "Z" furring channels vertically spaced not more than 600 mm (24 inches) on center.
3. At corners where rigid furring channels are positioned horizontally, provide mitered joints in furring channels.
4. Ends of spliced furring channels shall be nested not less than 200 mm (8 inches).
5. Fasten furring channels to walls with power-actuated drive pins or hardened steel concrete nails. Where channels are spliced, provide two fasteners in each flange.
6. Locate furring channels at interior and exterior corners in accordance with wall finish material manufacturers printed erection instructions. Locate "Z" channels within 100 mm (4 inches) of corner.

D. Installing Wall Furring-Bracket System: Space furring channels not more than 400 mm (16 inches) on center.

3.4 INSTALLING SUPPORTS REQUIRED BY OTHER TRADES

A. Provide for attachment and support of electrical outlets, plumbing, laboratory or heating fixtures, recessed type plumbing fixture accessories, access panel frames, wall bumpers, wood seats, toilet stall partitions, dressing booth partitions, urinal screens, chalkboards, tackboards, wall-hung casework, handrail brackets,

recessed fire extinguisher cabinets and other items like auto door buttons and auto door operators supported by stud construction.

B. Provide additional studs where required. Install metal backing plates, or special metal shapes as required, securely fastened to metal studs.

3.5 NOT USED

3.6 INSTALLING FURRED AND SUSPENDED CEILINGS OR SOFFITS

A. Install furred and suspended ceilings or soffits in accordance with ASTM C754 or ASTM C841 except as otherwise specified or shown for screw attached gypsum board ceilings and for plaster ceilings or soffits.
   1. Space framing at 400 mm (16-inch) centers for metal lath anchorage.
   2. Space framing at 600 mm (24-inch) centers for gypsum board anchorage.

B. New exposed concrete slabs:
   1. Use metal inserts required for attachment and support of hangers or hanger wires with tied wire loops for embedding in concrete.
   2. Furnish for installation under Division 3, CONCRETE.
   3. Suspended ceilings under concrete rib construction shall have runner channels at right angles to ribs and be supported from ribs with hangers at ends and at 1200 mm (48-inch) maximum intervals along channels. Stagger hangers at alternate channels.

C. Concrete slabs on steel decking composite construction:
   1. Use pull down tabs when available.
   2. Use power activated fasteners when direct attachment to structural framing can not be accomplished.

D. Where bar joists or beams are more than 1200 mm (48 inches) apart, provide intermediate hangers so that spacing between supports does not exceed 1200 mm (48 inches). Use clips, bolts, or wire ties for direct attachment to steel framing.

E. Existing concrete construction exposed or concrete on steel decking:
   1. Use power actuated fasteners either eye pin, threaded studs or drive pins for type of hanger attachment required.
   2. Install fasteners at approximate mid height of concrete beams or joists. Do not install in bottom of beams or joists.

F. Steel decking without concrete topping:
   1. Do not fasten to steel decking 0.76 mm (0.0299-inch) or thinner.
   2. Toggle bolt to decking 0.9 mm (0.0359-inch) or thicker only where anchorage to steel framing is not possible.

G. Installing suspended ceiling system for gypsum board (ASTM C635 Option):
   1. Install only for ceilings to receive screw attached gypsum board.
   2. Install in accordance with ASTM C636.
      a. Install main runners spaced 1200 mm (48 inches) on center.
      b. Install 1200 mm (four foot) tees not over 600 mm (24 inches) on center; locate for edge support of gypsum board.
      c. Install wall track channel at perimeter.

3.7 TOLERANCES

A. Fastening surface for application of subsequent materials shall not vary more than 3 mm (1/8-inch) from the layout line.

B. Plumb and align vertical members within 3 mm (1/8-inch.)

C. Level or align ceilings within 3 mm (1/8-inch.)

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SECTION 09 29 00
GYPSUM BOARD

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies installation and finishing of gypsum board.

1.2 RELATED WORK

A. Installation of steel framing members for walls, partitions, furring, soffits, and ceilings: Section 09 22 16, NON-STRUCTURAL METAL FRAMING.

B. Sound deadening board: Section 07 21 13, THERMAL INSULATION.

C. Acoustical Sealants: Section 07 92 00, JOINT SEALANTS.

1.3 TERMINOLOGY

A. Definitions and description of terms shall be in accordance with ASTM C11, C840, and as specified.

B. Underside of Structure Overhead: In spaces where steel trusses or bar joists are shown, the underside of structure overhead shall be the underside of the floor or roof construction supported by the trusses or bar joists.

C. "Yoked": Gypsum board cut out for opening with no joint at the opening (along door jamb or above the door).

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:

1. Cornerbead and edge trim.
2. Finishing materials.
3. Laminating adhesive.
4. Gypsum board, each type.

C. Shop Drawings:

1. Typical gypsum board installation, showing corner details, edge trim details and the like.
2. Typical sound rated assembly, showing treatment at perimeter of partitions and penetrations at gypsum board.
3. Typical shaft wall assembly.
4. Typical fire rated assembly and column fireproofing, indicating details of construction same as that used in fire rating test.

D. Samples:

1. Cornerbead.

2. Edge trim.

3. Control joints.

E. Test Results:

1. Fire rating test, each fire rating required for each assembly.

2. Sound rating test.

F. Certificates: Certify that gypsum board types, gypsum backing board types, cementitious backer units, and joint treating materials do not contain asbestos material.

1.5 DELIVERY, IDENTIFICATION, HANDLING AND STORAGE

In accordance with the requirements of ASTM C840.

1.6 ENVIRONMENTAL CONDITIONS

In accordance with the requirements of ASTM C840.

1.7 APPLICABLE PUBLICATIONS

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

B. American Society for Testing And Materials (ASTM):

C11-08.....Terminology Relating to Gypsum and Related Building Materials and Systems

C475-02.....Joint Compound and Joint Tape for Finishing Gypsum Board

C840-08.....Application and Finishing of Gypsum Board

C919-08.....Sealants in Acoustical Applications

C954-07.....Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases to Steel Stud from 0.033 in. (0.84mm) to 0.112 in. (2.84mm) in thickness

C1002-07.....Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs

C1047-05.....Accessories for Gypsum Wallboard and Gypsum Veneer Base

C1177-06.....Glass Mat Gypsum Substrate for Use as Sheathing

C1658-06.....Glass Mat Gypsum Panels

C1396-06.....Gypsum Board

E84-08.....Surface Burning Characteristics of Building Materials

C. Underwriters Laboratories Inc. (UL):
Latest Edition.....Fire Resistance Directory

D. Inchcape Testing Services (ITS):
Latest Editions.....Certification Listings

PART 2 - PRODUCTS

2.1 GYPSUM BOARD

A. Gypsum Board: ASTM C1396, Type X, 16 mm (5/8 inch) thick unless shown otherwise.

B. Coreboard or Shaft Wall Liner Panels.
1. ASTM C1396, Type X.
2. ASTM C1658: Glass Mat Gypsum Panels,
3. Coreboard for shaft walls 300, 400, 600 mm (12, 16, or 24 inches) wide by required lengths 25 mm (one inch) thick with paper faces treated to resist moisture.

C. Water Resistant Gypsum Backing Board: ASTM C620, Type X, 16 mm (5/8 inch) thick.

D. Paper facings shall contain 100 percent post-consumer recycled paper content.

2.2 GYPSUM SHEATHING BOARD

A. ASTM C1396, Type X, water-resistant core, 16 mm (5/8 inch) thick.

B. ASTM C1177, Type X.

2.3 ACCESSORIES

A. ASTM C1047, except form of 0.39 mm (0.015 inch) thick zinc coated steel sheet or rigid PVC plastic.

B. Flanges not less than 22 mm (7/8 inch) wide with punchouts or deformations as required to provide compound bond.

2.4 FASTENERS

A. ASTM C1002 and ASTM C840, except as otherwise specified.

B. ASTM C954, for steel studs thicker than 0.04 mm (0.33 inch).

C. Select screws of size and type recommended by the manufacturer of the material being fastened.

D. For fire rated construction, type and size same as used in fire rating test.

E. Clips: Zinc-coated (galvanized) steel; gypsum board manufacturer's standard items.

2.5 FINISHING MATERIALS AND LAMINATING ADHESIVE

ASTM C475 and ASTM C840. Free of antifreeze, vinyl adhesives, preservatives, biocides and other VOC. Adhesive shall contain a maximum VOC content of 50 g/l.

PART 3 - EXECUTION

3.1 GYPSUM BOARD HEIGHTS

A. Extend all layers of gypsum board from floor to underside of structure overhead on following partitions and furring:
   1. Two sides of partitions:
      a. Fire rated partitions.
      b. Smoke partitions.
      c. Sound rated partitions.
      d. Full height partitions shown (FHP).
      e. Corridor partitions.
   2. One side of partitions or furring:
      a. Inside of exterior wall furring or stud construction.
      b. Room side of room without suspended ceilings.
      c. Furring for pipes and duct shafts, except where fire rated shaft wall construction is shown.
   3. Extend all layers of gypsum board construction used for fireproofing of columns from floor to underside of structure overhead, unless shown otherwise.
B. In locations other than those specified, extend gypsum board from floor to heights as follows:
   1. Not less than 100 mm (4 inches) above suspended acoustical ceilings.
   2. At ceiling of suspended gypsum board ceilings.
   3. At existing ceilings.

3.2 INSTALLING GYPSUM BOARD

A. Coordinate installation of gypsum board with other trades and related work.
B. Install gypsum board in accordance with ASTM C840, except as otherwise specified.
C. Moisture and Mold-Resistant Assemblies: Provide and install moisture and mold-resistant glass mat gypsum wallboard products with moisture-resistant surfaces complying with ASTM C1658 where shown and in locations which might be subject to moisture exposure during construction.

D. Use gypsum boards in maximum practical lengths to minimize number of end joints.

E. Bring gypsum board into contact, but do not force into place.

F. Ceilings:

1. For single-ply construction, use perpendicular application.
2. For two-ply assembles:
   a. Use perpendicular application.
   b. Apply face ply of gypsum board so that joints of face ply do not occur at joints of base ply with joints over framing members.

G. Walls (Except Shaft Walls):

1. When gypsum board is installed parallel to framing members, space fasteners 300 mm (12 inches) on center in field of the board, and 200 mm (8 inches) on center along edges.
2. When gypsum board is installed perpendicular to framing members, space fasteners 300 mm (12 inches) on center in field and along edges.
3. Stagger screws on abutting edges or ends.
4. For single-ply construction, apply gypsum board with long dimension either parallel or perpendicular to framing members as required to minimize number of joints except gypsum board shall be applied vertically over "Z" furring channels.
5. For two-ply gypsum board assemblies, apply base ply of gypsum board to assure minimum number of joints in face layer. Apply face ply of wallboard to base ply so that joints of face ply do not occur at joints of base ply with joints over framing members.
6. For three-ply gypsum board assemblies, apply plies in same manner as for two-ply assemblies, except that heads of fasteners need only be driven flush with surface for first and second plies. Apply third ply of wallboard in same manner as second ply of two-ply assembly, except use fasteners of sufficient length enough to have the same penetration into framing members as required for two-ply assemblies.
7. No offset in exposed face of walls and partitions will be permitted because of single-ply and two-ply or three-ply application requirements.
8. Installing Two Layer Assembly Over Sound Deadening Board:
   a. Apply face layer of wallboard vertically with joints staggered from joints in sound deadening board over framing members.

b. Fasten face layer with screw, of sufficient length to secure to framing, spaced 300 mm (12 inches) on center around perimeter, and 400 mm (16 inches) on center in the field.

9. Control Joints ASTM C840 and as follows:
   a. Locate at both side jambs of openings if gypsum board is not "yoked". Use one system throughout.
   b. Not required for wall lengths less than 9000 mm (30 feet).
   c. Extend control joints the full height of the wall or length of soffit/ceiling membrane.

H. Acoustical or Sound Rated Partitions, Fire and Smoke Partitions:
   1. Cut gypsum board for a space approximately 3 mm to 6 mm (1/8 to 1/4 inch) wide around partition perimeter.
   2. Coordinate for application of caulking or sealants to space prior to taping and finishing.
   3. For sound rated partitions, use sealing compound (ASTM C919) to fill the annular spaces between all receptacle boxes and the partition finish material through which the boxes protrude to seal all holes and/or openings on the back and sides of the boxes. STC minimum values as shown.

I. Electrical and Telecommunications Boxes:
   1. Seal annular spaces between electrical and telecommunications receptacle boxes and gypsum board partitions.

J. Accessories:
   1. Set accessories plumb, level and true to line, neatly mitered at corners and intersections, and securely attach to supporting surfaces as specified.
   2. Install in one piece, without the limits of the longest commercially available lengths.
   3. Corner Beads:
      a. Install at all vertical and horizontal external corners and where shown.
      b. Use screws only. Do not use crimping tool.
   4. Edge Trim (casings Beads):
      a. At both sides of expansion and control joints unless shown otherwise.

b. Where gypsum board terminates against dissimilar materials and at perimeter of openings, except where covered by flanges, casings or permanently built-in equipment.

c. Where gypsum board surfaces of non-load bearing assemblies abut load bearing members.

d. Where shown.

3.3 INSTALLING GYPSUM SHEATHING

A. Install in accordance with ASTM C840, except as otherwise specified or shown.

B. Use screws of sufficient length to secure sheathing to framing.

C. Space screws 9 mm (3/8 inch) from ends and edges of sheathing and 200 mm (8 inches) on center. Space screws a maximum of 200 mm (8 inches) on center on intermediate framing members.

D. Apply 600 mm by 2400 mm (2 foot by 8 foot) sheathing boards horizontally with tongue edge up.

E. Apply 1200 mm by 2400 mm or 2700 mm (4 ft. by 8 ft. or 9 foot) gypsum sheathing boards vertically with edges over framing.

3.4 FINISHING OF GYPSUM BOARD

A. Finish joints, edges, corners, and fastener heads in accordance with ASTM C840. Use Level 4 finish for al finished areas open to public view.

B. Before proceeding with installation of finishing materials, assure the following:

1. Gypsum board is fastened and held close to framing or furring.
2. Fastening heads in gypsum board are slightly below surface in dimple formed by driving tool.

C. Finish joints, fasteners, and all openings, including openings around penetrations, on that part of the gypsum board extending above suspended ceilings to seal surface of non decorated, smoke barrier, fire rated, and sound rated gypsum board construction. After the installation of hanger rods, hanger wires, supports, equipment, conduits, piping and similar work, seal remaining openings and maintain the integrity of the smoke barrier, fire rated and sound rated construction. Sanding is not required of non decorated surfaces.

3.5 REPAIRS

A. After taping and finishing has been completed, and before decoration, repair all damaged and defective work, including nondecorated surfaces.

B. Patch holes or openings 13 mm (1/2 inch) or less in diameter, or equivalent size, with a setting type finishing compound or patching plaster.

C. Repair holes or openings over 13 mm (1/2 inch) diameter, or equivalent size, with 16 mm (5/8 inch) thick gypsum board secured in such a manner as to provide solid substrate equivalent to undamaged surface.

D. Tape and refinish scratched, abraded or damaged finish surfaces including cracks and joints in non decorated surface to provide smoke tight construction or fire protection equivalent to the fire rated construction and STC equivalent to the sound rated construction.

3.6 UNACCESSIBLE CEILINGS

At Mental Health and Behavioral Nursing Units, areas accessible to patients and not continuously observable by staff (e.g., patient bedrooms, day rooms), ceilings should be a solid material such as gypsum board. This will limit patient access. Access doors are needed to access electrical and mechanical equipment above the ceiling. These doors should be locked to prevent unauthorized access and secured to ceiling using tamper resistant fasteners.

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SECTION 09 65 13
RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Resilient base (RB) adhered to interior walls and partitions.

1.2 RELATED REQUIREMENTS

A. 01 81 13 Sustainable Construction Requirements.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.
B. ASTM International (ASTM):
   1. F1861-08(2012)e1 - Resilient Wall Base.
   2. D4259-88(2012) - Abrading Concrete.
C. International Concrete Repair Institute (ICRI):
   1. 310.2R-13 - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Manufacturer's Literature and Data:
   1. Description of each product.
   2. Adhesives and primers indicating manufacturer's recommendation for each application.
   3. Installation instructions.
C. Samples:
   1. Resilient Base: 150 mm (6 inches) long, each type and color.
D. Operation and Maintenance Data:
   1. Care instructions for each exposed finish product.

1.5 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.
B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, color, production run number, and manufacture date.
C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.6 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage when handling and during construction operations.

1.7 FIELD CONDITIONS

A. Environment:

1. Product Temperature: Minimum 21 degrees C (70 degrees F) for minimum 48 hours before installation.
2. Work Area Ambient Temperature Range: 21 to 27 degrees C (70 to 80 degrees F) continuously, beginning 48 hours before installation.
3. Install products when building is permanently enclosed and when wet construction is completed, dried, and cured.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Basis of Design: Match existing.

B. Provide each product from one manufacturer and from one production run.

2.2 RESILIENT BASE

A. Resilient Base: 3 mm (1/8 inch) thick, 100 mm (4 inches) high.

1. Type: Rubber.
2. ASTM F1861, Type TP thermoplastic rubber, Group 2 - layered.

B. Applications:

1. Cove.

2.3 PRIMER (FOR CONCRETE FLOORS)

A. Primer: Type recommended by adhesive manufacturer.

2.4 LEVELING COMPOUND (FOR CONCRETE FLOORS)

A. Leveling Compound: Provide products mixed with latex or polyvinyl acetate resins.

2.5 ADHESIVES

A. Adhesives: Low pollutant-emitting, water based type recommended by adhered product manufacturer for each application.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Remove existing base to permit new installation.

1. Dispose of removed materials.

D. Correct substrate deficiencies.

1. Fill cracks, pits, and depressions with leveling compound.
2. Remove protrusions; grind high spots.
3. Apply leveling compound to achieve 3 mm (1/8 inch) in 3 m (10 feet) maximum surface variation.

E. Clean substrates. Remove contaminants capable of affecting subsequently installed product's performance.

1. Mechanically clean concrete floor substrate according to ASTM D4259.
2. Surface Profile: ICRI Guideline No. 310.2R.

F. Allow substrate to dry and cure.

G. Perform flooring manufacturer’s recommended bond, substrate moisture content, and pH tests.

3.2 INSTALLATION GENERAL

A. Install products according to manufacturer's instructions.

1. When instructions deviate from specifications, submit proposed resolution for Contracting Officer consideration.

3.3 RESILIENT BASE INSTALLATION

A. Applications:

1. Install resilient base in rooms scheduled on Drawings.
2. Extend resilient base into closets, alcoves, and cabinet knee spaces, and around columns within scheduled room.

B. Lay out resilient base with minimum number of joints.

1. Length: 600 mm (24 inches) minimum, each piece.
2. Locate joints 150 mm (6 inches) minimum from corners and intersection of adjacent materials.

C. Installation:

1. Apply adhesive uniformly for full contact between resilient base and substrate.

2. Set resilient base with hairline butted joints aligned along top edge.

D. Factory form corners and end stops.

1. V-groove back of outside corner.
2. V-groove face of inside corner and notch cove for miter joint.

E. Roll resilient base ensuring complete adhesion.

3.4 CLEANING

A. Remove excess adhesive before adhesive sets.

B. Clean exposed resilient base and surfaces. Remove contaminants and stains.

1. Clean with mild detergent. Leave surfaces free of detergent residue.

C. Polish exposed resilient base to gloss sheen.

3.5 PROTECTION

A. Protect products from construction traffic and operations.

1. Maintain protection until directed by Contracting Officer's Representative.

B. Replace damaged products and re-clean.

1. Damaged Products include cut, gouged, scraped, torn, and unbonded products.

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SECTION 09 91 00
PAINTING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. Work of this Section includes all labor, materials, equipment, and services necessary to complete the painting and finishing as shown on the construction documents and/or specified herein, including, but not limited to, the following:

1. Prime coats which may be applied in shop under other sections.
2. Prime painting unprimed surfaces to be painted under this Section.
3. Painting items furnished with a prime coat of paint, including touching up of or repairing of abraded, damaged or rusted prime coats applied by others.
4. Painting ferrous metal (except stainless steel) exposed to view.
5. Painting galvanized ferrous metals exposed to view.
6. Painting interior concrete block exposed to view.
7. Painting gypsum drywall exposed to view.
8. Painting of wood exposed to view, except items which are specified to be painted or finished under other Sections of these specifications. Back painting of all wood in contact with concrete, masonry or other moisture areas.
9. Painting pipes, pipe coverings, conduit, ducts, insulation, hangers, supports and other mechanical and electrical items and equipment exposed to view.
10. Painting surfaces above, behind or below grilles, gratings, diffusers, louvers lighting fixtures, and the like, which are exposed to view through these items.
11. Painting includes shellacs, stains, varnishes, coatings specified, and striping or markers and identity markings.
12. Incidental painting and touching up as required to produce proper finish for painted surfaces, including touching up of factory finished items.
13. Painting of any surface not specifically mentioned to be painted herein or on construction documents, but for which painting is obviously necessary to complete the job, or work which comes within the intent of these specifications, is to be included as though specified.

1.2 RELATED WORK:

A. Activity Hazard Analysis: Section 01 35 26, SAFETY REQUIREMENTS.

B. Masonry Repairs: Section 04 05 13, MASONRY MORTARING and Section 04 05 16, MASONRY GROUTING.

E. Shop prime painting of steel and ferrous metals: Division 05 - METALS, Division 08 - OPENINGS; Division 22 - PLUMBING; Division 23 – HEATING; VENTILATION AND AIR-CONDITIONING; Division 26 - ELECTRICAL; and Division 27 - COMMUNICATIONS.

1.3 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Not used

C. Painter qualifications.

D. Manufacturer's Literature and Data:

1. Before work is started, or sample panels are prepared, submit manufacturer's literature and technical data, the current Master Painters Institute (MPI) "Approved Product List" indicating brand label, product name and product code as of the date of contract award, will be used to determine compliance with the submittal requirements of this specification. The Contractor may choose to use subsequent MPI "Approved Product List", however, only one (1) list may be used for the entire contract and each coating system is to be from a single manufacturer. All coats on a particular substrate must be from a single manufacturer. No variation from the MPI "Approved Product List" where applicable is acceptable.

E. Sample Panels:

1. After painters' materials have been approved and before work is started submit sample panels showing each type of finish and color specified.
2. Panels to Show Color: Composition board, 100 x 250 mm (4 x 10 inch).
3. Not used
4. Attach labels to panel stating the following:
   a. Federal Specification Number or manufacturers name and product number of paints used.
   b. Specification code: Match existing
   c. Product type and color.
   d. Name of project.

5. Strips showing not less than 50 mm (2 inch) wide strips of undercoats and 100 mm (4 inch) wide strip of finish coat.

F. Sample of identity markers if used.

G. Manufacturers' Certificates indicating compliance with specified requirements:

1. Manufacturer's paint substituted for Federal Specification paints meets or exceeds performance of paint specified.
2. High temperature aluminum paint.
3. Epoxy coating.
4. Intumescent clear coating or fire retardant paint.
5. Plastic floor coating.

1.4 DELIVERY AND STORAGE:

A. Deliver materials to site in manufacturer's sealed container marked to show following:

1. Name of manufacturer.
2. Product type.
3. Batch number.
4. Instructions for use.
5. Safety precautions.

B. In addition to manufacturer's label, provide a label legibly printed as following:

1. Federal Specification Number, where applicable, and name of material.
2. Surface upon which material is to be applied.
3. Specify Coat Types: Prime; body; finish; etc.

C. Maintain space for storage, and handling of painting materials and equipment in a ventilated, neat and orderly condition to prevent spontaneous combustion from occurring or igniting adjacent items.

D. Store materials at site at least 24 hours before using, at a temperature between 7 and 30 degrees C (45 and 85 degrees F).

1.5 QUALITY ASSURANCE:

A. Qualification of Painters: Use only qualified journeyman painters for the mixing and application of paint on exposed surfaces. Submit evidence that key personnel have successfully performed surface preparation and application of coating on a minimum of three (3) similar projects within the past three (3) years.

B. Paint Coordination: Provide finish coats which are compatible with the prime paints used. Review other Sections of these specifications in which

prime paints are to be provided to ensure compatibility of the total coatings system for the various substrates. Upon request from other subcontractors, furnish information on the characteristics of the finish materials proposed to be used, to ensure that compatible prime coats are used. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify the Contracting Officer Representative (COR) in writing of any anticipated problems using the coating systems as specified with substrates primed by others.

1.6 REGULATORY REQUIREMENTS:

A. Paint materials are to conform to the restrictions of the local Environmental and Toxic Control jurisdiction.

1. Volatile Organic Compounds (VOC) Emissions Requirements: Field-applied paints and coatings that are inside the waterproofing system to not exceed limits of authorities having jurisdiction.
2. Lead-Base Paint:
   a. Comply with Section 410 of the Lead-Based Paint Poisoning Prevention Act, as amended, and with implementing regulations promulgated by Secretary of Housing and Urban Development.
   b. Regulations concerning prohibition against use of lead-based paint in federal and federally assisted construction, or rehabilitation of residential structures are set forth in Subpart F, Title 24, Code of Federal Regulations, Department of Housing and Urban Development.
   c. Do not use coatings having a lead content over 0.06 percent by weight of non-volatile content.
   d. For lead-paint removal, see Section 02 83 33.13, LEAD-BASED PAINT REMOVAL AND DISPOSAL.
3. Asbestos: Provide materials that do not contain asbestos.
4. Chromate, Cadmium, Mercury, and Silica: Provide materials that do not contain zinc-chromate, strontium-chromate, Cadmium, mercury or mercury compounds or free crystalline silica.
5. Human Carcinogens: Provide materials that do not contain any of the ACGIH-BKLT and ACGHI-DOC confirmed or suspected human carcinogens.
6. Use high performance acrylic paints in place of alkyd paints.

1.7 SAFETY AND HEALTH

A. Apply paint materials using safety methods and equipment in accordance with the following:

1. Comply with applicable Federal, State, and local laws and regulations, and with the ACCIDENT PREVENTION PLAN, including the Activity Hazard Analysis (AHA) as specified in Section 01 35 26, SAFETY REQUIREMENTS. The AHA is to include analyses of the potential impact of painting operations on painting personnel and on others involved in and adjacent to the work zone.

B. Safety Methods Used During Paint Application: Comply with the requirements of SSPC PA Guide 10.

C. Toxic Materials: To protect personnel from overexposure to toxic materials, conform to the most stringent guidance of:

1. The applicable manufacturer's Material Safety Data Sheets (MSDS) or local regulation.
2. 29 CFR 1910.1000.
3. ACHIH-BKLT and ACGHI-DOC, threshold limit values.

1.8 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.

B. American Conference of Governmental Industrial Hygienists (ACGIH):

ACGIH TLV-BKLT-2012.....Threshold Limit Values (TLV) for Chemical Substances and Physical Agents and Biological Exposure Indices (BEIs)

ACGIH TLV-DOC-2012.....Documentation of Threshold Limit Values and Biological Exposure Indices, (Seventh Edition)

C. ASME International (ASME):

A13.1-07(R2013).....Scheme for the Identification of Piping Systems

D. Code of Federal Regulation (CFR):

40 CFR 59.....Determination of Volatile Matter Content, Water Content, Density Volume Solids, and Weight Solids of Surface Coating

E. Commercial Item Description (CID):

A-A-1272A.....Plaster Gypsum (Spackling Compound)

F. Federal Specifications (Fed Spec):

TT-P-1411A.....Paint, Copolymer-Resin, Cementitious (For Waterproofing Concrete and Masonry Walls) (CEP)

G. Master Painters Institute (MPI):

1.....Aluminum Paint

4.....Interior/ Exterior Latex Block Filler
5.....Exterior Alkyd Wood Primer
7.....Exterior Oil Wood Primer
8.....Exterior Alkyd, Flat MPI Gloss Level 1
9.....Exterior Alkyd Enamel MPI Gloss Level 6
10.....Exterior Latex, Flat
11.....Exterior Latex, Semi-Gloss
18.....Organic Zinc Rich Primer
22.....Aluminum Paint, High Heat (up to 590% - 1100F)
27.....Exterior / Interior Alkyd Floor Enamel, Gloss
31.....Polyurethane, Moisture Cured, Clear Gloss
36.....Knot Sealer
43.....Interior Satin Latex, MPI Gloss Level 4
44.....Interior Low Sheen Latex, MPI Gloss Level 2
45.....Interior Primer Sealer
46.....Interior Enamel Undercoat
47.....Interior Alkyd, Semi-Gloss, MPI Gloss Level 5
48.....Interior Alkyd, Gloss, MPI Gloss Level 6
50.....Interior Latex Primer Sealer
51.....Interior Alkyd, Eggshell, MPI Gloss Level 3
52.....Interior Latex, MPI Gloss Level 3
53.....Interior Latex, Flat, MPI Gloss Level 1
54.....Interior Latex, Semi-Gloss, MPI Gloss Level 5
59.....Interior/Exterior Alkyd Porch & Floor Enamel, Low Gloss
60.....Interior/Exterior Latex Porch & Floor Paint, Low Gloss
66.....Interior Alkyd Fire Retardant, Clear Top-Coat (ULC Approved)
67.....Interior Latex Fire Retardant, Top-Coat (ULC Approved)
68.....Interior/ Exterior Latex Porch & Floor Paint, Gloss
71.....Polyurethane, Moisture Cured, Clear, Flat
77.....Epoxy Cold Cured, Gloss
79.....Marine Alkyd Metal Primer
90.....Interior Wood Stain, Semi-Transparent

91.....Wood Filler Paste

94.....Exterior Alkyd, Semi-Gloss

95.....Fast Drying Metal Primer

98.....High Build Epoxy Coating

101.....Epoxy Anti-Corrosive Metal Primer

108.....High Build Epoxy Coating, Low Gloss

114.....Interior Latex, Gloss

119.....Exterior Latex, High Gloss (acrylic)

134.....Galvanized Water Based Primer

135.....Non-Cementitious Galvanized Primer

138.....Interior High Performance Latex, MPI Gloss Level 2

139.....Interior High Performance Latex, MPI Gloss Level 3

140.....Interior High Performance Latex, MPI Gloss Level 4

141.....Interior High Performance Latex (SG) MPI Gloss Level 5

163.....Exterior Water Based Semi-Gloss Light Industrial Coating, MPI Gloss Level 5

H. Society for Protective Coatings (SSPC):

SSPC SP 1-82(R2004).....Solvent Cleaning

SSPC SP 2-82(R2004).....Hand Tool Cleaning

SSPC SP 3-28(R2004).....Power Tool Cleaning

SSPC SP 10/NACE No.2....Near-White Blast Cleaning

SSPC PA Guide 10.....Guide to Safety and Health Requirements

I. Maple Flooring Manufacturer’s Association (MFMA):

J. U.S. National Archives and Records Administration (NARA):

29 CFR 1910.1000.....Air Contaminants

K. Underwriter’s Laboratory (UL)

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Conform to the coating specifications and standards referenced in PART 3. Submit manufacturer’s technical data sheets for specified coatings and solvents.

2.2 PAINT PROPERTIES:

A. Use ready-mixed (including colors), except two component epoxies, polyurethanes, polyesters, paints having metallic powders packaged separately and paints requiring specified additives.

B. Where no requirements are given in the referenced specifications for primers, use primers with pigment and vehicle, compatible with substrate and finish coats specified.

C. Provide undercoat paint produced by the same manufacturer as the finish coats. Use only thinners approved by the paint manufacturer, and use only to recommended limits.

PART 3 - EXECUTION

3.1 JOB CONDITIONS:

A. Safety: Observe required safety regulations and manufacturer's warning and instructions for storage, handling and application of painting materials.

1. Take necessary precautions to protect personnel and property from hazards due to falls, injuries, toxic fumes, fire, explosion, or other harm.
2. Deposit soiled cleaning rags and waste materials in metal containers approved for that purpose. Dispose of such items off the site at end of each day’s work.

B. Atmospheric and Surface Conditions:

1. Do not apply coating when air or substrate conditions are:
   a. Less than 3 degrees C (5 degrees F) above dew point.
   b. Below 10 degrees C (50 degrees F) or over 35 degrees C (95 degrees F), unless specifically pre-approved by the COR and the product manufacturer. Under no circumstances are application conditions to exceed manufacturer recommendations.
   c. When the relative humidity exceeds 85 percent; or to damp or wet surfaces; unless otherwise permitted by the paint manufacturer’s printed instructions.
2. Maintain interior temperatures until paint dries hard.
3. Do no exterior painting when it is windy and dusty.
4. Do not paint in direct sunlight or on surfaces that the sun will warm.
5. Apply only on clean, dry and frost free surfaces except as follows:
   a. Apply water thinned acrylic and cementitious paints to damp (not wet) surfaces only when allowed by manufacturer's printed instructions.
   b. Concrete and masonry when permitted by manufacturer’s recommendations, dampen surfaces to which water thinned acrylic and

cementitious paints are applied with a fine mist of water on hot dry days to prevent excessive suction and to cool surface.

6. Varnishing:
   a. Apply in clean areas and in still air.
   b. Before varnishing vacuum and dust area.
   c. Immediately before varnishing wipe down surfaces with a tack rag.

3.2 INSPECTION:

A. Examine the areas and conditions where painting and finishing are to be applied and correct any conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions are corrected to permit proper installation of the work.

3.3 GENERAL WORKMANSHIP REQUIREMENTS:

A. Application may be by brush or roller. Spray application only upon acceptance from the COR in writing.

B. Furnish to the COR a painting schedule indicating when the respective coats of paint for the various areas and surfaces will be completed. This schedule is to be kept current as the job progresses.

C. Protect work at all times. Protect all adjacent work and materials by suitable covering or other method during progress of work. Upon completion of the work, remove all paint and varnish spots from floors, glass and other surfaces. Remove from the premises all rubbish and accumulated materials of whatever nature not caused by others and leave work in a clean condition.

D. Remove and protect hardware, accessories, device plates, lighting fixtures, and factory finished work, and similar items, or provide in place protection. Upon completion of each space, carefully replace all removed items by workmen skilled in the trades involved.

E. When indicated to be painted, remove electrical panel box covers and doors before painting walls. Paint separately and re-install after all paint is dry.

F. Materials are to be applied under adequate illumination, evenly spread and flowed on smoothly to avoid runs, sags, holidays, brush marks, air bubbles and excessive roller stipple.

G. Apply materials with a coverage to hide substrate completely. When color, stain, dirt or undercoats show through final coat of paint, the surface is to be covered by additional coats until the paint film is of uniform

finish, color, appearance and coverage, at no additional cost to the Government.

H. All coats are to be dry to manufacturer's recommendations before applying succeeding coats.

I. All suction spots or "hot spots" in plaster after the application of the first coat are to be touched up before applying the second coat.

J. Do not apply paint behind frameless mirrors that use mastic for adhering to wall surface.

3.4 SURFACE PREPARATION:

A. General:

1. The Contractor shall be held wholly responsible for the finished appearance and satisfactory completion of painting work. Properly prepare all surfaces to receive paint, which includes cleaning, sanding, and touching-up of all prime coats applied under other Sections of the work. Broom clean all spaces before painting is started. All surfaces to be painted or finished are to be completely dry, clean and smooth.
2. See other sections of specifications for specified surface conditions and prime coat.
3. Perform preparation and cleaning procedures in strict accordance with the paint manufacturer's instructions and as herein specified, for each particular substrate condition.
4. Clean surfaces before applying paint or surface treatments with materials and methods compatible with substrate and specified finish. Remove any residue remaining from cleaning agents used. Do not use solvents, acid, or steam on concrete and masonry. Schedule the cleaning and painting so that dust and other contaminants from the cleaning process will not fall in wet, newly painted surfaces.
5. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   a. Concrete: 12 percent.
   b. Fiber-Cement Board: 12 percent.
   c. Masonry (Clay and CMU's): 12 percent.
   d. Wood: 15 percent.
   e. Gypsum Board: 12 percent.
   f. Plaster: 12 percent.

B. Wood:

1. Sand to a smooth even surface and then dust off.
2. Sand surfaces showing raised grain smooth between each coat.
3. Wipe surface with a tack rag prior to applying finish.
4. Surface painted with an opaque finish:
   a. Coat knots, sap and pitch streaks with MPI 36 (Knot Sealer) before applying paint.
   b. Apply two coats of MPI 36 (Knot Sealer) over large knots.
5. After application of prime or first coat of stain, fill cracks, nail and screw holes, depressions and similar defects with wood filler paste. Sand the surface to make smooth and finish flush with adjacent surface.
6. Before applying finish coat, reapply wood filler paste if required, and sand surface to remove surface blemishes. Finish flush with adjacent surfaces.
7. Fill open grained wood such as oak, walnut, ash and mahogany with MPI 91 (Wood Filler Paste), colored to match wood color.
   a. Thin filler in accordance with manufacturer's instructions for application.
   b. Remove excess filler, wipe as clean as possible, dry, and sand as specified.

C. Ferrous Metals:
1. Remove oil, grease, soil, drawing and cutting compounds, flux and other detrimental foreign matter in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Remove loose mill scale, rust, and paint, by hand or power tool cleaning, as defined in SSPC-SP 2 (Hand Tool Cleaning) and SSPC-SP 3 (Power Tool Cleaning).
3. Fill dents, holes and similar voids and depressions in flat exposed surfaces of hollow steel doors and frames, access panels, roll-up steel doors and similar items specified to have semi-gloss or gloss finish with TT-F-322D (Filler, Two-Component Type, For Dents, Small Holes and Blow-Holes). Finish flush with adjacent surfaces.
   a. Fill flat head countersunk screws used for permanent anchors.
   b. Do not fill screws of item intended for removal such as glazing beads.

4. Spot prime abraded and damaged areas in shop prime coat which expose bare metal with same type of paint used for prime coat. Feather edge of spot prime to produce smooth finish coat.
5. Spot prime abraded and damaged areas which expose bare metal of factory finished items with paint as recommended by manufacturer of item.

D. Zinc-Coated (Galvanized) Metal Surfaces Specified Painted:
1. Clean surfaces to remove grease, oil and other deterrents to paint adhesion in accordance with SSPC-SP 1 (Solvent Cleaning).
2. Spot coat abraded and damaged areas of zinc-coating which expose base metal on hot-dip zinc-coated items with MPI 18 (Organic Zinc Rich Coating). Prime or spot prime with MPI 134 (Waterborne Galvanized Primer) or MPI 135 (Non-Cementitious Galvanized Primer) depending on finish coat compatibility.

E. Masonry, Concrete, Cement Board, Cement Plaster and Stucco:
1. Clean and remove dust, dirt, oil, grease efflorescence, form release agents, laitance, and other deterrents to paint adhesion.
2. Use emulsion type cleaning agents to remove oil, grease, paint and similar products. Use of solvents, acid, or steam is not permitted.
3. Remove loose mortar in masonry work.
4. Replace mortar and fill open joints, holes, cracks and depressions with new mortar specified in Section 04 05 13, MASONRY MORTARING and Section 04 05 16, MASONRY GROUTING. Do not fill weep holes. Finish to match adjacent surfaces.
5. Neutralize Concrete floors to be painted by washing with a solution of 1.4 Kg (3 pounds) of zinc sulfate crystals to 3.8 L (1 gallon) of water, allow to dry three (3) days and brush thoroughly free of crystals.
6. Repair broken and spalled concrete edges with concrete patching compound to match adjacent surfaces as specified in Division 03, CONCRETE Sections. Remove projections to level of adjacent surface by grinding or similar methods.

F. Gypsum Plaster and Gypsum Board:
1. Remove efflorescence, loose and chalking plaster or finishing materials.
2. Remove dust, dirt, and other deterrents to paint adhesion.
3. Fill holes, cracks, and other depressions with CID-A-A-1272A finished flush with adjacent surface, with texture to match texture of adjacent

surface. Patch holes over 25 mm (1-inch) in diameter as specified in Section for plaster or gypsum board.

3.5 PAINT PREPARATION:

A. Thoroughly mix painting materials to ensure uniformity of color, complete dispersion of pigment and uniform composition.

B. Do not thin unless necessary for application and when finish paint is used for body and prime coats. Use materials and quantities for thinning as specified in manufacturer's printed instructions.

C. Remove paint skins, then strain paint through commercial paint strainer to remove lumps and other particles.

D. Mix two (2) component and two (2) part paint and those requiring additives in such a manner as to uniformly blend as specified in manufacturer's printed instructions unless specified otherwise.

E. For tinting required to produce exact shades specified, use color pigment recommended by the paint manufacturer.

3.6 APPLICATION:

A. Start of surface preparation or painting will be construed as acceptance of the surface as satisfactory for the application of materials.

B. Unless otherwise specified, apply paint in three (3) coats; prime, body, and finish. When two (2) coats applied to prime coat are the same, first coat applied over primer is body coat and second coat is finish coat.

C. Apply each coat evenly and cover substrate completely.

D. Allow not less than 48 hours between application of succeeding coats, except as allowed by manufacturer's printed instructions, and approved by COR.

E. Apply by brush or roller. Spray application for new or existing occupied spaces only upon approval by acceptance from COR in writing.

1. Apply painting materials specifically required by manufacturer to be applied by spraying.
2. In new construction and in existing occupied spaces, where paint is applied by spray, mask or enclose with polyethylene, or similar air tight material with edges and seams continuously sealed including items specified in “Building and Structural Work Field Painting”; “Work not Painted”; motors, controls, telephone, and electrical equipment, fronts of sterilizes and other recessed equipment and similar prefinished items.

F. Do not paint in closed position operable items such as access doors and panels, window sashes, overhead doors, and similar items except overhead roll-up doors and shutters.

3.7 PRIME PAINTING:

A. After surface preparation, prime surfaces before application of body and finish coats, except as otherwise specified.

B. Spot prime and apply body coat to damaged and abraded painted surfaces before applying succeeding coats.

C. Additional field applied prime coats over shop or factory applied prime coats are not required except for exterior exposed steel apply an additional prime coat.

D. Prime rabbets for stop and face glazing of wood, and for face glazing of steel.

E. Wood and Wood Particleboard:

1. Use same kind of primer specified for exposed face surface.
   a. Exterior wood: MPI 7 (Exterior Oil Wood Primer) for new construction and MPI 5(Exterior Alkyd Wood Primer) for repainting bare wood primer except where MPI 90 (Interior Wood Stain, Semi-Transparent) is scheduled.
   b. Interior wood except for transparent finish: MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat), thinned if recommended by manufacturer.
2. Apply two (2) coats of primer MPI 7 (Exterior Oil Wood Primer) or MPI 5 (Exterior Alkyd Wood Primer) or sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) to surfaces of wood doors, including top and bottom edges, which are cut for fitting or for other reason.
3. Apply one (1) coat of primer MPI 7 (Exterior Oil Wood Primer) or MPI 5 (Exterior Alkyd Wood Primer) or sealer MPI 45 (Interior Primer Sealer) or MPI 46 (Interior Enamel Undercoat) as soon as delivered to site to surfaces of unfinished woodwork, except concealed surfaces of shop fabricated or assembled millwork and surfaces specified to have varnish, stain or natural finish.
4. Back prime and seal ends of exterior woodwork, and edges of exterior plywood specified to be finished.
5. Apply MPI 67 (Interior Latex Fire Retardant, Top-Coat (UL Approved)) to wood for fire retardant finish.

F. Metals except boilers, incinerator stacks, and engine exhaust pipes:
   1. Steel and iron: MPI 79 (Marine Alkyd Metal Primer) or MPI 95 (Fast Drying Metal Primer).
   2. Zinc-coated steel and iron: MPI 134 (Waterborne Galvanized Primer).
   3. Aluminum scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
   4. Copper and copper alloys scheduled to be painted: MPI 95 (Fast Drying Metal Primer).
   5. Machinery not factory finished: MPI 9 (Exterior Alkyd Enamel).
   6. Asphalt coated metal: MPI 1 (Aluminum Paint).
   7. Metal over 94 degrees C (201 degrees F), Boilers, Incinerator Stacks, and Engine Exhaust Pipes: MPI 22 (High Heat Resistant Coating).

G. Gypsum Board:
   1. Surfaces scheduled to have MPI 11 (Exterior Latex, Semi-Gloss).
   2. Primer: MPI 50 (Interior Latex Primer Sealer) except use MPI 45 (Interior Primer Sealer) in shower and bathrooms.

H. Gypsum Plaster and Veneer Plaster:
   1. MPI 45 (Interior Primer Sealer), except use MPI 50 (Interior Latex Primer Sealer) when an alkyd flat finish is specified.
   2. Surfaces scheduled to have MPI 11 (Exterior Latex, Semi-Gloss) respectively.
   3. Use MPI 101 (Cold Curing Epoxy Primer) for surfaces scheduled to receive MPI 77 (Epoxy Cold Cured, Gloss) finish.

I. Concrete Masonry Units except glazed or integrally colored and decorative units:
   1. MPI 4 (Block Filler) on interior surfaces.
   2. Prime exterior surface as specified for exterior finishes.

J. Concrete Floors: MPI 99 (Water-based Acrylic Curing and Sealing Compound).

3.8 EXTERIOR FINISHES:

A. Apply following finish coats where specified in Section 09 06 00, SCHEDULE FOR FINISHES.

B. Steel and Ferrous Metal:
   1. Two (2) coats of MPI 94 (Exterior Alkyd, Semi-Gloss) on exposed surfaces, except on surfaces over 94 degrees C (201 degrees F).

C. Machinery without factory finish except for primer: MPI 94 (Exterior Alkyd, Semi-Gloss).

D. Concrete Masonry Units Brick and Concrete:
   1. General:

a. Where shown.
b. Mix as specified in manufacturer's printed directions.
c. Do not mix more paint than can be used within four (4) hours after mixing. Discard paint that has started to set.
d. Dampen warm surfaces above 24 degrees C (75 degrees F) with fine mist of water before application of paint. Do not leave free water on surface.
e. Cure paint with a fine mist of water as specified in manufacturer's printed instructions.

2. Use two (2) coats of TT-P-1411 (Paint, Co-polymer-Resin, Cementitious), unless specified otherwise.

3.9 INTERIOR FINISHES:

A. Apply following finish coats over prime coats in spaces or on surfaces specified in Section 09 06 00, SCHEDULE FOR FINISHES.

B. Metal Work:

1. Apply to exposed surfaces.
2. Omit body and finish coats on surfaces concealed after installation except electrical conduit containing conductors over 600 volts.
3. Ferrous Metal, Galvanized Metal, and Other Metals Scheduled:
   a. Apply two (2) coats of MPI 47 (Interior Alkyd, Semi-Gloss) unless specified otherwise.
   b. Two (2) coats of MPI 51 (Interior Alkyd, Eggshell).
   c. One (1) coat of MPI 46 (Interior Enamel Undercoat) plus one coat of MPI 47 (Interior Alkyd, Semi-Gloss) on exposed interior surfaces of alkyd-amine enamel prime finished windows.
   d. Machinery: One (1) coat MPI 9 (Exterior Alkyd Enamel).
   e. Asphalt Coated Metal: One (1) coat MPI 1 (Aluminum Paint).
   f. Ferrous Metal over 94 degrees K (290 degrees F): Boilers, Incinerator Stacks, and Engine Exhaust Pipes: One (1) coat MPI 22 (High Heat Resistant Coating.

C. Gypsum Board:

1. One (1) coat of MPI 45 (Interior Primer Sealer) plus one (1) coat of MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5) or MPI 114 (Interior Latex, Gloss).

D. Masonry and Concrete Walls:

1. Two (2) coats of MPI 54 (Interior Latex, Semi-Gloss, MPI Gloss Level 5)

E. Wood:

1. Sanding:
   a. Use 220-grit sandpaper.
   b. Sand sealers and varnish between coats.
   c. Sand enough to scarify surface to assure good adhesion of subsequent coats, to level roughly applied sealer and varnish, and to knock off "whiskers" of any raised grain as well as dust particles.
2. Sealers:
   a. MPI 31 (gloss) or MPI 71 (flat) thinned as recommended by manufacturer at rate of one (1) part of thinner to four (4) parts of varnish.
   b. Apply sealers specified except sealer may be omitted where pigmented, penetrating, or wiping stains containing resins are used.
   c. Allow manufacturer's recommended drying time before sanding, but not less than 24 hours or 36 hours in damp or muggy weather.
   d. Sand as specified.
3. Paint Finish:
   a. One (1) coat of MPI 45 (Interior Primer Sealer) plus one (1) coat of MPI 47 (Interior Alkyd, Semi-Gloss.
   b. One (1) coat MPI 66 (Interior Alkyd Fire retardant, Clear Top-Coat (UL Approved)) or MPI 67 (Interior Latex Fire Retardant, Top-Coat (UL Approved), intumescent type, on exposed wood in attics with floors used for mechanical equipment and above ceilings where shown.
   c. One (1) coat of MPI 45 Interior Primer Sealer) plus one (1) coat of MPI 48 (Interior Alkyd Gloss).
   d. Two (2) coats of MPI 51 (Interior Alkyd, Eggshell).
   e. Fire Retardant Intumescent Varnish:
      1) MPI 66 (Interior Alkyd Fire Retardant, Clear Top-Coat (UL Approved)) Intumescent Type, Fire Retardant Coating where scheduled: Two (2) coats.

F. Concrete Floors: One (1) coat of MPI 68 (Interior/ Exterior Latex Porch & Floor Paint, Gloss).

G. Miscellaneous:
   1. Apply where specified in Section 09 06 00, SCHEDULE FOR FINISHES.
   2. MPI 1 (Aluminum Paint): Two (2) coats of aluminum paint.
   3. Existing acoustical units scheduled to be repainted except acoustical units with a vinyl finish:

a. Clean units free of dust, dirt, grease, and other deterrents to paint adhesion.
b. Mineral fiber units: One (1) coat of MPI 53 (Interior Latex, Flat, MPI Gloss Level 1).
c. Units of organic fiber or other material not having a class A rating: One (1) coat of MPI 66 (Interior Alkyd Fire Retardant, Clear Top-Coat (UL Approved)).

3.10 REFINISHING EXISTING PAINTED SURFACES:

A. Clean, patch and repair existing surfaces as specified under "Surface Preparation". No "telegraphing" of lines, ridges, flakes, etc., through new surfacing is permitted. Where this occurs, sand smooth and re-finish until surface meets with COR's approval.
B. Remove and reinstall items as specified under "General Workmanship Requirements".
C. Remove existing finishes or apply separation coats to prevent non compatible coatings from having contact.
D. Patched or Replaced Areas in Surfaces and Components: Apply spot prime and body coats as specified for new work to repaired areas or replaced components.
E. Except where scheduled for complete painting apply finish coat over plane surface to nearest break in plane, such as corner, reveal, or frame.
F. In existing rooms and areas where alterations occur, clean existing stained and natural finished wood retouch abraded surfaces and then give entire surface one (1) coat of MPI 31 (Polyurethane, Moisture Cured, Clear Gloss).
G. Refinish areas as specified for new work to match adjoining work unless specified or scheduled otherwise.
H. Coat knots and pitch streaks showing through old finish with MPI 36 (Knot Sealer) before refinishing.
I. Sand or dull glossy surfaces prior to painting.
J. Sand existing coatings to a feather edge so that transition between new and existing finish will not show in finished work.

3.11 PAINT COLOR:

A. Color and gloss of finish coats is specified in Section 09 06 00, SCHEDULE FOR FINISHES.

B. For additional requirements regarding color see Articles, "REFINISHING EXISTING PAINTED SURFACE" and "MECHANICAL AND ELECTRICAL FIELD PAINTING SCHEDULE".

C. Coat Colors:

1. Color of priming coat: Lighter than body coat.
2. Color of body coat: Lighter than finish coat.
3. Color prime and body coats to not show through the finish coat and to mask surface imperfections or contrasts.

D. Painting, Caulking, Closures, and Fillers Adjacent to Casework:

1. Paint to match color of casework where casework has a paint finish.
2. Paint to match color of wall where casework is stainless steel, plastic laminate, or varnished wood.

3.12 MECHANICAL AND ELECTRICAL WORK FIELD PAINTING SCHEDULE:

A. Field painting of mechanical and electrical consists of cleaning, touching-up abraded shop prime coats, and applying prime, body and finish coats to materials and equipment if not factory finished in space scheduled to be finished.

B. In spaces not scheduled to be finish painted in Section 09 06 00, SCHEDULE FOR FINISHES paint as specified below.

C. Paint various systems specified in Division 02 – EXISTING CONDITIONS, Division 21 – FIRE SUPPRESSION, Division 22 - PLUMBING, Division 23 – HEATING, VENTILATION AND AIR-CONDITIONING, Division 26 - ELECTRICAL, Division 27 - COMMUNICATIONS, and Division 28 – ELECTRONIC SAFETY AND SECURITY.

D. Paint after tests have been completed.

E. Omit prime coat from factory prime-coated items.

F. Finish painting of mechanical and electrical equipment is not required when located in interstitial spaces, above suspended ceilings, in concealed areas such as pipe and electric closets, pipe basements, pipe tunnels, trenches, attics, roof spaces, shafts and furred spaces except on electrical conduit containing feeders 600 volts or more.

G. Omit field painting of items specified in "BUILDING AND STRUCTURAL WORK FIELD PAINTING"; "Building and Structural Work not Painted".

H. Color:

1. Paint items having no color specified in Section 09 06 00, SCHEDULE FOR FINISHES to match surrounding surfaces.

2. Paint colors as specified in Section 09 06 00, SCHEDULE FOR FINISHES except for following:
   a. White: Exterior unfinished surfaces of enameled plumbing fixtures. Insulation coverings on breeching and uptake inside boiler house, drums and drum-heads, oil heaters, condensate tanks and condensate piping.
   b. Gray: Heating, ventilating, air conditioning and refrigeration equipment (except as required to match surrounding surfaces), and water and sewage treatment equipment and sewage ejection equipment.
   c. Aluminum Color: Ferrous metal on outside of boilers and in connection with boiler settings including supporting doors and door frames and fuel oil burning equipment, and steam generation system (bare piping, fittings, hangers, supports, valves, traps and miscellaneous iron work in contact with pipe).
   d. Federal Safety Red: Exposed fire protection piping hydrants, post indicators, electrical conducts containing fire alarm control wiring, and fire alarm equipment.
   e. Federal Safety Orange: Entire lengths of electrical conduits containing feeders 600 volts or more.
   f. Color to match brickwork sheet metal covering on breeching outside of exterior wall of boiler house.

I. Apply paint systems on properly prepared and primed surface as follows:
   1. Exterior Locations:
      a. Apply two (2) coats of MPI 8 (Exterior Alkyd, Flat) to the following ferrous metal items:
         Vent and exhaust pipes with temperatures under 94 degrees C(201 degrees F), roof drains, fire hydrants, post indicators, yard hydrants, exposed piping and similar items.
      b. Apply two (2) coats of MPI 10 (Exterior Latex, Flat) to galvanized and zinc-copper alloy metal.
      c. Apply one (1) coat of MPI 22 (High Heat Resistant Coating), 650 degrees C (1200 degrees F) to incinerator stacks, boiler stacks, and engine generator exhaust.
   2. Interior Locations:
      a. Apply two (2) coats of MPI 47 (Interior Alkyd, Semi-Gloss) to following items:

1) Metal under 94 degrees C (201 degrees F) of items such as bare piping, fittings, hangers and supports.
2) Equipment and systems such as hinged covers and frames for control cabinets and boxes, cast-iron radiators, electric conduits and panel boards.
3) Heating, ventilating, air conditioning, plumbing equipment, and machinery having shop prime coat and not factory finished.

b. Ferrous metal exposed in hydrotherapy equipment room and chlorinator room of water and sewerage treatment plants: One (1) coat of MPI 101 (Cold Curing Epoxy Primer) and one (1) coat of MPI 77 (Epoxy Cold Cured, Gloss.

c. Apply one (1) coat of MPI 50 (Interior Latex Primer Sealer) and one (1) coat of MPI 53 (Interior Latex, Flat, MPI Gloss Level 1) on finish of insulation on boiler breeching and uptakes inside boiler house, drums, drumheads, oil heaters, feed water heaters, tanks and piping.

d. Apply two (2) coats of MPI 22 (High Heat Resistant Coating) to ferrous metal surface over 94 degrees K (290 degrees F) of following items:
1) Garbage and trash incinerator.
2) Medical waste incinerator.
3) Exterior of boilers and ferrous metal in connection with boiler settings including supporting members, doors and door frames and fuel oil burning equipment.
4) Steam line flanges, bare pipe, fittings, valves, hangers and supports over 94 degrees K (290 degrees F).
5) Engine generator exhaust piping and muffler.

e. Paint electrical conduits containing cables rated 600 volts or more using two (2) coats of MPI 9 (Exterior Alkyd Enamel) in the Federal Safety Orange color in exposed and concealed spaces full length of conduit.

3. Other exposed locations:

a. Metal surfaces, except aluminum, of cooling towers exposed to view, including connected pipes, rails, and ladders: Two (2) coats of MPI 1 (Aluminum Paint).

b. Cloth jackets of insulation of ducts and pipes in connection with plumbing, air conditioning, ventilating refrigeration and heating

systems: One (1) coat of MPI 50 (Interior Latex Primer Sealer) and one (1) coat of MPI 10 (Exterior Latex, Flat).

3.13 BUILDING AND STRUCTURAL WORK FIELD PAINTING:

A. Painting and finishing of interior and exterior work except as specified here-in-after.
   1. Painting and finishing of new and existing work including colors and gloss of finish selected is specified in Finish Schedule, Section 09 06 00, SCHEDULE FOR FINISHES.
   2. Painting of disturbed, damaged and repaired or patched surfaces when entire space is not scheduled for complete repainting or refinishing.
   3. Painting of ferrous metal and galvanized metal.
   4. Painting of wood with fire retardant paint exposed in attics, when used as mechanical equipment space (except shingles).
   5. Identity painting and safety painting.

B. Building and Structural Work not Painted:
   1. Prefinished items:
      a. Casework, doors, elevator entrances and cabs, metal panels, wall covering, and similar items specified factory finished under other sections.
      b. Factory finished equipment and pre-engineered metal building components such as metal roof and wall panels.
   2. Finished surfaces:
      a. Hardware except ferrous metal.
      b. Anodized aluminum, stainless steel, chromium plating, copper, and brass, except as otherwise specified.
      c. Signs, fixtures, and other similar items integrally finished.
   3. Concealed surfaces:
      a. Inside dumbwaiter, elevator and duct shafts, interstitial spaces, pipe basements, crawl spaces, pipe tunnels, above ceilings, attics, except as otherwise specified.
      b. Inside walls or other spaces behind access doors or panels.
      c. Surfaces concealed behind permanently installed casework and equipment.
   4. Moving and operating parts:
      a. Shafts, chains, gears, mechanical and electrical operators, linkages, and sprinkler heads, and sensing devices.
      b. Tracks for overhead or coiling doors, shutters, and grilles.

5. Labels:
   a. Code required label, such as Underwriters Laboratories Inc., Intertek Testing Service or Factory Mutual Research Corporation.
   b. Identification plates, instruction plates, performance rating, and nomenclature.
6. Galvanized metal:
   a. Exterior chain link fence and gates, corrugated metal areaways, and gratings.
   b. Gas Storage Racks.
   c. Except where specifically specified to be painted.
7. Metal safety treads and nosings.
8. Gaskets.
9. Concrete curbs, gutters, pavements, retaining walls, exterior exposed foundations walls and interior walls in pipe basements.
10. Face brick.
11. Structural steel encased in concrete, masonry, or other enclosure.
12. Structural steel to receive sprayed-on fire proofing.
13. Ceilings, walls, columns in interstitial spaces.
14. Ceilings, walls, and columns in pipe basements.
15. Wood Shingles.

3.14 IDENTITY PAINTING SCHEDULE:

A. Identify designated service in new buildings or projects with extensive remodeling in accordance with ASME A13.1, unless specified otherwise, on exposed piping, piping above removable ceilings, piping in accessible pipe spaces, interstitial spaces, and piping behind access panels. For existing spaces where work is minor match existing.
   1. Legend may be identified using snap-on coil plastic markers or by paint stencil applications.
   2. Apply legends adjacent to changes in direction, on branches, where pipes pass through walls or floors, adjacent to operating accessories such as valves, regulators, strainers and cleanouts a minimum of 12.2 M (40 feet) apart on straight runs of piping. Identification next to plumbing fixtures is not required.
   3. Locate Legends clearly visible from operating position.
   4. Use arrow to indicate direction of flow using black stencil paint.
   5. Identify pipe contents with sufficient additional details such as temperature, pressure, and contents to identify possible hazard. Insert

working pressure shown on construction documents where asterisk appears for High, Medium, and Low Pressure designations as follows:

a. High Pressure - 414 kPa (60 psig) and above.

b. Medium Pressure - 104 to 413 kPa (15 to 59 psig).

c. Low Pressure - 103 kPa (14 psig) and below.

d. Add Fuel oil grade numbers.

6. Legend name in full or in abbreviated form as follows:

PIPING	COLOR OF EXPOSED PIPING	COLOR OF BACKGROUND	COLOR OF LETTERS	LEGEND ABBREVIATIONS
Drain Line		Green	White	Drain
Emergency Shower		Green	White	Emg Shower
Water Sampling	Green	White	Sample	
Cold Water (Domestic)	White	Green	White	C.W. Dom
Hot Water (Domestic)				
Supply	White	Yellow	Black	H.W. Dom
Return	White	Yellow	Black	H.W. Dom Ret
Tempered Water	White	Yellow	Black	Temp. Wtr
Sanitary Waste		Green	White	San Waste
Sanitary Vent		Green	White	San Vent
Storm Drainage		Green	White	St Drain
Atmospheric Vent		Green	White	ATV

B. Fire and Smoke Partitions:

1. Identify partitions above ceilings on both sides of partitions except within shafts in letters not less than 64 mm (2 1/2 inches) high.
2. Stenciled message: "SMOKE BARRIER" or, "FIRE BARRIER" as applicable.
3. Locate not more than 6096 mm (20 feet) on center on corridor sides of partitions, and with a least one (1) message per room on room side of partition.
4. Use semi-gloss paint of color that contrasts with color of substrate.

C. Identify columns in pipe basements and interstitial space:

1. Apply stenciled number and letters to correspond with grid numbering and lettering indicated on construction documents.
2. Paint numbers and letters 101 mm (4 inches) high, locate 45 mm (18 inches) below overhead structural slab.
3. Apply on four (4) sides of interior columns and on inside face only of exterior wall columns.

4. Color:
   a. Use black on concrete columns.
   b. Use white or contrasting color on steel columns.

3.15 PROTECTION CLEAN UP, AND TOUCH-UP:

A. Protect work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.

B. Upon completion, clean paint from hardware, glass and other surfaces and items not required to be painted of paint drops or smears.

C. Before final inspection, touch-up or refinished in a manner to produce solid even color and finish texture, free from defects in work which was damaged or discolored.

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SECTION 22 05 11
COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section shall apply to all sections of Division 22.

B. Definitions:

1. Exposed: Piping and equipment exposed to view in finished rooms.

C. Abbreviations/Acronyms:

1. ABS: Acrylonitrile Butadiene Styrene
2. AC: Alternating Current
3. ACR: Air Conditioning and Refrigeration
4. AI: Analog Input
5. AISI: American Iron and Steel Institute
6. AO: Analog Output
7. AWG: American Wire Gauge
8. BACnet: Building Automation and Control Network
9. BAg: Silver-Copper-Zinc Brazing Alloy
10. BAS: Building Automation System
11. BCuP: Silver-Copper-Phosphorus Brazing Alloy
12. BSG: Borosilicate Glass Pipe
13. CDA: Copper Development Association
14. C: Celsius
15. CLR: Color
16. CO: Carbon Monoxide
17. COR: Contracting Officer’s Representative
18. CPVC: Chlorinated Polyvinyl Chloride
19. CR: Chloroprene
20. CRS: Corrosion Resistant Steel
21. CWP: Cold Working Pressure
22. CxA: Commissioning Agent
23. db(A): Decibels (A weighted)
24. DDC: Direct Digital Control
25. DI: Digital Input
26. DISS: Diameter Index Safety System
27. DO: Digital Output

28. DVD: Digital Video Disc
29. DN: Diameter Nominal
30. DWV: Drainage, Waste and Vent
31. ECC: Engineering Control Center
32. EPDM: Ethylene Propylene Diene Monomer
33. EPT: Ethylene Propylene Terpolymer
34. ETO: Ethylene Oxide
35. F: Fahrenheit
36. FAR: Federal Acquisition Regulations
37. FD: Floor Drain
38. FED: Federal
39. FG: Fiberglass
40. FNPT: Female National Pipe Thread
41. FPM: Fluoroelastomer Polymer
42. GPM: Gallons Per Minute
43. HDPE: High Density Polyethylene
44. Hg: Mercury
45. HOA: Hands-Off-Automatic
46. HP: Horsepower
47. HVE: High Volume Evacuation
48. ID: Inside Diameter
49. IPS: Iron Pipe Size
50. Kg: Kilogram
51. kPa: Kilopascal
52. lb: Pound
53. L/s: Liters Per Second
54. L/min: Liters Per Minute
55. MAWP: Maximum Allowable Working Pressure
56. MAX: Maximum
57. MED: Medical
58. m: Meter
59. MFG: Manufacturer
60. mg: Milligram
61. mg/L: Milligrams per Liter
62. ml: Milliliter
63. mm: Millimeter
64. MIN: Minimum

65. NF: Oil Free Dry (Nitrogen)
66. NPTF: National Pipe Thread Female
67. NPS: Nominal Pipe Size
68. NPT: Nominal Pipe Thread
69. OD: Outside Diameter
70. OSD: Open Sight Drain
71. OS&Y: Outside Stem and Yoke
72. OXY: Oxygen
73. PBPU: Prefabricated Bedside Patient Units
74. PH: Power of Hydrogen
75. PLC: Programmable Logic Controllers
76. PP: Polypropylene
77. PPM: Parts per Million
78. PSIG: Pounds per Square Inch
79. PTFE: Polytetrafluoroethylene
80. PVC: Polyvinyl Chloride
81. PVDF: Polyvinylidene Fluoride
82. RAD: Radians
83. RO: Reverse Osmosis
84. RPM: Revolutions Per Minute
85. RTRP: Reinforced Thermosetting Resin Pipe
86. SCFM: Standard Cubic Feet Per Minute
87. SDI: Silt Density Index
88. SPEC: Specification
89. SPS: Sterile Processing Services
90. STD: Standard
91. SUS: Saybolt Universal Second
92. SWP: Steam Working Pressure
93. TEFC: Totally Enclosed Fan-Cooled
94. TFE: Tetrafluoroethylene
95. THHN: Thermoplastic High-Heat Resistant Nylon Coated Wire
96. THWN: Thermoplastic Heat & Water Resistant Nylon Coated Wire
97. T/P: Temperature and Pressure
98. USDA: U.S. Department of Agriculture
99. V: Volt
100. VAC: Vacuum
101. VA: Veterans Administration

102. VAMC: Veterans Administration Medical Center
103. VAC: Voltage in Alternating Current
104. WAGD: Waste Anesthesia Gas Disposal
105. WOG: Water, Oil, Gas

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.
B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
C. Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
D. Section 02 82 11, ASBESTOS ABATEMENT.
F. Section 03 30 53, CAST-IN-PLACE CONCRETE.
G. Section 05 50 00, METAL FABRICATIONS.
H. Section 07 60 00, FLASHING AND SHEET METAL: Flashing for Wall and Roof Penetrations.
I. Section 07 84 00, FIRESTOPPING.
J. Section 07 92 00, JOINT SEALANTS.
K. Section 09 91 00, PAINTING.
L. Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.
M. Section 22 07 11, PLUMBING INSULATION.
N. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.
O. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.
P. Section 31 20 11, EARTHWORK (SHORT FORM).

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below shall form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
B. American Society of Mechanical Engineers (ASME):
ASME Boiler and Pressure Vessel Code -
BPVC Section IX-2013....Welding, Brazing, and Fusing Qualifications
B31.1-2012.....Power Piping
C. American Society for Testing and Materials (ASTM):
A36/A36M-2012.....Standard Specification for Carbon Structural Steel
A575-96(R2013)e1.....Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades
E84-2013a.....Standard Test Method for Surface Burning Characteristics of Building Materials

E119-2012a.....Standard Test Methods for Fire Tests of Building Construction and Materials

F1760-01(R2011).....Standard Specification for Coextruded Poly(Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content

D. International Code Council, (ICC):

IBC-2012.....International Building Code

IPC-2012.....International Plumbing Code

E. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc:

SP-58-2009.....Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application and Installation

SP-69-2003.....Pipe Hangers and Supports - Selection and Application

F. Military Specifications (MIL):

P-21035B.....Paint High Zinc Dust Content, Galvanizing Repair (Metric)

G. National Electrical Manufacturers Association (NEMA):

MG 1-2011.....Motors and Generators

H. National Fire Protection Association (NFPA):

51B-2014.....Standard for Fire Prevention During Welding, Cutting and Other Hot Work

54-2012.....National Fuel Gas Code

70-2014.....National Electrical Code (NEC)

I. NSF International (NSF):

5-2012.....Water Heaters, Hot Water Supply Boilers, and Heat Recovery Equipment

14-2012.....Plastic Piping System Components and Related Materials

61-2012.....Drinking Water System Components – Health Effects

372-2011.....Drinking Water System Components – Lead Content

J. Department of Veterans Affairs (VA):

PG-18-10.....Plumbing Design Manual

PG-18-13-2011.....Barrier Free Design Guide

VHA Directive 1061.....Prevention of Healthcare-Associated Legionella Disease and Scald Injury From Potable Water Distribution Systems

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 05 11, COMMON WORK RESULTS FOR PLUMBING", with applicable paragraph identification.

C. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements and will fit the space available.

D. If equipment is submitted which differs in arrangement from that shown, provide drawings that show the rearrangement of all associated systems. Approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

E. Prior to submitting shop drawings for approval, contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed drawings and specifications, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

F. Installing Contractor shall provide lists of previous installations for selected items of equipment. Contact persons who will serve as references, with telephone numbers and e-mail addresses shall be submitted with the references.

G. Manufacturer's Literature and Data: Manufacturer’s literature shall be submitted under the pertinent section rather than under this section.

1. Electric motor data and variable speed drive data shall be submitted with the driven equipment.
2. Equipment and materials identification.
3. Firestopping materials.
4. Hangers, inserts, supports and bracing. Provide load calculations for variable spring and constant support hangers.
5. Wall, floor, and ceiling plates.

H. Submittals and shop drawings for interdependent items, containing applicable descriptive information, shall be furnished together and complete in a group. Coordinate and properly integrate materials and equipment in each group to provide a completely compatible and efficient installation. Final review and approvals will be made only by groups.

I. Coordination Drawings: Complete consolidated and coordinated layout drawings shall be submitted for all new systems, and for existing systems that are in the same areas. The drawings shall include plan views, elevations and sections of all systems and shall be on a scale of not less than 1:32 (3/8 inch equal to one foot). Clearly identify and dimension the proposed locations of the principal items of equipment. The drawings shall clearly show the proposed location and adequate clearance for all equipment, controls, piping, pumps, valves and other items. All valves, trap primer valves, water hammer arrestors, strainers, and equipment requiring service shall be provided with an access door sized for the complete removal of plumbing device, component, or equipment. Equipment foundations shall not be installed until equipment or piping layout drawings have been approved. Detailed layout drawings shall be provided for all piping systems. In addition, details of the following shall be provided.

1. Mechanical equipment rooms.
2. Interstitial space.
3. Hangers, inserts, supports, and bracing.
4. Pipe sleeves.
5. Equipment penetrations of floors, walls, ceilings, or roofs.

J. Maintenance Data and Operating Instructions:

1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment. Include complete list indicating all components of the systems with diagrams of the internal wiring for each item of equipment.
2. Include listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment shall be provided. The listing shall include belts for equipment: Belt manufacturer, model number, size and style, and distinguished whether of multiple belt sets.

1.5 QUALITY ASSURANCE

A. Products Criteria:

1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture, supply and servicing of the specified products for at least 5 years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least 5 years.
2. Equipment Service: There shall be permanent service organizations, authorized and trained by manufacturers of the equipment supplied, located within 160 km (100 miles) of the project. These organizations shall come to the site and provide acceptable service to restore operations within four hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shut-down of equipment; or within 24 hours in a non-emergency. Names, mail and e-mail addresses and phone numbers of service organizations providing service under these conditions for (as applicable to the project): pumps, compressors, water heaters, critical instrumentation, computer workstation and programming shall be submitted for project record and inserted into the operations and maintenance manual.
3. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
4. The products and execution of work specified in Division 22 shall conform to the referenced codes and standards as required by the specifications. Local codes and amendments enforced by the local code official shall be enforced, if required by local authorities such as the natural gas supplier. If the local codes are more stringent, then the local code shall apply. Any conflicts shall be brought to the attention of the Contracting Officers Representative (COR).
5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.

6. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.
8. Asbestos products or equipment or materials containing asbestos shall not be used.
9. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

B. Welding: Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:
1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".
2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
3. Certify that each welder and welding operator has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
4. All welds shall be stamped according to the provisions of the American Welding Society.

C. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the COR prior to installation. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material.

D. Execution (Installation, Construction) Quality:

1. All items shall be applied and installed in accordance with manufacturer's written instructions. Conflicts between the manufacturer's instructions and the contract documents shall be referred to the COR for resolution. Printed copies or electronic files of manufacturer’s installation instructions shall be provided to the COR at least 10 working days prior to commencing installation of any item.
2. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration, shall be easily and safely accessible by persons standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include, but are not limited to: all types of valves, filters and strainers, transmitters, and control devices. Prior to commencing installation work, refer conflicts between this requirement and contract documents to COR for resolution.
3. Complete layout drawings shall be required by Paragraph, SUBMITTALS. Construction work shall not start on any system until the layout drawings have been approved by VA.
4. Installer Qualifications: Installer shall be licensed and shall provide evidence of the successful completion of at least five projects of equal or greater size and complexity. Provide tradesmen skilled in the appropriate trade.
5. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or additional time to the Government.

E. Guaranty: Warranty of Construction, FAR clause 52.246-21.

F. Plumbing Systems: IPC, International Plumbing Code. Unless otherwise required herein, perform plumbing work in accordance with the latest version of the IPC. For IPC codes referenced in the contract documents, advisory provisions shall be considered mandatory, the word “should” shall be interpreted as “shall”. Reference to the “code official” or “owner” shall be interpreted to mean the COR.

G. Cleanliness of Piping and Equipment Systems:

1. Care shall be exercised in the storage and handling of equipment and piping material to be incorporated in the work. Debris arising from cutting, threading and welding of piping shall be removed.

2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
3. The interior of all tanks shall be cleaned prior to delivery and beneficial use by the Government. All piping shall be tested in accordance with the specifications and the International Plumbing Code (IPC). All filters, strainers, fixture faucets shall be flushed of debris prior to final acceptance.
4. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:
1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage.
2. Damaged equipment shall be replaced with an identical unit as determined and directed by the COR. Such replacement shall be at no additional cost or additional time to the Government.
3. Interiors of new equipment and piping systems shall be protected against entry of foreign matter. Both inside and outside shall be cleaned before painting or placing equipment in operation.
4. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.

1.7 AS-BUILT DOCUMENTATION

A. Submit manufacturer’s literature and data updated to include submittal review comments and any equipment substitutions.
B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be in electronic PDF version via Electronic Transmittal and Hard Copy inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations.

Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided in electronic PDF version via Electronic Transmittal and Hard Copy inserted into a three ring binder Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.

D. Certification documentation shall be provided prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and a certification that all results of tests were within limits specified.

PART 2 - PRODUCTS

2.1 MATERIALS FOR VARIOUS SERVICES

A. Material or equipment containing a weighted average of greater than 0.25 percent lead shall not be used in any potable water system intended for human consumption, and shall be certified in accordance with NSF 61.

B. In-line devices such as water meters, building valves, check valves, stops, valves, fittings, tanks and backflow preventers shall comply with NSF 61.

C. End point devices such as drinking fountains, lavatory faucets, kitchen and bar faucets, ice makers supply stops, and end-point control valves used to dispense drinking water must meet requirements of NSF 61.

2.2 FACTORY-ASSEMBLED PRODUCTS

A. Standardization of components shall be maximized to reduce spare part requirements.

B. Manufacturers of equipment assemblies that include components made by others shall assume complete responsibility for final assembled unit.

1. All components of an assembled unit need not be products of same manufacturer.

2. Constituent parts that are alike shall be products of a single manufacturer.
3. Components shall be compatible with each other and with the total assembly for intended service.
4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly at no additional cost or time to the Government.

C. Components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a name plate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

D. Major items of equipment, which serve the same function, shall be the same make and model.

2.3 COMPATIBILITY OF RELATED EQUIPMENT

A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the result will be a complete and fully operational system that conforms to contract requirements.

2.4 SAFETY GUARDS

A. Pump shafts and couplings shall be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material shall be minimum 16-gage sheet steel; ends shall be braked and drilled and attached to pump base with minimum of four 8 mm (1/4 inch) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.

B. All Equipment shall have moving parts protected from personal injury.

2.5 LIFTING ATTACHMENTS

A. Equipment shall be provided with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.6 ELECTRIC MOTORS, MOTOR CONTROL, CONTROL WIRING

A. All material and equipment furnished and installation methods used shall conform to the requirements of Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT; Section 26 29 11, MOTOR

CONTROLLERS; and, Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES. All electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems shall be provided. Premium efficient motors shall be provided. Unless otherwise specified for a particular application, electric motors shall have the following requirements.

B. Special Requirements:

1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional cost or time to the Government.
2. Assemblies of motors, starters, and controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
3. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:
   a. Wiring material located where temperatures can exceed 71° C (160° F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers and water heaters.
   b. Other wiring at boilers and water heaters, and to control panels, shall be NFPA 70 designation THWN.
   c. Shielded conductors or wiring in separate conduits for all instrumentation and control systems shall be provided where recommended by manufacturer of equipment.
4. Motor sizes shall be selected so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.
5. Motors utilized with variable frequency drives shall be rated "inverter-ready" per NEMA Standard, MG1.

C. Motor Efficiency and Power Factor: All motors, when specified as "high efficiency or Premium Efficiency" by the project specifications on driven equipment, shall conform to efficiency and power factor requirements in Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT, with no consideration of annual service hours. Motor manufacturers generally define these efficiency requirements as "NEMA premium efficient" and the requirements generally exceed those of

the Energy Policy Act (EPACT), revised 2005. Motors not specified as "high efficiency or premium efficient" shall comply with EPACT.

D. Single-phase Motors: Capacitor-start type for hard starting applications. Motors for centrifugal pumps may be split phase or permanent split capacitor (PSC).

E. Poly-phase Motors: NEMA Design B, Squirrel cage, induction type. Each two-speed motor shall have two separate windings. A time delay (20 seconds minimum) relay shall be provided for switching from high to low speed.

F. Rating: Rating shall be continuous duty at 100 percent capacity in an ambient temperature of 40° C (104° F); minimum horsepower as shown on drawings; maximum horsepower in normal operation shall not exceed nameplate rating without service factor.

G. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame shall be measured at the time of final inspection.

2.7 VARIABLE SPEED MOTOR CONTROLLERS

A. Refer to Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS and Section 26 29 11, MOTOR CONTROLLERS for specifications.

B. The combination of controller and motor shall be provided by the respective pump manufacturer, and shall be rated for 100 percent output performance. Multiple units of the same class of equipment, i.e. pumps, shall be product of a single manufacturer.

C. Motors shall be premium efficient type, "invertor duty", and be approved by the motor controller manufacturer. The controller-motor combination shall be guaranteed to provide full motor nameplate horsepower in variable frequency operation. Both driving and driven motor sheaves shall be fixed pitch.

D. Controller shall not add any current or voltage transients to the input AC power distribution system, DDC controls, sensitive medical equipment, etc., nor shall be affected from other devices on the AC power system.

2.8 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Use symbols, nomenclature and equipment numbers specified, shown on the drawings, or shown in the maintenance manuals. Coordinate equipment and valve identification with local VAMC shops. In addition, provide bar code identification nameplate for all equipment which will allow the equipment identification code to be scanned into the system for

maintenance and inventory tracking. Identification for piping is specified in Section 09 91 00, PAINTING.

B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 7 mm (3/16 inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING shall be permanently fastened to the equipment. Unit components such as water heaters, tanks, coils, filters, etc. shall be identified.

C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 7 mm (3/16 inch) high riveted or bolted to the equipment.

D. Control Items: All temperature, pressure, and controllers shall be labeled and the component’s function identified. Identify and label each item as they appear on the control diagrams.

E. Valve Tags and Lists:

1. Plumbing: All valves shall be provided with valve tags and listed on a valve list (Fixture stops not included).
2. Valve tags: Engraved black filled numbers and letters not less than 15 mm (1/2 inch) high for number designation, and not less than 8 mm (1/4 inch) for service designation on 19 gage, 40 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
3. Valve lists: Valve lists shall be created using a word processing program and printed on plastic coated cards. The plastic coated valve list card(s), sized 215 mm (8-1/2 inches) by 275 mm (11 inches) shall show valve tag number, valve function and area of control for each service or system. The valve list shall be in a punched 3-ring binder notebook. An additional copy of the valve list shall be mounted in picture frames for mounting to a wall. COR shall instruct contractor where frames shall be mounted.
4. A detailed plan for each floor of the building indicating the location and valve number for each valve shall be provided in the 3-ring binder notebook. Each valve location shall be identified with a color coded sticker or thumb tack in ceiling or access door.

2.9 FIRESTOPPING

A. Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for

piping. Refer to Section 22 07 11, PLUMBING INSULATION, for pipe insulation.

2.10 GALVANIZED REPAIR COMPOUND

A. Mil. Spec. DOD-P-21035B, paint.

2.11 PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

A. In lieu of the paragraph which follows, suspended equipment support and restraints may be designed and installed in accordance with the International Building Code (IBC) requirements, or the following paragraphs of this Section shall be stamped and signed by a professional engineer registered in the state where the project is located. The Support system of suspended equipment over 227 kg (500 pounds) shall be submitted for approval of the COR in all cases. See the above specifications for lateral force design requirements.

B. Type Numbers Specified: For materials, design, manufacture, selection, application, and installation refer to MSS SP-58. For selection and application refer to MSS SP-69. Refer to Section 05 50 00, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting.

C. For Attachment to Concrete Construction:
   1. Concrete insert: Type 18, MSS SP-58.
   2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 100 mm (4 inches) thick when approved by the COR for each job condition.
   3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 100 mm (4 inches) thick when approved by the COR for each job condition.

D. For Attachment to Steel Construction: MSS SP-58.
   1. Welded attachment: Type 22.
   2. Beam clamps: Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23 mm (7/8 inch) outside diameter.

E. For Attachment to Wood Construction: Wood screws or lag bolts.

F. Hanger Rods: Hot-rolled steel, ASTM A36/A36M or ASTM A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 40 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.

G. Multiple (Trapeze) Hangers: Galvanized, cold formed, lipped steel channel horizontal member, not less than 43 mm by 43 mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (No. 12 gage), designed to accept special spring held, hardened steel nuts.
   1. Allowable hanger load: Manufacturers rating less 91kg (200 pounds).
   2. Guide individual pipes on the horizontal member of every other trapeze hanger with 8 mm (1/4 inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 15 mm (1/2 inch) galvanized steel bands, or insulated calcium silicate shield for insulated piping at each hanger.

H. Pipe Hangers and Supports: (MSS SP-58), use hangers sized to encircle insulation on insulated piping. Refer to Section 22 07 11, PLUMBING INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or insulated calcium silicate shields. Provide Type 40 insulation shield or insulated calcium silicate shield at all other types of supports and hangers including those for insulated piping.
   1. General Types (MSS SP-58):
      a. Standard clevis hanger: Type 1; provide locknut.
      b. Riser clamps: Type 8.
      c. Wall brackets: Types 31, 32 or 33.
      d. Roller supports: Type 41, 43, 44 and 46.
      e. Saddle support: Type 36, 37 or 38.
      f. Turnbuckle: Types 13 or 15.
      g. U-bolt clamp: Type 24.
      h. Copper Tube:
         1) Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, copper-coated, plastic coated or taped with isolation tape to prevent electrolysis.
         2) For vertical runs use epoxy painted, copper-coated or plastic coated riser clamps.
         3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
         4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.

i. Supports for plastic or glass piping: As recommended by the pipe manufacturer with black rubber tape extending one inch beyond steel support or clamp.

j. Spring hangers are required on all plumbing system pumps one horsepower and greater.

2. Plumbing Piping (Other Than General Types):

a. Horizontal piping: Type 1, 5, 7, 9, and 10.

b. Chrome plated piping: Chrome plated supports.

c. Hangers and supports in pipe chase: Prefabricated system ABS self-extinguishing material, not subject to electrolytic action, to hold piping, prevent vibration and compensate for all static and operational conditions.

d. Blocking, stays and bracing: Angle iron or preformed metal channel shapes, 1.3 mm (18 gage) minimum.

I. Pre-insulated Calcium Silicate Shields:

1. Provide 360 degree water resistant high density 965 kPa (140 psig) compressive strength calcium silicate shields encased in galvanized metal.

2. Pre-insulated calcium silicate shields to be installed at the point of support during erection.

3. Shield thickness shall match the pipe insulation.

4. The type of shield is selected by the temperature of the pipe, the load it must carry, and the type of support it will be used with.

a. Shields for supporting cold water shall have insulation that extends a minimum of 25 mm (1 inch) past the sheet metal.

b. The insulated calcium silicate shield shall support the maximum allowable water filled span as indicated in MSS SP-69. To support the load, the shields shall have one or more of the following features: structural inserts 4138 kPa (600 psig) compressive strength, an extra bottom metal shield, or formed structural steel (ASTM A36/A36M) wear plates welded to the bottom sheet metal jacket.

5. Shields may be used on steel clevis hanger type supports, trapeze hangers, roller supports or flat surfaces.

2.12 PIPE PENETRATIONS

A. Pipe penetration sleeves shall be installed for all pipe other than rectangular blocked out floor openings for risers in mechanical bays.

B. Pipe penetration sleeve materials shall comply with all firestopping requirements for each penetration.

C. To prevent accidental liquid spills from passing to a lower level, provide the following:

1. For sleeves: Extend sleeve 25 mm (1 inch) above finished floor and provide sealant for watertight joint.
2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.

D. Penetrations are not allowed through beams or ribs, but may be installed in concrete beam flanges, with structural engineer prior approval. Any deviation from these requirements must receive prior approval of COR.

E. Sheet metal, plastic, or moisture resistant fiber sleeves shall be provided for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.

F. Cast iron or zinc coated pipe sleeves shall be provided for pipe passing through exterior walls below grade. The space between the sleeve and pipe shall be made watertight with a modular or link rubber seal. The link seal shall be applied at both ends of the sleeve.

G. Galvanized steel or an alternate black iron pipe with asphalt coating sleeves shall be for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. A galvanized steel sleeve shall be provided for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, sleeves shall be connected with a floor plate.

H. Brass Pipe Sleeves shall be provided for pipe passing through quarry tile, terrazzo or ceramic tile floors. The sleeve shall be connected with a floor plate.

I. Sleeve clearance through floors, walls, partitions, and beam flanges shall be 25 mm (1 inch) greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation plus 25 mm (1 inch) in diameter. Interior openings shall be caulked tight with firestopping material and sealant to prevent the spread of fire, smoke, water and gases.

J. Sealant and Adhesives: Shall be as specified in Section 07 92 00, JOINT SEALANTS. Bio-based materials shall be utilized when possible.

K. Pipe passing through roof shall be installed through a 4.9 kg per square meter copper flashing with an integral skirt or flange. Skirt or flange shall extend not less than 200 mm (8 inches) from the pipe and set in a solid coating of bituminous cement. Extend flashing a minimum of 250 mm (10 inches) up the pipe. Pipe passing through a waterproofing membrane shall be provided with a clamping flange. The annular space between the sleeve and pipe shall be sealed watertight.

2.13 TOOLS AND LUBRICANTS

A. Furnish, and turn over to the COR, special tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

C. Tool Containers: metal, permanently identified for intended service and mounted, or located, where directed by the COR.

D. Lubricants: A minimum of 0.95 L (1 quart) of oil, and 0.45 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application. Bio-based materials shall be utilized when possible.

2.14 WALL, FLOOR AND CEILING PLATES

A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.

B. Thickness: Not less than 2.4 mm (3/32 inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025 inch) for up to 75 mm (3 inch) pipe, 0.89 mm (0.035 inch) for larger pipe.

C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Wall plates shall be used where insulation ends on exposed water supply pipe drop from overhead. A watertight joint shall be provided in spaces where brass or steel pipe sleeves are specified.

2.15 ASBESTOS

A. Materials containing asbestos are not permitted.

PART 3 - EXECUTION

3.1 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

A. Location of piping, sleeves, inserts, hangers, and equipment, access provisions shall be coordinated with the work of all trades. Piping, sleeves, inserts, hangers, and equipment shall be located clear of windows, doors, openings, light outlets, and other services and utilities. Equipment layout drawings shall be prepared to coordinate proper location and personnel access of all facilities. The drawings shall be submitted for review.

B. Manufacturer's published recommendations shall be followed for installation methods not otherwise specified.

C. Operating Personnel Access and Observation Provisions: All equipment and systems shall be arranged to provide clear view and easy access, without use of portable ladders, for maintenance, testing and operation of all devices including, but not limited to: all equipment items, valves, backflow preventers, filters, strainers, transmitters, sensors, meters and control devices. All gages and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Maintenance and operating space and access provisions that are shown on the drawings shall not be changed nor reduced.

D. Structural systems necessary for pipe and equipment support shall be coordinated to permit proper installation.

E. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.

F. Cutting Holes:

1. Holes shall be located to avoid interference with structural members such as beams or grade beams. Holes shall be laid out in advance and drilling done only after approval by COR. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to COR for approval.
2. Waterproof membrane shall not be penetrated. Pipe floor penetration block outs shall be provided outside the extents of the waterproof membrane.
3. Holes through concrete and masonry shall be cut by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill will not be allowed, except as permitted by COR where working area space is limited.

G. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other services are not shown but must be provided.

H. Protection and Cleaning:

1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the COR. Damaged or defective items in the opinion of the COR, shall be replaced at no additional cost or time to the Government.
2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Pipe openings, equipment, and plumbing fixtures shall be tightly covered against dirt or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

I. Concrete and Grout: Concrete and shrink compensating grout 25 MPa (3000 psig) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE, shall be used for all pad or floor mounted equipment.

J. Gages, thermometers, valves and other devices shall be installed with due regard for ease in reading or operating and maintaining said devices. Thermometers and gages shall be located and positioned to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

K. Interconnection of Controls and Instruments: Electrical interconnection is generally not shown but shall be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, alarms, instruments and computer workstations. Comply with NFPA 70.

L. Work in Existing Building:

1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).

2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will cause the least interfere with normal operation of the facility.

M. Work in bathrooms, restrooms, housekeeping closets: All pipe penetrations behind escutcheons shall be sealed with plumbers putty.

N. Switchgear Drip Protection: Every effort shall be made to eliminate the installation of pipe above data equipment, and electrical and telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints. Drain valve shall be provided in low point of casement pipe.

O. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost or additional time to the Government.
2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as electrical conduit, motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

3.2 TEMPORARY PIPING AND EQUIPMENT

A. Continuity of operation of existing facilities may require temporary installation or relocation of equipment and piping. Temporary equipment or pipe installation or relocation shall be provided to maintain continuity of operation of existing facilities.

B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities. The requirements of paragraph 3.1 shall apply.

C. Temporary facilities and piping shall be completely removed back to the nearest active distribution branch or main pipe line and any openings in structures sealed. Dead legs are not allowed in potable water

systems. Necessary blind flanges and caps shall be provided to seal open piping remaining in service.

3.3 RIGGING

A. Openings in building structures shall be planned to accommodate design scheme.

B. Alternative methods of equipment delivery may be offered and will be considered by Government under specified restrictions of phasing and service requirements as well as structural integrity of the building.

C. All openings in the building shall be closed when not required for rigging operations to maintain proper environment in the facility for Government operation and maintenance of service.

D. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility.

E. Contractor shall check all clearances, weight limitations and shall provide a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.

F. Rigging plan and methods shall be referred to COR for evaluation prior to actual work.

3.4 PIPE AND EQUIPMENT SUPPORTS

A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Holes shall be drilled or burned in structural steel ONLY with the prior written approval of the COR.

B. The use of chain pipe supports, wire or strap hangers; wood for blocking, stays and bracing, or hangers suspended from piping above shall not be permitted. Rusty products shall be replaced.

C. Hanger rods shall be used that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. A minimum of 15 mm (1/2 inch) clearance between pipe or piping covering and adjacent work shall be provided.

D. For horizontal and vertical plumbing pipe supports, refer to the International Plumbing Code (IPC) and these specifications.

E. Overhead Supports:
   1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
   2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
   3. Tubing and capillary systems shall be supported in channel troughs.

F. Floor Supports:
   1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Concrete bases and structural systems shall be anchored and doweled to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.
   2. Bases and supports shall not be located and installed until equipment mounted thereon has been approved. Bases shall be sized to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Structural drawings shall be reviewed for additional requirements. Bases shall be neatly finished and smoothed, shall have chamfered edges at the top, and shall be suitable for painting.
   3. All equipment shall be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts shall be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a grout material to permit alignment and realignment.
   4. For seismic anchoring, refer to Section 13 05 41, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

3.5 LUBRICATION

A. All equipment and devices requiring lubrication shall be lubricated prior to initial operation. All devices and equipment shall be field checked for proper lubrication.

B. All devices and equipment shall be equipped with required lubrication fittings. A minimum of one liter (one quart) of oil and 0.45 kg (1 pound) of grease of manufacturer's recommended grade and type for each different application shall be provided. All materials shall be delivered to COR in unopened containers that are properly identified as to application.

C. A separate grease gun with attachments for applicable fittings shall be provided for each type of grease applied.

D. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.

E. All lubrication points shall be extended to one side of the equipment.

3.6 PLUMBING SYSTEMS DEMOLITION

A. Rigging access, other than indicated on the drawings, shall be provided after approval for structural integrity by the COR. Such access shall be provided without additional cost or time to the Government. Where work is in an operating plant, approved protection from dust and debris shall be provided at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.

B. In an operating plant, cleanliness and safety shall be maintained. The plant shall be kept in an operating condition. Government personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Work shall be confined to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Dust and debris shall not be permitted to accumulate in the area to the detriment of plant operation. All flame cutting shall be performed to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities shall be available at all times. All work shall be performed in accordance with recognized fire protection standards including NFPA 51B. Inspections will be made by personnel of the VA Medical Center, and the Contractor shall follow all directives of the COR with regard to rigging, safety, fire safety, and maintenance of operations.

C. Unless specified otherwise, all piping, wiring, conduit, and other devices associated with the equipment not re-used in the new work shall be completely removed from Government property per Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT. This includes all concrete equipment pads, pipe, valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. All openings shall be sealed after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with plans and specifications where specifically covered. All openings shall be sealed to maintain sound separation between spaces and to maintain existing fire rating. Contractor shall request Statement of Condition drawings for review of fire ratings. Structural integrity of the building system shall be maintained. Reference shall

also be made to the drawings and specifications of the other disciplines in the project for additional facilities to be demolished or handled.

D. All valves including gate, globe, ball, butterfly and check, all pressure gages and thermometers with wells shall remain Government property and shall be removed and delivered to COR and stored as directed. The Contractor shall remove all other material and equipment, devices and demolition debris under these plans and specifications. Such material shall be removed from Government property expeditiously and shall not be allowed to accumulate. Coordinate with the COR and Infection Control.

E. Asbestos Insulation Removal: Conform to Section 02 82 11, ASBESTOS ABATEMENT.

3.7 CLEANING AND PAINTING

A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment and systems shall be thoroughly cleaned and painted. Refer to Section 09 91 00, PAINTING.

B. In addition, the following special conditions apply:

1. Cleaning shall be thorough. Solvents, cleaning materials and methods recommended by the manufacturers shall be used for the specific tasks. All rust shall be removed prior to painting and from surfaces to remain unpainted. Scratches, scuffs, and abrasions shall be repaired prior to applying prime and finish coats.

2. The following Material and Equipment shall NOT be painted:

a. Motors, controllers, control switches, and safety switches.

b. Control and interlock devices.

c. Regulators.

d. Pressure reducing valves.

e. Control valves and thermostatic elements.

f. Lubrication devices and grease fittings.

g. Copper, brass, aluminum, stainless steel and bronze surfaces.

h. Valve stems and rotating shafts.

i. Pressure gages and thermometers.

j. Glass.

k. Name plates.

3. Control and instrument panels shall be cleaned and damaged surfaces repaired. Touch-up painting shall be made with matching paint type and color obtained from manufacturer or computer matched.
4. Pumps, motors, steel and cast iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same paint type and color as utilized by the pump manufacturer.
5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats per Section 09 91 00, Painting.
6. The final result shall be a smooth, even-colored, even-textured factory finish on all items. The entire piece of equipment shall be repainted, if necessary, to achieve this. Lead based paints shall not be used.

3.8 IDENTIFICATION SIGNS

A. Laminated plastic signs, with engraved lettering not less than 7 mm (3/16 inch) high, shall be provided that designates equipment function, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols shall correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.

B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, and performance data shall be placed on factory built equipment.

C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

3.9 STARTUP AND TEMPORARY OPERATION

A. Startup of equipment shall be performed as described in the equipment specifications. Vibration within specified tolerance shall be verified prior to extended operation. Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

3.10 OPERATING AND PERFORMANCE TESTS

A. Prior to the final inspection, all required tests shall be performed as specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TESTS and submit the test reports and records to the COR.

B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of

tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost to the Government.

C. When completion of certain work or systems occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then conduct such performance tests and finalize control settings during the first actual seasonal use of the respective systems following completion of work. Rescheduling of these tests shall be requested in writing to COR for approval.

3.11 OPERATION AND MAINTENANCE MANUALS

A. All new and temporary equipment and all elements of each assembly shall be included.

B. Data sheet on each device listing model, size, capacity, pressure, speed, horsepower, impeller size, and other information shall be included.

C. Manufacturer’s installation, maintenance, repair, and operation instructions for each device shall be included. Assembly drawings and parts lists shall also be included. A summary of operating precautions and reasons for precautions shall be included in the Operations and Maintenance Manual.

D. Lubrication instructions, type and quantity of lubricant shall be included.

E. Schematic diagrams and wiring diagrams of all control systems corrected to include all field modifications shall be included.

F. Set points of all interlock devices shall be listed.

G. Trouble-shooting guide for the control system troubleshooting shall be inserted into the Operations and Maintenance Manual.

H. The control system sequence of operation corrected with submittal review comments shall be inserted into the Operations and Maintenance Manual.

I. Emergency procedures for shutdown and startup of equipment and systems.

3.12 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for four hours to instruct VA Personnel in operation and maintenance of the system.

- - - E N D - - -

SECTION 22 05 12
GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the general motor requirements for plumbing equipment and applies to all sections of Division 22.

B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.3 APPLICABLE PUBLICATIONS

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

B. American Bearing Manufacturers Association (ABMA):
ABMA 9-1990 (R2008).....Load Ratings and Fatigue Life for Ball Bearings

C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
841-2009.....IEEE Standard for Petroleum and Chemical Industry-Premium-Efficiency, Severe-Duty, Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors--Up to and Including 370 kW (500 HP)

D. International Code Council (ICC):
IPC-2012.....International Plumbing Code

E. National Electrical Manufacturers Association (NEMA):
MG 1-2011.....Motors and Generators
MG 2-2001 (R2007).....Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators
250-2008.....Enclosures for Electrical Equipment (1000 Volts Maximum)

F. National Fire Protection Association (NFPA):
70-2011.....National Electrical Code (NEC)

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT", with applicable paragraph identification.

C. Shop Drawings:

1. Sufficient information, clearly presented, shall be included to determine compliance with drawings and specifications.
2. Motor nameplate information shall be submitted including electrical ratings, dimensions, mounting details, materials, horsepower, power factor, current as a function of speed, current efficiency, speed as a function of load, RPM, enclosure, starting characteristics, torque characteristics, code letter, full load and locked rotor current, service factor, and lubrication method.
3. Motor parameters required for the determination of the Reed Critical Frequency of vertical hollow shaft motors shall be submitted.

D. Operating and Maintenance Manuals: Companion copies of complete maintenance and operating manuals, including technical data sheets and application data shall be submitted simultaneously with the shop drawings. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replaceable parts:

1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

E. Certification: Two weeks prior to final inspection, unless otherwise noted, the following certification shall be submitted to the Contracting Officer's Representative (COR).

1. Certification shall be submitted stating that the motors have been properly applied, installed, adjusted, lubricated, and tested.

1.5 QUALITY ASSURANCE

A. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA

recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

PART 2 - PRODUCTS

2.1 MOTORS

A. For alternating current, fractional and integral horsepower motors, NEMA MG 1 and NEMA MG 2 shall apply.

B. For severe duty totally enclosed motors, IEEE 841 shall apply.

C. Voltage ratings shall be as follows:

1. Single phase:
   a. Motors connected to 120-volt systems: 115 volts.
   b. Motors connected to 208-volt systems: 200 volts.
   c. Motors connected to 240-volt or 480-volt systems: 230/460 volts, dual connection.
2. Three phase:
   a. Motors connected to 208-volt systems: 200 volts.
   b. Motors, less than 74.6 kW (100 HP), connected to 240-volt or 480-volt systems: 230/460 volts, dual connection.
   c. Motors, 74.6 kW (100 HP) or larger, connected to 240-volt systems: 230 volts.
   d. Motors, 74.6 kW (100 HP) or larger, connected to 480-volt systems: 460 volts.
   e. Motors connected to high voltage systems: Shall conform to NEMA MG 1 Standards for connection to the nominal system voltage shown on the drawings.

D. Number of phases shall be as follows:

1. Motors, less than 373 W (1/2 HP): Single phase.
2. Motors, 373 W (1/2 HP) and larger: 3 phase.
3. Exceptions:
   a. Hermetically sealed motors.
   b. Motors for equipment assemblies, less than 746 W (1 HP), may be single phase provided the manufacturer of the proposed assemblies cannot supply the assemblies with three phase motors.

E. Horsepower ratings shall be adequate for operating the connected loads continuously in the prevailing ambient temperatures in areas where the

motors are installed, without exceeding the NEMA standard temperature rises for the motor insulation.

F. Motor designs, as indicated by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting, acceleration and running torque without exceeding nameplate ratings or considering service factor.

G. Motor Enclosures:

1. Shall be the NEMA types shown on the drawings for the motors.
2. Where the types of motor enclosures are not shown on the drawings, they shall be the NEMA types per NEMA 250, which are most suitable for the environmental conditions where the motors are being installed.
3. Enclosures shall be primed and finish coated at the factory with manufacturer's prime coat and standard finish.
4. All motors in hazardous locations shall be approved for the application and meet the Class and Group as required by the area classification.

H. Electrical Design Requirements:

1. Motors shall be continuous duty.
2. The insulation system shall be rated minimum of Class B, 130 degrees C (266 degrees F).
3. The maximum temperature rise by resistance at rated power shall not exceed Class B limits, 80 degrees C (144 degrees F).
4. The speed/torque and speed/current characteristics shall comply with NEMA Design A or B, as specified.
5. Motors shall be suitable for full voltage starting, unless otherwise noted. Coordinate motor features with applicable motor controllers.
6. Motors for variable frequency drive applications shall adhere to NEMA MG 1, Part 30, Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General Purpose Motors Used with Adjustable Voltage or Adjustable Frequency Controls, or both, or NEMA MG 1, Part 31, Definite Purpose Inverter Fed Polyphase Motors.

I. Mechanical Design Requirements:

1. Bearings shall be rated for a minimum fatigue life of 26,280 hours for belt-driven loads and 100,000 hours for direct-drive loads based on L10 (Basic Rating Life) at full load direct coupled, except

vertical high thrust motors which require a 40,000 hour rating. A minimum fatigue life of 40,000 hours is required for VFD drives.

2. Vertical motors shall be capable of withstanding a momentary up thrust of at least 30 percent of normal down thrust.
3. Grease lubricated bearings shall be designed for electric motor use. Grease shall be capable of the temperatures associated with electric motors and shall be compatible with Polyurea based greases.
4. Grease fittings, if provided, shall be Alemite type or equivalent.
5. Oil lubricated bearings, when specified, shall have an externally visible sight glass to view oil level.
6. Vibration shall not exceed 3.8 mm (0.15 inch) per second, unfiltered peak.
7. Noise level shall meet the requirements of the application.
8. Motors on 180 frames and larger shall have provisions for lifting eyes or lugs capable of a safety factor of 5.
9. All external fasteners shall be corrosion resistant.
10. Condensation heaters, when specified, shall keep motor windings at least 5 degrees C (9 degrees F) above ambient temperature.
11. Winding thermostats, when specified shall be normally closed, connected in series.
12. Grounding provisions shall be in the main terminal box.

J. Additional requirements for specific motors, as indicated in other sections, shall also apply.

K. NEMA Premium Efficiency Electric Motors, Motor Efficiencies: All permanently wired polyphase motors of 746 W (1 HP) or more shall meet the minimum full-load efficiencies as indicated in the following table, and as specified in this specification. Motors of 746 W (1 HP) or more with open, drip-proof or totally enclosed fan-cooled enclosures shall be NEMA premium efficiency type, unless otherwise indicated. Motors provided as an integral part of motor driven equipment are excluded from this requirement if a minimum seasonal or overall efficiency requirement is indicated for that equipment by the provisions of another section.

Minimum Efficiencies Open Drip-Proof				Minimum Efficiencies Totally Enclosed Fan-Cooled			
Rating kW (HP)	1200 RPM	1800 RPM	3600 RPM	Rating kW (HP)	1200 RPM	1800 RPM	3600 RPM

0.746 (1)	82.5%	85.5%	77.0%	0.746 (1)	82.5%	85.5%	77.0%
1.12 (1.5)	86.5%	86.5%	84.0%	1.12 (1.5)	87.5%	86.5%	84.0%
1.49 (2)	87.5%	86.5%	85.5%	1.49 (2)	88.5%	86.5%	85.5%
2.24 (3)	88.5%	89.5%	85.5%	2.24 (3)	89.5%	89.5%	86.5%
3.73 (5)	89.5%	89.5%	86.5%	3.73 (5)	89.5%	89.5%	88.5%
5.60 (7.5)	90.2%	91.0%	88.5%	5.60 (7.5)	91.0%	91.7%	89.5%
7.46 (10)	91.7%	91.7%	89.5%	7.46 (10)	91.0%	91.7%	90.2%
11.2 (15)	91.7%	93.0%	90.2%	11.2 (15)	91.7%	92.4%	91.0%
14.9 (20)	92.4%	93.0%	91.0%	14.9 (20)	91.7%	93.0%	91.0%
18.7 (25)	93.0%	93.6%	91.7%	18.7 (25)	93.0%	93.6%	91.7%
22.4 (30)	93.6%	94.1%	91.7%	22.4 (30)	93.0%	93.6%	91.7%
29.8 (40)	94.1%	94.1%	92.4%	29.8 (40)	94.1%	94.1%	92.4%
37.3 (50)	94.1%	94.5%	93.0%	37.3 (50)	94.1%	94.5%	93.0%
44.8 (60)	94.5%	95.0%	93.6%	44.8 (60)	94.5%	95.0%	93.6%
56.9 (75)	94.5%	95.0%	93.6%	56.9 (75)	94.5%	95.4%	93.6%
74.6 (100)	95.0%	95.4%	93.6%	74.6 (100)	95.0%	95.4%	94.1%
93.3 (125)	95.0%	95.4%	94.1%	93.3 (125)	95.0%	95.4%	95.0%
112 (150)	95.4%	95.8%	94.1%	112 (150)	95.8%	95.8%	95.0%
149.2 (200)	95.4%	95.8%	95.0%	149.2 (200)	95.8%	96.2%	95.4%

L. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM and 3600 RPM. Power factor correction capacitors shall be installed unless the motor is controlled by a variable frequency drive. The power factor correction capacitors shall be able to withstand high voltage transients and power line variations without breakdown.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors in accordance with manufacturer’s recommendations, the NEC, NEMA, as shown on the drawings and/or as required by other sections of these specifications.

B. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no cost to the Government.

3.2 FIELD TESTS

Megger all motors after installation, before start-up. All shall test free from grounds.

- - - E N D - - -

SECTION 22 05 19
METERS AND GAGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the requirements for water meters and gages primarily used for troubleshooting the system and to indicate system performance.

B. This section also describes requirements for packaged water quality monitoring systems.

C. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.3 APPLICABLE PUBLICATIONS

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

B. American Society of Mechanical Engineers (ASME):
B40.100-2013.....Pressure Gauges and Gauge Attachments
B40.200-2008.....Thermometers, Direct Reading and Remote Reading

C. Institute of Electrical and Electronics Engineers (IEEE):
C2-2012.....National Electrical Safety Code (NESC)

D. International Code Council (ICC):
IPC-2012.....International Plumbing Code

E. National Fire Protection Association (NFPA):
70-2011.....National Electrical Code (NEC)

F. NSF International (NSF):
61-2012.....Drinking Water System Components - Health Effects
372-2011.....Drinking Water System Components - Lead Content

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 05 19, METERS AND GAGES FOR PLUMBING PIPING", with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Water Meter.
2. Pressure Gages.
3. Pressure Transmitter.
4. Thermometers.
5. Temperature Transmitters.
6. Continuous Water Quality Monitoring System (Packaged).
7. Product certificates for each type of meter and gage.
8. BACnet communication protocol.

D. Operations and Maintenance manual shall include:

1. System Description.
2. Major assembly block diagrams.
3. Troubleshooting and preventive maintenance guidelines.
4. Spare parts information.

E. Shop Drawings shall include the following: One line, wiring and terminal diagrams including terminals identified, protocol or communication modules, and Ethernet connections.

1.5 AS-BUILT DOCUMENTATION

A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit copies of complete operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be in electronic PDF version via Electronic Transmittal and Hard Copy inserted into a three ring binder and per the requirements of Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. A list of

recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

PART 2 – PRODUCTS

2.1 DISPLACEMENT WATER METER – NOT USED

2.2 TURBINE WATER METER – NOT USED

2.3 COMPOUND WATER METER – NOT USED

2.4 WATER METER STRAINER – NOT USED

2.5 WATER METER PROGRAMMING – NOT USED

2.6 WATER METER COMMUNICATION PROTOCOL – SEE 2.10

2.7 REMOTE READOUT REGISTER – NOT USED

2.8 PRESSURE GAGES FOR WATER

A. ASME B40.100 all metal case 115 mm (4-1/2 inches) diameter, bottom connected throughout, graduated as required for service, and identity labeled. Range shall be 0 to 1380 kPa (0 to 200 psig) gage.

B. The pressure element assembly shall be bourdon tube. The mechanical movement shall be lined to pressure element and connected to pointer.

C. The dial shall be non-reflective aluminum with permanently etched scale markings graduated in kPa and psig.

D. The pointer shall be dark colored metal.

E. The window shall be glass.

F. The ring shall be brass or stainless steel.

G. The accuracy shall be grade A, plus or minus 1 percent of middle half of scale range.

H. The pressure gage for water domestic use shall conform to NSF 61.

2.9 THERMOMETERS

A. Thermometers shall be straight stem, metal case, red liquid-filled thermometer, approximately 175 mm (7 inches) high, 4 degrees C to 100 degrees C (40 degrees F to 212 degrees F). Thermometers shall comply with ASME B40.200.

2.10 MAGNETIC FLOWMETERS (FLOW INDICATING TRANSMITTER)

A. Meter shall have an all-welded flanged 316 stainless steel engineered flow tube with no seals. No sensor parts shall be exposed to the flow stream. Design meter for mating with Schedule 40 piping. Meter shall match nominal pipe size on which it is installed.

1. Meter shall be suitable for 25% warmer than the fluid operating temperature and for 25% higher than either the fluid's operating pressure or 25% higher than the piping system's safety valve set pressure, whichever is higher.
2. Meter flanges shall be Class 150.
3. Meter shall be suitable for installation in ambient conditions ranging from -29 to 60 degrees C (-20 to 140 degrees F).

B. Provide meter data head.

1. Meters shall have digital readout of pressure-compensated flow rate and totalization located at transmitter and transmit flow rate and totalization digital signals to the Building Automation System. As an option, pressure compensation and the compensated flow rate may be performed and displayed by the Building Automation System receiving signals from the flow meter and from a pressure transmitter.
2. Provide programmable microprocessor electronics with on-board programming. Output signals shall be immune to ambient temperature swings. Processor shall include continuous self-diagnostic routines that identify electronics problems and provide a warning. Electronics shall be replaceable in the field without affecting metering accuracy. Provide power supply as recommended by meter manufacturer. Mount electronics in a NEMA 4 enclosure separate from meter body in position accessible from platform or floor without the use of a portable ladder.
   1) Power supply to meter and transmitter shall be 120V/60hz. Provide a Class 2 control voltage transformer for 24VDC power to meter as needed.
3. Head shall be remote mounted where indicated on drawings.
4. Provide with digital and analog outlets for integration into building controller.

C. Performance:

1. Transmitted signal from flowmeter and its transmitter shall have a total (rms) accuracy plus or minus 1.5% of flow rate.
2. Flowmeter accuracy shall be no more than plus or minus 1.5% of actual flow rate for gasses and plus or minus 1% of actual flow rate for liquids. Flowmeter repeatability shall be no more than 0.2% of

actual flow rate. Meter shall be designed to minimize vibration effect and to provide elimination of this effect.

3. Minimum turndown ratio shall be 20:1.

2.11 TEMPERATURE TRANSMITTERS

A. 4 to 20 mA output signal.

B. 2-wire transmitter.

C. Sensor body shall be stainless steel type 316L.

D. Where components contact domestic water, items shall conform to NSF 61.

2.12 CONTINUOUS WATER QUALITY MONITORING SYSTEM

A. Panel mounted system for automatic monitoring of free chlorine residuals, pH, temperature, pressure and conductivity.

B. Measure free residual oxidant (FRO) in potable water systems using the EPA accepted DPD colorimetric test method for measuring chlorine.

C. Measure chlorine residuals at configurable frequencies as short as 180 seconds.

D. Support water sample temperatures of up to 150°F using a sample cooler.

E. Measurement accuracy of 5% or less for readings of 0-6 mg/L as FRO or TRO.

F. Comply with US EPA regulation 40 CFR 140.74, Standard Method 4500-CLG, and US EPA Method 334.0 "Determination of Residual Chlorine in Drinking Water Using an Online Chlorine Analyzer.

G. NEMA 4X rating or equivalent.

H. The system must be pre-wired and pre-plumbed on a rugged single skid to ensure high quality and a simple installation. Installation must require only one tap from the main water line to provide a continuous sample stream of water to the monitoring system (not counting sample cooling). The system must be fully powered by a single 110V power supply.

I. The system shall be integrated into the existing Building Automation System. Contractor shall coordinate the controller supplied with the system to match standard communication protocol. Consult with project controls contractor.

J. Continuous Water Quality Monitoring System shall have characteristics of 5-20mV and refer to points list on sheet 00P004 for number and types of data points.

K. **BRAND NAME (SOLE SOURCE) SPECIFICATION: FREE CHLORINE ANALYZER - HACH CL17SC FREE CHLORINE ANALYZER. PROVIDE PANEL, STANDPIPE (OR PRESSURE**

REGULATOR CONFIGURATION) AND ANY OTHER MISC. COMPONENTS PER SITE SPECIFIC BEST FIT. PROVIDE A HACH SC4500 PANEL BETWEEN THE CHLORINE ANALYZER AND THE AGGREGATED WATER MONITORING PANEL. PROVIDE A SIX-MONTH SUPPLY OF REAGENTS FOR ALL OF THE ANALYZERS INCLUDING THE 11 EXISTING ANALYZERS.

2.13 PRESSURE TRANSMITTERS

A. For pressures 100 psi and above: Silicon strain gages molecularly bonded to the stainless steel diaphragm.
B. Operating Temperature: -40 to 185 deg F (-40 to 85 deg C).
C. Wetted Parts: 316 SS for psia below 100 and 17-4 PH SS for psia 100 and greater.
D. Include with mini DIN connector.
E. Include pressure snubber.
F. 4 to 20 mA output signal.
G. Where components contact domestic water, those items shall conform to NSF 61 and NSF 372.
H. Refer to Detail 4 on sheet PL502.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Direct mounted pressure gages shall be installed in piping tees with pressure gage located on pipe at the most readable position.
B. Valves and snubbers shall be installed in piping for each pressure gage.
D. Pressure gages shall be installed where indicated on the drawings and at the following locations:
   1. Inlet and outlet of each new backflow preventor station.
   2. Inlet and outlet of each new flow control valve station.
   3. Suction and discharge of each new domestic water pump or re-circulating hot water return pump.
E. Water meter installation shall conform to AWWA C700, AWWA C701, and AWWA C702. Electrical installations shall conform to IEEE C2, NFPA 70, and to the requirements specified herein. New materials shall be provided.
F. Thermometers shall be installed on, the new hot water circulation pump inlet piping, and at all locations of new temperature transmitters.

G. Continuous Water Quality Monitoring System shall be installed per manufacturers recommendations. System shall be installed to minimize sample water flow rate (water flowing to drain). Flow shall be throttled with panel mounted valve to minimum flow rate recommended by manufacturer. Ball type valves are not permissible for throttling. Cold water sampling panel shall be installed to discharge into sample cooler for hot water unit to minimize number of waste streams if recommended by and with guidance of the manufacturer.

H. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no cost to the Government.

3.2 FIELD QUALITY CONTROL

A. All meters, gauges, and sampling instrumentation shall be visually inspected and operationally tested.

- - - E N D - - -

SECTION 22 05 23
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the requirements for general-duty valves for domestic water and sewer systems.

B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.3 APPLICABLE PUBLICATIONS

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

B. American Society of Sanitary Engineering (ASSE):

1001-2008.....Performance Requirements for Atmospheric Type Vacuum Breakers

1003-2009.....Performance Requirements for Water Pressure Reducing Valves for Domestic Water Distribution Systems

1011-2004.....Performance Requirements for Hose Connection Vacuum Breakers

1013-2011.....Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers

1020-2004.....Performance Requirements for Pressure Vacuum Breaker Assembly

1069-2005.....Performance Requirements for Automatic Temperature Control Mixing Valves

1070-2004.....Performance Requirements for Water Temperature Limiting Devices

C. American Society for Testing and Materials (ASTM):

A126-2004(R2009).....Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings

A276-2013a.....Standard Specification for Stainless Steel Bars and Shapes

A536-1984(R2009).....Standard Specification for Ductile Iron Castings

B62-2009.....Standard Specification for Composition Bronze or Ounce Metal Castings

B584-2013.....Standard Specification for Copper Alloy Sand Castings for General Applications

D. International Code Council (ICC):

IPC-2012.....International Plumbing Code

E. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS):

SP-25-2008.....Standard Marking Systems for Valves, Fittings, Flanges and Unions

SP-67-2011.....Butterfly Valves

SP-70-2011.....Gray Iron Gate Valves, Flanged and Threaded Ends

SP-71-2011.....Gray Iron Swing Check Valves, Flanged and Threaded Ends

SP-80-2013.....Bronze Gate, Globe, Angle, and Check Valves

SP-85-2011.....Gray Iron Globe & Angle Valves, Flanged and Threaded Ends

SP-110-2010.....Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

F. National Environmental Balancing Bureau (NEBB):

7th Edition 2005 Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems

G. NSF International (NSF):

61-2012.....Drinking Water System Components – Health Effects

372-2011.....Drinking Water System Components – Lead Content

H. University of Southern California Foundation for Cross Connection Control and Hydraulic Research (USC FCCCHR):

9th Edition.....Manual of Cross-Connection Control

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING", with applicable paragraph identification.

C. Manufacturer's Literature and Data Including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. Ball Valves.
2. Gate Valves.
3. Butterfly Valves.
4. Balancing Valves.
5. Check Valves.
6. Globe Valves.
7. Water Pressure Reducing Valves and Connections.
8. Backflow Preventers.
9. Chainwheels.
10. Thermostatic Mixing Valves.
11. Solenoid Control Valves

D. Test and Balance reports for balancing valves.

E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replaceable parts:

1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.
4. Piping diagrams of thermostatic mixing valves to be installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Valves shall be prepared for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads, flange faces, grooves, and weld ends.
3. Set angle, gate, and globe valves closed to prevent rattling.

4. Set ball and plug valves open to minimize exposure of functional surfaces.
5. Set butterfly valves closed or slightly open.
6. Block check valves in either closed or open position.

B. Valves shall be prepared for storage as follows:
1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature.

C. A sling shall be used for large valves. The sling shall be rigged to avoid damage to exposed parts. Hand wheels or stems shall not be used as lifting or rigging points.

PART 2 - PRODUCTS

2.1 VALVES, GENERAL

A. Asbestos packing and gaskets are prohibited.

B. Bronze valves shall be made with dezincification resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc shall not be permitted.

C. Valves in insulated piping shall have 50 mm or DN50 (2 inch) stem extensions and extended handles of non-thermal conductive material that allows operating the valve without breaking the vapor seal or disturbing the insulation. Memory stops shall be fully adjustable after insulation is applied.

D. Exposed Valves over 65 mm or DN65 (2-1/2 inches) installed at an elevation over 3.6 m (12 feet) shall have a chain-wheel attachment to valve hand-wheel, stem, or other actuator.

E. All valves used to supply potable water shall meet the requirements of NSF 61 and NSF 372.

F. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

2.2 SHUT-OFF VALVES

A. Cold, Hot and Re-circulating Hot Water:
1. 50 mm or DN50 (2 inches) and smaller: Ball, MSS SP-110, Ball valve shall be full port three piece or two piece with a union design with

adjustable stem package. Threaded stem designs are not allowed. The ball valve shall have a SWP rating of 1035 kPa (150 psig) and a CWP rating of 4138 kPa (600 psig). The body material shall be Bronze ASTM B584, Alloy C844. The ends shall be non-lead solder.

2. Less than 100 mm DN100 (4 inches): Butterfly shall have an iron body with EPDM seal and aluminum bronze disc. The butterfly valve shall meet MSS SP-67, type I standard. The butterfly valve shall have a SWP rating of 1380 kPa (200 psig). The valve design shall be lug type suitable for bidirectional dead-end service at rated pressure. The body material shall meet ASTM A536, ductile iron.
3. 100 mm DN100 (4 inches) and larger:
   a. Class 125, OS&Y, Cast Iron Gate Valve. The gate valve shall meet MSS SP-70 type I standard. The gate valve shall have a CWP rating of 1380 kPa (200 psig). The valve materials shall meet ASTM A126, grey iron with bolted bonnet, flanged ends, bronze trim, and positive-seal resilient solid wedge disc. The gate valve shall be gear operated for sizes under 200 mm or DN200 (8 inches) and crank operated for sizes 200 mm or DN200 (8 inches) and above.
   b. Single flange, ductile iron butterfly valves: The single flanged butterfly valve shall meet the MSS SP-67 standard. The butterfly valve shall have a CWP rating of 1380 kPa (200 psig). The butterfly valve shall be lug type, suitable for bidirectional dead-end service at rated pressure without use of downstream flange. The body material shall comply with ASTM A536 ductile iron. The seat shall be EPDM with stainless steel disc and stem.
   c. Grooved end, ductile iron butterfly valves. The grooved butterfly valve shall meet the MSS SP-67 standard. The grooved butterfly valve shall have a CWP rating of 1380 kPa (200 psig). The valve materials shall be epoxy coated ductile iron conforming to ASTM A536 with two piece stainless steel stem, EPDM encapsulated ductile iron disc, and EPDM seal. The butterfly valve shall be gear operated.

2.3 BALANCING VALVES / CIRCUIT SETTERS

A. Hot Water Re-circulating, 75 mm or DN75 (3 inches) and smaller manual balancing valve shall be of bronze body, brass ball construction with glass and carbon filled TFE seat rings and designed for positive shutoff. The manual balancing valve shall have differential pressure

read-out ports across the valve seat area. The read out ports shall be fitting with internal EPT inserts and check valves. The valve body shall have 8 mm or DN8 NPT (1/4 inch NPT) tapped drain and purge port. The valves shall have memory stops that allow the valve to close for service and then reopened to set point without disturbing the balance position. All valves shall have calibrated nameplates to assure specific valve settings.

2.4 CHECK VALVES

A. 75 mm or DN75 (3 inches) and smaller shall be Class 125, bronze swing check valves with non-metallic disc suitable for type of service. The check valve shall meet MSS SP-80 Type 4 standard. The check valve shall have a CWP rating of 1380 kPa (200 psig). The check valve shall have a Y pattern horizontal body design with bronze body material conforming to ASTM B62, solder joints, and PTFE or TFE disc.

B. 100 mm or DN100 (4 inches) and larger:

1. Check valves shall be Class 125, iron swing check valve with lever and weight closure control. The check valve shall meet MSS SP-71 Type I standard. The check valve shall have a CWP rating of 1380 kPa (200 psig). The check valve shall have a clear or full waterway body design with gray iron body material conforming to ASTM A126, bolted bonnet, flanged ends, bronze trim.
2. All check valves on the discharge side of submersible sump pumps shall have factory installed exterior level and weight with sufficient weight to prevent the check valve from hammering against the seat when the sump pump stops.

2.5 GLOBE VALVES

A. 75 mm or DN75 (3 inches) or smaller: Class 150, bronze globe valve with non-metallic disc. The globe valve shall meet MSS SP-80, Type 2 standard. The globe valve shall have a CWP rating of 2070 kPa (300 psig). The valve material shall be bronze with integral seal and union ring bonnet conforming to ASTM B62 with solder ends, copper-silicon bronze stem, PTFE or TFE disc, and malleable iron hand wheel.

B. Larger than 75 mm or DN75 (3 inches): Similar to above, except with cast iron body and bronze trim, Class 125, iron globe valve. The globe valve shall meet MSS SP-85, Type 1 standard. The globe valve shall have a CWP rating of 1380 kPa (200 psig). The valve material shall be gray

iron with bolted bonnet conforming to ASTM A126 with flanged ends, bronze trim, and malleable iron handwheel.

2.6 BACKFLOW PREVENTERS

A. A backflow prevention assembly shall be installed at any point in the plumbing system where the potable water supply comes in contact with a potential source of contamination. The backflow prevention assembly shall be approved by the University of Southern California Foundation for Cross Connection Control and Hydraulic Research (USCFCCC).

B. The reduced pressure principle backflow prevention assembly shall be ASSE listed 1013 with full port OS&Y positive-seal resilient gate valves and an integral relief monitor switch. The main body and access cover shall be epoxy coated ductile iron conforming to ASTM A536 grade 4. The seat ring and check valve shall be the thermoplastic type suited for water service. The stem shall be stainless steel conforming to ASTM A276. The seat disc shall be the elastomer type suited for water service. The checks and the relief valve shall be accessible for maintenance without removing the device from the line. An epoxy coated wye type strainer with flanged connections shall be installed on the inlet. Reduced pressure backflow preventers shall be installed in the following applications.

1. Deionizers.
2. Sterilizers.
3. Stills.
4. Dialysis, Deionized or Reverse Osmosis Water Systems.
5. Water make up to heating systems, cooling tower, chilled water system, generators, and similar equipment consuming water.
6. Water service entrance from loop system.
7. Dental equipment.
8. Power washer.
9. Medical equipment.
10. Process equipment.
11. Autopsy, on each hot and cold water outlet at each table or sink.
12. Reclaimed water systems.

C. The pipe applied or integral atmospheric vacuum breaker shall be ASSE listed 1001. The main body shall be cast bronze. The seat disc shall be the elastomer type suited for water service. The device shall be accessible for maintenance without removing the device from the service

line. The installation shall not be in a concealed or inaccessible location or where the venting of water from the device during normal operation is deemed objectionable. Atmospheric vacuum breakers shall be installed in the following applications.

1. Hose bibs and sinks with threaded outlets.
2. Disposers.
3. Showers (telephone/handheld type).
4. Hydrotherapy units.
5. All kitchen equipment, if not protected by air gap.
6. Ventilating hoods with wash down system.
7. Film processor.
8. Detergent system.
9. Fume hoods.
10. Glassware washers.
11. Service sinks (integral with faucet only).
12. Laundry tubs (integral with faucet only).
13. Sitz baths.

D. The hose connection vacuum breaker shall be ASSE listed 1011. The main body shall be cast brass with stainless steel working parts. The diaphragm and disc shall be the elastomer type suited for water service. The device shall permit the attachment of portable hoses to hose thread outlets. Hose connection vacuum breakers shall be installed in the following locations requiring non-continuous pressure:

1. Hose bibbs and wall hydrants.

E. The pressure vacuum breaker shall be ASSE listed 1020. The main body shall be brass. The disc and O-ring seal shall be the elastomer type. The valve seat and disc float shall be the thermoplastic type. Tee handle or lever handle shut-off ball valves. Test cocks for testing and draining where freezing conditions occur. All materials shall be suitable for water service. The device shall be accessible for maintenance without removing the device from the service line. The installation shall not be in a concealed or inaccessible location or where the venting of water from the device during normal operation is deemed objectionable. Pressure vacuum breakers shall be installed in the following locations requiring continuous pressure and no backpressure including equipment with submerged inlet connections:

1. Lawn Irrigation.

F. The laboratory faucet vacuum breaker shall be ASSE listed 1035. The main body shall be cast brass. Dual check valves with stainless steel working parts. The diaphragm and disc shall be the elastomer type suited for water service. The device shall permit the attachment of portable hoses to laboratory faucets for non-continuous pressure applications.

G. The double check backflow prevention assembly shall be ASSE listed 1015 and supply with full port, OS&Y, positive-seal, resilient gate valves. The main body and access cover shall be epoxy coated ductile iron conforming to ASTM A536 grade. The seat ring and check valve shall be the thermoplastic type suited for water service. The stem shall be stainless steel conforming to ASTM A276. The seat disc shall be the elastomer type suited for water service. The first and second check valve shall be accessible for maintenance without removing the device from the line. Double check valves shall be installed in the following location requiring continuous pressure subject to backpressure and backsiphonage conditions.
   1. Lawn Irrigation.
   2. Food Processing Equipment.
   3. Laundry equipment.

2.7 THERMOSTATIC MIXING VALVES

A. Thermostatic Mixing Valves shall comply with the following general performance requirements:
   1. Shall meet ASSE requirements for water temperature control.
   2. The body shall be cast bronze or brass with corrosion resistant internal parts preventing scale and biofilm build-up. Provide chrome-plated finish in exposed areas.
   3. No special tool shall be required for temperature adjustment, maintenance, replacing parts and disinfecting operations.
   4. Valve shall be able to be placed in various positions without making temperature adjustment or reading difficult.
   5. Valve finish shall be chrome plated in exposed areas.
   6. Valve shall allow easy temperature adjustments to allow hot water circulation. Internal parts shall be able to withstand disinfecting operations of chemical and thermal treatment of water temperatures up to 82°C (180°F) for 30 minutes or 50 mg/L (50 ppm) chlorine residual concentration for 24 hours.

7. Parts shall be easily removed or replaced without dismantling the valves, for easy scale removal and disinfecting of parts.
8. Valve shall have a manual adjustable temperature control with locking mechanism to prevent tampering by end user. Outlet temperature shall be visible to ensure outlet temperature does not exceed specified limits, particularly after thermal eradication procedures.
9. Provide mixing valves with integral check valves with screens and stop valves.

B. Automatic Water Temperature Control Mixing Valves:
1. Application: Gang plumbing fixtures point-of-use when no other mixing at fixtures occurs.
2. Standard: ASSE 1069.
3. Pressure Rating: 861 kPa (125 psig).
4. Type: Thermostatically controlled water mixing valve set at 43 degrees C (110 degrees F).
5. Connections: Threaded union or soldered inlets and outlet.
6. Thermometers shall be provided to indicate mixed water temperature.
7. Upon cold water supply failure the hot water flow shall automatically be reduced to 0.5 gpm maximum.

C. Water Temperature Limiting Devices:
1. Application: Single plumbing fixture point-of-use such as sinks or lavatories.
2. Standard: ASSE 1070.
3. Pressure Rating: 861 kPa (125 psig).
4. Type: Thermostatically controlled water mixing valve set at 43 degrees C (110 degrees F).
5. Connections: Threaded union, compression or soldered inlets and outlet.
6. Upon cold water supply failure the hot water flow shall automatically be reduced to 0.2 gpm maximum.

D. Temperature Activated Mixing Valves:
1. Application: Emergency eye/face/drench shower equipment.
2. Standard: ASSE 1071.
3. Pressure Rating: 861 kPa (125 psig).
4. Type: Thermostatically controlled water mixing valve set at 24-30 degrees C (75-85 degrees F).

5. Connections: Soldered or threaded union inlets and outlet.
6. Cabinet: Factory-fabricated, stainless steel, for recessed or surface mounting and with hinged, stainless-steel door.
7. Thermometers shall be provided to indicate mixed water temperature.
8. Upon cold water supply failure the hot water flow shall automatically be reduced to 0.5 gpm maximum.

2.8 SOLENOID CONTROL VALVE

A. Solenoid Control Valve shall be a pilot operated diaphragm valve designed to open fully or close drip-tight as commanded by a 3-Way Solenoid Pilot (electrical). The valve shall have provisions for manual operation in the event of power outage.

B. The valve shall contain a disc and diaphragm assembly that forms a sealed chamber below the valve cover, separating operating pressure from line pressure.

C. Body: Ductile iron ASTM A536. Internal components are ductile iron or 316 Stainless Steel. All ductile iron components shall be lined and coated with NSF 61 Certified epoxy Coating.

D. The pilot control system shall contain a 3-Way Solenoid Pilot with screw type Manual Operator, 3-Way Accelerator Pilot, separate adjustable opening and closing speed controls, an external Y-Strainer and Isolation Ball Valves on all body connections.

E. The main valve shall open when the solenoid is energized.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Valve interior shall be examined for cleanliness, freedom from foreign matter, and corrosion. Special packing materials shall be removed, such as blocks, used to prevent disc movement during shipping and handling.

B. Valves shall be operated in positions from fully open to fully closed. Guides and seats shall be examined and made accessible by such operations.

C. Threads on valve and mating pipe shall be examined for form and cleanliness.

D. Mating flange faces shall be examined for conditions that might cause leakage. Bolting shall be checked for proper size, length, and material. Gaskets shall be verified for proper size and that its material composition is suitable for service and free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Valves shall be located for easy access and shall be provide with separate support. Valves shall be accessible with access doors when installed inside partitions or above hard ceilings.

C. Valves shall be installed in horizontal piping with stem at or above center of pipe.

D. Valves shall be installed in a position to allow full stem movement.

E. Check valves shall be installed for proper direction of flow and as follows:

1. Swing Check Valves: In horizontal position with hinge pin level and on top of valve.

F. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction. Locate backflow preventers in same room as connected equipment or system.

1. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe to floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are not acceptable for this application.

G. Install pressure gages on outlet of backflow preventers.

H. Do not install bypass piping around backflow preventers.

I. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets.

1. Install thermometers if specified.
2. Install cabinet-type units recessed in or surface mounted on wall as specified.

J. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no cost to the Government.

3.3 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
   1. Calibrated balancing valves.
   2. Master, thermostatic, water mixing valves.
   3. Manifold, thermostatic, water-mixing-valve assemblies.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.

3.4 ADJUSTING

A. Valve packing shall be adjusted or replaced after piping systems have been tested and put into service but before final adjusting and balancing. Valves shall be replaced if persistent leaking occurs.

B. Set field-adjustable flow set points of balancing valves and record data. Ensure recorded data represents actual measured or observed conditions. Permanently mark settings of valves and other adjustment devices allowing settings to be restored. Set and lock memory stops. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

D. Testing and adjusting of balancing valves shall be performed by an independent NEBB Accredited Test and Balance Contractor. A final settings and flow report shall be submitted to the VA Contracting Officer’s Representative (COR).

3.5 COMMISSIONING

A. Components provided under this section of the specification will be tested as part of a larger system.

- - - E N D - - -

SECTION 22 07 11
PLUMBING INSULATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Field applied insulation for thermal efficiency and condensation control for the following:
   1. Plumbing piping and equipment.

B. Definitions:
   1. ASJ: All Service Jacket, Kraft paper, white finish facing or jacket.
   2. Air conditioned space: Space having air temperature and/or humidity controlled by mechanical equipment.
   3. All insulation systems installed within supply, return, exhaust, relief and ventilation air plenums shall be limited to uninhabited crawl spaces, areas above a ceiling or below the floor, attic spaces, interiors of air conditioned or heating ducts, and mechanical equipment rooms shall be noncombustible or shall be listed and labeled as having a flame spread indexes of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E84 or UL 723. Note: ICC IMC, Section 602.2.1.
   4. Cold: Equipment or piping handling media at design temperature of 15 degrees C (60 degrees F) or below.
   5. Concealed: Piping above ceilings and in chases, interstitial space, and pipe spaces.
   6. Exposed: Piping and equipment exposed to view in finished areas including mechanical equipment rooms or exposed to outdoor weather. Shafts, chases, interstitial spaces, unfinished attics, crawl spaces and pipe basements are not considered finished areas.
   7. FSK: Foil-scrim-Kraft facing.
   8. Hot: Plumbing equipment or piping handling media above 40 degrees C (104 degrees F).
   9. Density: kg/m^3 - kilograms per cubic meter (Pcf - pounds per cubic foot).
   10. Thermal conductance: Heat flow rate through materials.
      a. Flat surface: Watts per square meter (BTU per hour per square foot).

b. Pipe or Cylinder: Watts per linear meter (BTU per hour per linear foot) for a given outside diameter.

11. Thermal Conductivity (k): Watts per meter, per degree K (BTU - inch thickness, per hour, per square foot, per degree F temperature difference).
12. Vapor Retarder (Vapor Barrier): A material which retards the transmission (migration) of water vapor. Performance of the vapor retarder is rated in terms of permeance (perms). For the purpose of this specification, vapor retarders/vapor barriers shall have a maximum published permeance of .02 perms.
13. HWR: Hot water recirculating.
14. CW: Cold water.
15. SW: Soft water.
16. HW: Hot water.
17. PVDC: Polyvinylidene chloride vapor retarder jacketing, white.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.
B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
C. Section 07 84 00, FIRESTOPPING: Mineral fiber and bond breaker behind sealant.
D. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING: General mechanical requirements and items, which are common to more than one section of Division 22.
E. Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING: Hot and cold water piping.
F. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING: Hot and cold water piping.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.
B. American Society for Testing and Materials (ASTM):

B209-2014.....Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
C411-2011.....Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation

C449-2007 (R2013).....Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement

C450-2008 (R2014).....Standard Practice for Fabrication of Thermal Insulating Fitting Covers for NPS Piping, and Vessel Lagging

Adjunct to C450.....Compilation of Tables that Provide Recommended Dimensions for Prefab and Field Thermal Insulating Covers, etc.

C533-2013.....Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation

C534/C534M-2014.....Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

C547-2015.....Standard Specification for Mineral Fiber Pipe Insulation

C552-2014.....Standard Specification for Cellular Glass Thermal Insulation

C553-2013.....Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

C591-2013.....Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation

C680-2014.....Standard Practice for Estimate of the Heat Gain or Loss and the Surface Temperatures of Insulated Flat, Cylindrical, and Spherical Systems by Use of Computer Programs

C612-2014.....Standard Specification for Mineral Fiber Block and Board Thermal Insulation

C1126-2014.....Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation

C1136-2012.....Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation

C1710-2011.....Standard Guide for Installation of Flexible Closed Cell Preformed Insulation in Tube and Sheet Form

D1668/D1668M-1997a (2014)e1 Standard Specification for Glass Fabrics (Woven and Treated) for Roofing and Waterproofing

E84-2015a.....Standard Test Method for Surface Burning Characteristics of Building Materials

E2231-2015.....Standard Practice for Specimen Preparation and Mounting of Pipe and Duct Insulation to Assess Surface Burning Characteristics

C. Federal Specifications (Fed. Spec.):

L-P-535E-1979.....Plastic Sheet (Sheeting): Plastic Strip; Poly (Vinyl Chloride) and Poly (Vinyl Chloride - Vinyl Acetate), Rigid.

D. International Code Council, (ICC):

IMC-2012.....International Mechanical Code

E. Military Specifications (Mil. Spec.):

MIL-A-3316C (2)-1990....Adhesives, Fire-Resistant, Thermal Insulation

MIL-A-24179A (2)-1987...Adhesive, Flexible Unicellular-Plastic Thermal Insulation

MIL-PRF-19565C (1)-1988.Coating Compounds, Thermal Insulation, Fire-and Water-Resistant, Vapor-Barrier

MIL-C-20079H-1987.....Cloth, Glass; Tape, Textile Glass; and Thread, Glass and Wire-Reinforced Glass

F. National Fire Protection Association (NFPA):

90A-2015.....Standard for the Installation of Air-Conditioning and Ventilating Systems

G. Underwriters Laboratories, Inc (UL):

723-2008 (R2013).....Standard for Test for Surface Burning Characteristics of Building Materials

1887-2004 (R2013).....Standard for Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics

H. 3E Plus® version 4.1 Insulation Thickness Computer Program: Available from NAIMA with free download; http://.www.pipeinsulation.net

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 07 11, PLUMBING INSULATION", with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

D. Shop Drawings:

1. All information, clearly presented, shall be included to determine compliance with drawings and specifications and ASTM Designation, Federal and Military specifications.

a. Insulation materials: Specify each type used and state surface burning characteristics.

b. Insulation facings and jackets: Each type used and state surface burning characteristics.

c. Insulation accessory materials: Each type used.

d. Manufacturer's installation and fitting fabrication instructions for flexible unicellular insulation shall follow the guidelines in accordance with ASTM C1710.

e. Make reference to applicable specification paragraph numbers for coordination.

f. All insulation fittings (exception flexible unicellular insulation) shall be fabricated in accordance with ASTM C450 and the referenced Adjunct to ASTM C450.

1.5 QUALITY ASSURANCE

A. Refer to article QUALITY ASSURANCE, in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

B. Criteria:

1. Comply with NFPA 90A, particularly paragraphs 4.3.3.1 through 4.3.3.6, 4.3.11.2.6, parts of which are quoted as follows:

4.3.3.1 Pipe and duct insulation and coverings, duct linings, vapor retarder facings, adhesives, fasteners, tapes, and supplementary materials added to air ducts, plenums, panels and duct silencers used in duct systems shall have, in the form in which they are used, a maximum flame spread index of 25 without

evidence of continued progressive combustion and a maximum smoke developed index of 50 when tested in accordance with ASTM E84 and appropriate mounting practice, e.g. ASTM E2231.

4.3.3.3 Coverings and linings for air ducts, pipes, plenums and panels including all pipe and duct insulation materials shall not flame, glow, smolder, or smoke when tested in accordance with a similar test for pipe covering, ASTM C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation, at the temperature to which they are exposed in service. In no case shall the test temperature be below 121 degrees C (250 degrees F).

4.3.11.2.6.3 Nonferrous fire sprinkler piping shall be listed as having a maximum peak optical density of 0.5 or less, an average optical density of 0.15 or less, and a maximum flame spread distance of 1.5 m (5 ft) or less when tested in accordance with UL 1887, Standard for Safety Fire Test of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics.

4.3.11.2.6.8 Smoke detectors shall not be required to meet the provisions of Section 4.3.

2. Test methods: ASTM E84, UL 723, and ASTM E2231.
3. Specified k factors are at 24 degrees C (75 degrees F) mean temperature unless stated otherwise. Where optional thermal insulation material is used, select thickness to provide thermal conductance no greater than that for the specified material. For pipe, use insulation manufacturer's published heat flow tables. For domestic hot water supply and return, run out insulation and condensation control insulation, no thickness adjustment need be made.
4. All materials shall be compatible and suitable for service temperature, and shall not contribute to corrosion or otherwise attack surface to which applied in either the wet or dry state.

C. Bio-Based Materials: For products designated by the USDA’s Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

1.6 AS-BUILT DOCUMENTATION

A. Submit manufacturer’s literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be in

electronic PDF version via Electronic Transmittal and Hard Copy inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided in electronic PDF version via Electronic Transmittal and Hard Copy inserted into a three ring binder. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.

D. Certification documentation shall be provided prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certification that all results of tests were within limits specified.

1.7 STORAGE AND HANDLING OF MATERIAL

A. Store materials in clean and dry environment, pipe insulation jackets shall be clean and unmarred. Place adhesives in original containers. Maintain ambient temperatures and conditions as required by printed instructions of manufacturers of adhesives, mastics and finishing cements.

PART 2 - PRODUCTS

2.1 MINERAL FIBER OR FIBER GLASS

A. ASTM C612 (Board, Block), Class 1 or 2, density 48 kg/m^3 (nominal 3 pcf), k = 0.037 (.26) at 24 degrees C (75 degrees F), external insulation for temperatures up to 204 degrees C (400 degrees F).

B. ASTM C553 (Blanket, Flexible) Type I, Class B-5, Density 32 kg/m^3 (nominal 2 pcf), k = 0.04 (0.27) at 24 degrees C (75 degrees F), for use at temperatures up to 204 degrees C (400 degrees F).

C. ASTM C547 (Pipe Fitting Insulation and Preformed Pipe Insulation), Class 1, k = 0.037 (0.26) at 24 degrees C (75 degrees F), for use at temperatures up to 230 degrees C (446 degrees F) with an all service vapor retarder jacket (ASJ) and with polyvinyl chloride (PVC) premolded fitting covering.

2.2 FLEXIBLE ELASTOMERIC CELLULAR THERMAL

A. ASTM C534/C534M, k = 0.039 (0.27) at 24 degrees C (75 degrees F), flame spread not over 25, smoke developed not over 50, for temperatures from minus 4 degrees C (40 degrees F) to 93 degrees C (199 degrees F). Under high humidity exposures for condensation control an external vapor retarder/barrier jacket is required. Consult ASTM C1710.

2.3 INSULATION FACINGS AND JACKETS

A. Vapor Retarder, higher strength with low water permeance = 0.02 or less perm rating, Beach puncture 50 units for insulation facing on pipe insulation jackets. Facings and jackets shall be ASJ or PVDC Vapor Retarder jacketing.

B. ASJ shall be white finish (kraft paper) bonded to 0.025 mm (1 mil) thick aluminum foil, fiberglass reinforced, with pressure sensitive adhesive closure. Comply with ASTM C1136. Beach puncture is 50 units, suitable for painting without sizing. Jackets shall have minimum 40 mm (1-1/2 inch) lap on longitudinal joints and minimum 75 mm (3 inch) butt strip on end joints. Butt strip material shall be same as the jacket. Lap and butt strips shall be self-sealing type with factory-applied pressure sensitive adhesive.

C. Vapor Retarder medium strength with low water vapor permeance of 0.02 or less perm rating), Beach puncture 25 units: FSK or PVDC type for concealed ductwork and equipment.

D. Except for flexible elastomeric cellular thermal insulation (not for high humidity exposures), field applied vapor barrier jackets shall be provided, in addition to the specified facings and jackets, on all exterior piping as well as on interior piping exposed to outdoor air (i.e.; in ventilated attics, piping in ventilated (not air conditioned) spaces, etc.)in high humidity locations conveying fluids below ambient temperature. The vapor barrier jacket shall consist of a multi-layer

laminated cladding with a maximum water vapor permeance of 0.001 perms. The minimum puncture resistance shall be 35 cm-kg (30 inch-pounds) for interior locations and 92 cm-kg (80 inch-pounds) for exterior or exposed locations or where the insulation is subject to damage.

E. Except for cellular glass thermal insulation, when all longitudinal and circumferential joints are vapor sealed with a vapor barrier mastic or caulking, vapor barrier jackets may not be provided. For aesthetic and physical abuse applications, exterior jacketing is recommended. Otherwise field applied vapor barrier jackets shall be provided, in addition to the applicable specified facings and jackets, on all exterior piping as well as on interior piping exposed to outdoor air (i.e.; in ventilated attics, piping in ventilated (not air conditioned) spaces, etc.) in high humidity locations conveying fluids below ambient temperature. The vapor barrier jacket shall consist of a multi-layer laminated cladding with a maximum water vapor permeance of 0.001 perms. The minimum puncture resistance shall be 35 cm-kg (30 inch-pounds) for interior locations and 92 cm-kg (80 inch-pounds) for exterior or exposed locations or where the insulation is subject to damage.

F. Glass Cloth Jackets: Presized, minimum 0.18 kg per square meter (7.8 ounces per square yard), 2070 kPa (300 psig) bursting strength with integral vapor retarder where required or specified. Weather proof if utilized for outside service.

G. Pipe fitting insulation covering (jackets): Fitting covering shall be premolded to match shape of fitting and shall be PVC conforming to Fed Spec L-P-535E, composition A, Type II Grade GU, and Type III, minimum thickness 0.7 mm (0.03 inches). Provide color matching vapor retarder pressure sensitive tape. Staples, tacks, or any other attachment that penetrates the PVC covering is not allowed on any form of a vapor barrier system in below ambient process temperature applications.

H. Aluminum Jacket-Piping systems and circular breeching and stacks: ASTM B209, 3003 alloy, H-14 temper, 0.6 mm (0.023 inch) minimum thickness with locking longitudinal joints. Jackets for elbows, tees and other fittings shall be factory-fabricated or with cut aluminum gores to match shape of fitting and of 0.6 mm (0.024 inch) minimum thickness aluminum. Aluminum fittings shall be of same construction with an internal moisture barrier as straight run jackets but need not be of the same alloy. Factory-fabricated stainless steel bands with wing

seals shall be installed on all circumferential joints. Bands shall be 15 mm (0.5 inch) wide on 450 mm (18 inch) centers. System shall be weatherproof if utilized for outside service.

I. Aluminum jacket-Rectangular breeching: ASTM B209, 3003 alloy, H-14 temper, 0.5 mm (0.020 inches) thick with 32 mm (1-1/4 inch) corrugations or 0.8 mm (0.032 inches) thick with no corrugations. System shall be weatherproof if used for outside service.

2.4 PIPE COVERING PROTECTION SADDLES

A. Cold pipe support: Premolded pipe insulation 180 degrees (half-shells) on bottom half of pipe at supports. Material shall be cellular glass or high density Polyisocyanurate insulation of the same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m^3 (3.0 pcf).

Nominal Pipe Size and Accessories Material (Insert Blocks)	
Nominal Pipe Size mm (inches)	**Insert Blocks mm (inches)**
Up through 125 (5)	150 (6) long
150 (6)	150 (6) long
200 (8), 250 (10), 300 (12)	225 (9) long
350 (14), 400 (16)	300 (12) long
450 through 600 (18 through 24)	350 (14) long

B. Warm or hot pipe supports: Premolded pipe insulation (180 degree half-shells) on bottom half of pipe at supports. Material shall be high density Polyisocyanurate (for temperatures up to 149 degrees C (300 degrees F)), cellular glass or calcium silicate. Insulation at supports shall have same thickness as adjacent insulation. Density of Polyisocyanurate insulation shall be a minimum of 48 kg/m^3 (3.0 pcf).

2.5 ADHESIVE, MASTIC, CEMENT

A. Mil. Spec. MIL-A-3316, Class 1: Jacket and lap adhesive and protective finish coating for insulation.

B. Mil. Spec. MIL-A-3316, Class 2: Adhesive for laps and for adhering insulation to metal surfaces.

C. Mil. Spec. MIL-A-24179A, Type II Class 1: Adhesive for installing flexible unicellular insulation and for laps and general use.

D. Mil. Spec. MIL-PRF-19565C, Type I: Protective finish for outdoor use.

E. Mil. Spec. MIL-PRFC-19565C, Type I or Type II: Vapor barrier compound for indoor use.

F. ASTM C449: Mineral fiber hydraulic-setting thermal insulating and finishing cement.

G. Other: Insulation manufacturers' published recommendations.

2.6 MECHANICAL FASTENERS

A. Pins, anchors: Welded pins, or metal or nylon anchors with galvanized steel or fiber washer, or clips. Pin diameter shall be as recommended by the insulation manufacturer.

B. Staples: Outward clinching galvanized steel. Staples are not allowed for below ambient vapor barrier applications.

C. Wire: 1.3 mm thick (18 gage) soft annealed galvanized or 1.9 mm (14 gage) copper clad steel or nickel copper alloy or stainless steel.

D. Bands: 13 mm (1/2 inch) nominal width, brass, galvanized steel, aluminum or stainless steel.

E. Tacks, rivets, screws or any other attachment device capable of penetrating the vapor retarder shall NOT be used to attach/close the any type of vapor retarder jacketing. Thumb tacks sometimes used on PVC jacketing and preformed fitting covers closures are not allowed for below ambient vapor barrier applications.

2.7 REINFORCEMENT AND FINISHES

A. Glass fabric, open weave: ASTM D1668/D1668M, Type III (resin treated) and Type I (asphalt or white resin treated).

B. Glass fiber fitting tape: Mil. Spec MIL-C-20079H, Type II, Class 1.

C. Tape for Flexible Elastomeric Cellular Insulation: As recommended by the insulation manufacturer.

D. Hexagonal wire netting: 25 mm (one inch) mesh, 0.85 mm thick (22 gage) galvanized steel.

E. Corner beads: 50 mm (2 inch) by 50 mm (2 inch), 0.55 mm thick (26 gage) galvanized steel; or, 25 mm (1 inch) by 25 mm (1 inch), 0.47 mm thick (28 gage) aluminum angle adhered to 50 mm (2 inch) by 50 mm (2 inch) Kraft paper.

F. PVC fitting cover: Fed. Spec L-P-535E, Composition A, 11-86 Type II, Grade GU, with Form B Mineral Fiber insert, for media temperature 10 to 121 degrees C (50 to 250 degrees F). Below 10 degrees C (50 degrees F) and above 121 degrees C (250 degrees F) provide mitered pipe insulation

of the same type as insulating straight pipe. Provide double layer insert. Provide vapor barrier pressure sensitive tape matching the color of the PVC jacket.

2.8 FIRESTOPPING MATERIAL

A. Other than pipe insulation, refer to Section 07 84 00, FIRESTOPPING.

2.9 FLAME AND SMOKE

A. Unless shown otherwise all assembled systems shall meet flame spread 25 and smoke developed 50 rating as developed under ASTM and UL standards and specifications. See paragraph "Quality Assurance".

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Required pressure tests of piping joints and connections shall be completed and the work approved by the Contracting Officer’s Representative (COR) for application of insulation. Surface shall be clean and dry with all foreign materials, such as dirt, oil, loose scale and rust removed.

B. Except for specific exceptions or as noted, insulate all specified equipment, and piping (pipe, fittings, valves, accessories). Insulate each pipe individually. Do not use scrap pieces of insulation where a full length section will fit.

C. Insulation materials shall be installed with smooth and even surfaces, with jackets and facings drawn tight and smoothly cemented down and sealed at all laps. Insulation shall be continuous through all sleeves and openings, except at fire dampers and duct heaters (NFPA 90A).

D. Vapor retarders shall be continuous and uninterrupted throughout systems with operating temperature 15 degrees C (60 degrees F) and below. Lap and seal vapor barrier over ends and exposed edges of insulation. Anchors, supports and other metal projections through insulation on cold surfaces shall be insulated and vapor sealed for a minimum length of 150 mm (6 inches).

E. Install vapor stops with operating temperature 15 degrees C (60 degrees F) and below at all insulation terminations on either side of valves, pumps, fittings, and equipment and particularly in straight lengths every 4.6 to 6.1 meters (approx. 15 to 20 feet) of pipe insulation. The annular space between the pipe and pipe insulation of approx. 25 mm (1 inch) in length at every vapor stop shall be sealed with appropriate

vapor barrier sealant. Bio-based materials shall be utilized when possible.

F. Construct insulation on parts of equipment such as cold water pumps and heat exchangers that must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage. Install insulation with bolted 1 mm thick (20 gage) galvanized steel or aluminum covers as complete units, or in sections, with all necessary supports, and split to coincide with flange/split of the equipment. Do not insulate over equipment nameplate data.

G. Insulation on hot piping and equipment shall be terminated square at items not to be insulated, access openings and nameplates. Cover all exposed raw insulation with white sealer coating (caution about coating’s maximum temperature limit) or jacket material.

H. Protect all insulations outside of buildings with aluminum jacket using lock joint or other approved system for a continuous weather tight system. Access doors and other items requiring maintenance or access shall be removable and sealable.

I. Plumbing work not to be insulated unless otherwise noted:
   1. Piping and valves of fire protection system.
   2. Chromium plated brass piping.
   3. Water piping in contact with earth.
   4. Distilled water piping.

J. Apply insulation materials subject to the manufacturer's recommended temperature limits. Apply adhesives, mastic and coatings at the manufacturer's recommended minimum wet or dry film thickness. Bio-based materials shall be utilized when possible.

K. Elbows, flanges and other fittings shall be insulated with the same material as is used on the pipe straights. Use of polyurethane or polyisocyanurate spray-foam to fill a PVC elbow jacket is prohibited on cold applications.

L. Firestop Pipe insulation:
   1. Provide firestopping insulation at fire and smoke barriers through penetrations. Firestopping insulation shall be UL listed as defined in Section 07 84 00, FIRESTOPPING.
   2. Pipe penetrations requiring fire stop insulation including, but not limited to the following:
      a. Pipe risers through floors

b. Pipe chase walls and floors

c. Smoke partitions

d. Fire partitions

e. Hourly rated walls

M. Freeze protection of above grade outdoor piping (over heat tracing tape): 20 mm (3/4 inch) thick insulation, for all pipe sizes 75 mm (3 inches) and smaller and 25 mm (1 inch) thick insulation for larger pipes. Provide metal jackets for all pipe insulations. Provide freeze protection for cold water make-up piping and equipment where indicated on the drawings as described in Section 23 21 13, HYDRONIC PIPING (electrical heat tracing systems).

N. Provide vapor barrier systems as follows:

1. All piping exposed to outdoor weather.
2. All interior piping conveying fluids exposed to outdoor air (i.e. in attics, ventilated (not air conditioned) spaces, etc.) below ambient air temperature in high humidity locations.

O. Provide metal jackets over insulation as follows:

1. All plumbing piping exposed to outdoor weather.
2. Piping exposed in building, within 1829 mm (6 feet) of the floor, that connects to sterilizers, kitchen and laundry equipment. Jackets may be applied with pop rivets except for cold pipe or tubing applications. Provide aluminum angle ring escutcheons at wall, ceiling or floor penetrations.
3. A 50 mm (2 inch) jacket overlap is required at longitudinal and circumferential joints with the overlap at the bottom.

P. Provide PVC jackets over insulation as follows:

1. Piping exposed in building, within 1829 mm (6 feet) of the floor, on piping that is not precluded in previous sections.
2. A 50 mm (2 inch) jacket overlap is required at longitudinal and circumferential joints with the overlap at the bottom.

3.2 INSULATION INSTALLATION

A. Mineral Fiber Board:

1. Vapor retarder faced board: Apply board on pins spaced not more than 300 mm (12 inches) on center each way, and not less than 75 mm (3 inches) from each edge of board. In addition to pins, apply insulation bonding adhesive to entire underside of horizontal metal surfaces. (Bio-based materials shall be utilized when possible.)

Butt insulation edges tightly and seal all joints with laps and butt strips. After applying speed clips cut pins off flush and apply vapor seal patches over clips.

2. Plain unfaced board:
   a. Insulation shall be scored, beveled or mitered to provide tight joints and be secured to equipment with bands spaced 225 mm (9 inches) on center for irregular surfaces or with pins and clips on flat surfaces. Use corner beads to protect edges of insulation.
   b. For hot equipment: Stretch 25 mm (1 inch) mesh wire, with edges wire laced together, over insulation and finish with insulating and finishing cement applied in one coat, 6 mm (1/4 inch) thick, trowelled to a smooth finish.
   c. For cold equipment: Apply meshed glass fabric in a tack coat 1.5 to 1.7 square meter per liter (60 to 70 square feet per gallon) of vapor mastic and finish with mastic at 0.3 to 0.4 square meter per liter (12 to 15 square feet per gallon) over the entire fabric surface.
3. Cold equipment: 40 mm (1-1/2inch) thick insulation faced with vapor retarder ASJ or FSK. Seal all facings, laps, and termination points and do not use staples or other attachments that may puncture ASJ or FSK.
   a. Water filter, chemical feeder pot or tank.
   b. Pneumatic, cold storage water and surge tanks.
4. Hot equipment: 40 mm (1-1/2 inch) thick insulation faced with unsealed ASJ or FSK.
   a. Domestic water heaters and hot water storage tanks (not factory insulated).
   b. Booster water heaters for dietetics dish and pot washers and for washdown grease-extracting hoods.

B. Molded Mineral Fiber Pipe and Tubing Covering:
1. Fit insulation to pipe, aligning all longitudinal joints. Seal longitudinal joint laps and circumferential butt strips by rubbing hard with a nylon sealing tool to assure a positive seal. Staples may be used to assist in securing insulation except for cold piping. Seal all vapor retarder penetrations on cold piping with a generous application of vapor barrier mastic. Provide cellar glass inserts

and install with metal insulation shields at outside pipe supports. Install freeze protection insulation over heating cable.

2. Contractor's options for fitting, flange and valve insulation:
   a. Insulating and finishing cement for sizes less than 100 mm (4 inches) operating at surface temperature of 15 degrees C (60 degrees F) or more.
   b. Factory premolded, one piece PVC covers with mineral fiber, (Form B), inserts surface temperature of above 4 degrees C (40 degrees F) to 121 degrees C (250 degrees F). Provide mitered preformed insulation of the same type as the installed straight pipe insulation for pipe temperatures below 4 degrees C (40 degrees F). Secure first layer of mineral fiber insulation with twine. Seal seam edges with vapor barrier mastic and secure with fitting tape.
   c. Factory preformed, ASTM C547 or fabricated mitered sections, joined with adhesive or (hot only) wired in place. (Bio-based materials shall be utilized when possible.) For hot piping finish with a smoothing coat of finishing cement. For cold fittings, 15 degrees C (60 degrees F) or less, vapor seal with a layer of glass fitting tape imbedded between two 2 mm (1/16 inch) coats of vapor barrier mastic.
   d. Fitting tape shall extend over the adjacent pipe insulation and overlap on itself at least 50 mm (2 inches).
3. Nominal thickness in millimeters and inches specified in the schedule at the end of this section.

C. Flexible Elastomeric Cellular Thermal Insulation:
1. Apply insulation and fabricate fittings in accordance with the manufacturer's installation instructions and finish with two coats of weather resistant finish as recommended by the insulation manufacturer. External vapor barrier jacketing may be required for expected or anticipated high humidity exposures. See ASTM C1710.
2. Pipe and tubing insulation:
   a. Use proper size material. Do not stretch or strain insulation.
   b. To avoid undue compression of insulation, use supports as recommended by the elastomeric insulation manufacturer. Insulation shields are specified under Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

c. Where possible, slip insulation over the pipe or tubing prior to connection, and seal the butt joints with adhesive. Where the slip-on technique is not possible, slit the insulation and apply it to the pipe sealing the seam and joints with contact adhesive. Optional tape sealing, as recommended by the manufacturer, may be employed. Bio-based materials shall be utilized when possible.

3. Apply sheet insulation to flat or large curved surfaces with 100 percent adhesive coverage. For fittings and large pipe, apply adhesive to seams only.
4. Pipe insulation: nominal thickness in millimeters (inches as specified in the schedule at the end of this section.

3.3 PIPE INSULATION SCHEDULE

A. Provide insulation for piping systems as scheduled below:

Insulation Thickness Millimeters (Inches)					
		Nominal Pipe Size Millimeters (Inches)			
Operating Temperature Range/Service	**Insulation Material**	**Less than 25 (1)**	**25 – 32 (1 – 1¼)**	**38 – 75 (1½ - 3)**	**100 (4) and Greater**
38-60 degrees C (100-140 degrees F) (Domestic Hot Water Supply and Return)	Mineral Fiber (Above ground piping only)	38 (1.5)	38 (1.5)	50 (2.0)	50 (2.0)
(4-15 degrees C (40-60 degrees F)	Flexible Elastomeric Cellular Thermal (Above ground piping only)	25 (1.0)	25(1.0)	25 (1.0)	25 (1.0)

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SECTION 22 11 00
FACILITY WATER DISTRIBUTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Domestic water systems, including piping, equipment and all necessary accessories as designated in this section.

B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 07 84 00, FIRESTOPPING.

D. Section 07 92 00, JOINT SEALANTS.

E. Section 09 91 00, PAINTING.

F. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

G. Section 22 07 11, PLUMBING INSULATION.

1.3 APPLICABLE PUBLICATIONS

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

B. American Society of Mechanical Engineers (ASME):

A13.1-2007 (R2013).....Scheme for Identification of Piping Systems

B16.3-2011.....Malleable Iron Threaded Fittings: Classes 150 and 300

B16.9-2012.....Factory-Made Wrought Buttwelding Fittings

B16.11-2011.....Forged Fittings, Socket-Welding and Threaded

B16.12-2009 (R2014).....Cast Iron Threaded Drainage Fittings

B16.15-2013 .....Cast Copper Alloy Threaded Fittings: Classes 125 and 250

B16.18-2012.....Cast Copper Alloy Solder Joint Pressure Fittings

B16.22-2013.....Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings

B16.24-2011.....Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500

ASME Boiler and Pressure Vessel Code -

BPVC Section IX-2015....Welding, Brazing, and Fusing Qualifications

C. American Society for Testing and Materials (ASTM):

A47/A47M-1999 (R2014)...Standard Specification for Ferritic Malleable Iron Castings

A53/A53M-2012.....Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

A183-2014.....Standard Specification for Carbon Steel Track Bolts and Nuts

A269/A269M-2014e1.....Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service

A312/A312M-2015.....Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes

A403/A403M-2014.....Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings

A536-1984 (R2014).....Standard Specification for Ductile Iron Castings

A733-2013.....Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples

B32-2008 (R2014).....Standard Specification for Solder Metal

B43-2014.....Standard Specification for Seamless Red Brass Pipe, Standard Sizes

B61-2008 (R2013).....Standard Specification for Steam or Valve Bronze Castings

B62-2009.....Standard Specification for Composition Bronze or Ounce Metal Castings

B75/B75M-2011.....Standard Specification for Seamless Copper Tube

B88-2014.....Standard Specification for Seamless Copper Water Tube

B584-2014.....Standard Specification for Copper Alloy Sand Castings for General Applications

B687-1999 (R2011).....Standard Specification for Brass, Copper, and Chromium-Plated Pipe Nipples

B 828-2016 .....Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.

C919-2012.....Standard Practice for Use of Sealants in Acoustical Applications

D1785-2012.....Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

D2000-2012.....Standard Classification System for Rubber Products in Automotive Applications

D2564-2012.....Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems

D2657-2007.....Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings

D2855-1996 (R2010).....Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings

D4101-2014.....Standard Specification for Polypropylene Injection and Extrusion Materials

E1120-2008.....Standard Specification for Liquid Chlorine

E1229-2008.....Standard Specification for Calcium Hypochlorite

F2389-2010.....Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems

F2620-2013.....Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings

F2769-2014.....Standard Specification for Polyethylene of Raised Temperature (PE-RT) Plastic Hot and Cold-Water Tubing and Distribution Systems

D. American Water Works Association (AWWA):

M41-2009 .....Ductile-Iron Pipe and Fittings, Third Edition

M6-2012..... Water Meters: Selection, Installation, Testing & Maintenance, Fifth Edition

M20-2006..... Water Chlorination & Chloramination Practices & Principles, Second Edition

C110-2012.....Ductile-Iron and Gray-Iron Fittings

C151-2009.....Ductile Iron Pipe, Centrifugally Cast

C153-2011.....Ductile-Iron Compact Fittings

C203-2008.....Coal-Tar Protective Coatings and Linings for Steel Water Pipelines - Enamel and Tape - Hot Applied

C213-2007.....Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines

C651-2014.....Disinfecting Water Mains

E. American Welding Society (AWS):

A5.8M/A5.8-2011-AMD1....Specification for Filler Metals for Brazing and Braze Welding

F. International Code Council (ICC):

IPC-2012.....International Plumbing Code

G. Manufacturers Specification Society (MSS):

SP-58-2009.....Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation

SP-72-2010a.....Ball Valves with Flanged or Butt-Welding Ends for General Service

SP-110-2010.....Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends

H. NSF International (NSF):

14-2015.....Plastics Piping System Components and Related Materials

61-2014a.....Drinking Water System Components – Health Effects

372-2011.....Drinking Water System Components – Lead Content

I. Plumbing and Drainage Institute (PDI):

PDI-WH 201-2010.....Water Hammer Arrestors

J. Department of Veterans Affairs:

H-18-8-2013.....Seismic Design Handbook

H-18-10.....Plumbing Design Manual

K. Ohio Administrative Code:

4101:1 Board of Building Standards: Ohio Building Code

4101:3 Board of Building Standards: Ohio Plumbing Code

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 11 00, FACILITY WATER DISTRIBUTIONS", with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

1. All items listed in Part 2 - Products.

D. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replacement parts:

1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

1.5 QUALITY ASSURANCE

A. A certificate shall be submitted prior to welding of steel piping showing the Welder's certification. The certificate shall be current and no more than one year old. Welder's qualifications shall be in accordance with ASME BPVC Section IX.

B. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be by the same manufacturer as the groove components.

C. All pipe, couplings, fittings, and specialties shall bear the identification of the manufacturer and any markings required by the applicable referenced standards.

D. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

1.6 SPARE PARTS – NOT USED

1.7 AS-BUILT DOCUMENTATION

A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be in electronic PDF version via Electronic Transmittal and Hard Copy inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices shall be included. A list of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided in electronic PDF version via Electronic Transmittal and Hard Copy inserted into a three ring binder. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.

D. Certification documentation shall be provided to COR 10 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certificate if applicable that all results of tests were within limits specified. If a certificate is not available, all documentation shall be on the Certifier's letterhead.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Material or equipment containing a weighted average of greater than 0.25 percent lead are prohibited in any potable water system intended

for human consumption, and shall be certified in accordance with NSF 61 or NSF 372. Endpoint devices used to dispense water for drinking shall meet the requirements of NSF 61, Section 9.

B. As per TITLE XIV OF THE PUBLIC HEALTH SERVICE ACT of the Safe Drinking Water Act, "lead free" means: "(A) not containing more than 0.2 percent lead when used with respect to solder and flux; and (B) not more than a weighted average of 0.25 percent lead when used with respect to the wetted surfaces of pipes, pipe fittings, plumbing fittings, and fixtures."

C. Plastic pipe, fittings, and solvent cement shall meet NSF 14 and shall be NSF listed for the service intended.

D. Join pipe and fittings according to the ASTM B 828 Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.

2.2 UNDERGROUND WATER SERVICE CONNECTIONS TO BUILDINGS

A. From inside face of exterior wall to a distance of approximately 1500 mm (5 feet) outside of building and underground inside building, material to be the same for the size specified inside the building.

B. 75 mm (3 inch) Diameter and Greater: Ductile iron, AWWA C151, 2413 kPa (350 psig) pressure class, exterior bituminous coating, and cement lined. Bio-based materials shall be utilized when possible. Provide flanged and anchored connection to interior piping.

C. Under 75 mm (3 inch) Diameter: Copper tubing, ASTM B88, Type K, seamless, annealed. Fittings are as specified in paragraph "Above Ground (Interior) Water Piping". Use brazing alloys, AWS A5.8M/A5.8, Classification BCuP.

D. Flexible Expansion Joint: Ductile iron with ball joints rated for 1725 kPa (250 psig) working pressure conforming to AWWA C153, capable of deflecting a minimum of 20 degrees in each direction. Flexible expansion joint size shall match the pipe size it is connected to and shall have the expansion capability designed as an integral part of the ductile iron ball castings. Pressure containing parts shall be lined with a minimum of 15 mils of fusion bonded epoxy conforming to the applicable requirements of AWWA C213 and shall be factory tested with a 1500 volt spark test. Flexible expansion joint shall have flanged connections conforming to AWWA C110. Bolts and nuts shall be 316 stainless steel and gaskets shall be neoprene. The flexible expansion

fitting shall not expand or exert an axial thrust under internal water pressure. Provide piping joint restraints at each mechanical joint end connection and piping restraints at the penetration of the building wall. The restraints shall be provided to address the developed thrust at the change of piping direction.

2.3 ABOVE GROUND (INTERIOR) WATER PIPING

A. Pipe: Copper tube, ASTM B88, Type K or L, drawn. For pipe 150 mm (6 inches) and larger, stainless steel, ASTM A312, schedule 10 or 40 shall be used.

B. Fittings for Copper Tube:

1. Wrought copper or bronze castings conforming to ASME B16.18 and B16.22. Unions shall be bronze, MSS SP-72, MSS SP-110, solder or braze joints. Use 95/5 tin and antimony for all soldered joints.
2. Grooved fittings, 50 to 150 mm (2 to 6 inch) wrought copper ASTM B75/B75M C12200, 125 to 150 mm (5 to 6 inch) bronze casting ASTM B584, C84400. Mechanical grooved couplings, 2070 kpa (300 psig) minimum ductile iron, ASTM A536 Grade 448-310-12 (Grade 65-45-12), or malleable iron, ASTM A47/A47M Grade 22410 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.
3. Mechanical press-connect fittings for copper pipe and tube **<u>are prohibited</u>**. See Plumbing Design Manual for additional information.
4. Mechanically formed tee connection: Form mechanically extracted collars in a continuous operation by drilling pilot hole and drawing out tube surface to form collar, having a height of not less than three times the thickness of tube wall. Adjustable collaring device shall ensure proper tolerance and complete uniformity of the joint. Notch and dimple joining branch tube in a single process to provide free flow where the branch tube penetrates the fitting. Braze joints.
5. Flanged fittings, bronze, class 150, solder-joint ends conforming to ASME B16.24.

C. Fittings for Stainless Steel:

1. Stainless steel butt-welded fittings, Type 316, Schedule 10, conforming to ASME B16.9.
2. Grooved fittings, stainless steel, Type 316, Schedule 10 or 40, conforming to ASTM A403/A403M. Segmentally fabricated fittings are

not allowed. Mechanical grooved couplings, ductile iron, 4138 kPa (600 psig), ASTM A536 Grade 448-310-12 (Grade 65-45-12), or malleable iron, ASTM A47/A47M Grade 22410 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.

D. Adapters: Provide adapters for joining pipe or tubing with dissimilar end connections.

E. Solder: ASTM B32 alloy type Sb5, HA or HB. Provide non-corrosive flux.

F. Brazing alloy: AWS A5.8M/A5.8, brazing filler metals shall be BCuP series for copper to copper joints and BAg series for copper to steel joints.

2.4 EXPOSED WATER PIPING

A. Finished Room: Use full iron pipe size chrome plated brass piping for exposed water piping connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Government or specified in other sections.

1. Pipe: ASTM B43, standard weight.
2. Fittings: ASME B16.15 cast bronze threaded fittings with chrome finish.
3. Nipples: ASTM B687, Chromium-plated.
4. Unions: MSS SP-72, MSS SP-110, brass or bronze with chrome finish. Unions 65 mm (2-1/2 inches) and larger shall be flange type with approved gaskets.

B. Unfinished Rooms, Mechanical Rooms and Kitchens: Chrome-plated brass piping is not required. Paint piping systems as specified in Section 09 91 00, PAINTING.

2.5 ETHYLENE OXIDE (ETO) STERILIZER WATER SUPPLY PIPING - NOT USED

2.6 TRAP PRIMER WATER PIPING - NOT USED

2.7 STRAINERS

A. Provide on high pressure side of pressure reducing valves, on suction side of pumps, on inlet side of indicating and control instruments and equipment subject to sediment damage and where shown on drawings. Strainer element shall be removable without disconnection of piping.

B. Water: Basket or "Y" type with easily removable cover and brass strainer basket.

C. Body: Less than 75 mm (3 inches), brass or bronze; 75 mm (3 inches) and greater, cast iron or semi-steel.

2.8 DIELECTRIC FITTINGS

A. Provide dielectric couplings or unions between pipe of dissimilar metals.

2.9 STERILIZATION CHEMICALS

A. Hypochlorite: ASTM E1120.

B. Liquid Chlorine: ASTM E1229.

2.10 WATER HAMMER ARRESTER

A. Closed copper tube chamber with permanently sealed 413 kPa (60 psig) air charge above a Double O-ring piston. Two high heat Buna-N 0-rings pressure packed and lubricated with FDA approved silicone compound. All units shall be designed in accordance with ASSE 1010. Access shall be provided where devices are concealed within partitions or above ceilings. Size and install in accordance with PDI-WH 201 requirements. Provide water hammer arrestors at:

1. All solenoid valves.
2. All groups of two or more flush valves.
3. All quick opening or closing valves.
4. All medical washing equipment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General: Comply with the International Plumbing Code and the following:

1. Install branch piping for water from the piping system and connect to all fixtures, valves, cocks, outlets, casework, cabinets and equipment, including those furnished by the Government or specified in other sections.
2. Pipe shall be round and straight. Cutting shall be done with proper tools. Pipe, except for plastic and glass, shall be reamed to remove burrs and a clean smooth finish restored to full pipe inside diameter.
3. All pipe runs shall be laid out to avoid interference with other work/trades.
4. Install union and shut-off valve on pressure piping at connections to equipment.
5. Pipe Hangers, Supports and Accessories:
   a. All piping shall be supported per the IPC, H-18-8 Seismic Design Handbook, MSS SP-58, and SMACNA as required.

b. Shop Painting and Plating: Hangers, supports, rods, inserts and accessories used for pipe supports shall be shop coated with zinc chromate primer paint. Electroplated copper hanger rods, hangers and accessories may be used with copper tubing.

c. Floor, Wall and Ceiling Plates, Supports, Hangers:

1) Solid or split un-plated cast iron.
2) All plates shall be provided with set screws.
3) Pipe Hangers: Height adjustable clevis type.
4) Adjustable Floor Rests and Base Flanges: Steel.
5) Concrete Inserts: "Universal" or continuous slotted type.
6) Hanger Rods: Mild, low carbon steel, fully threaded or Threaded at each end with two removable nuts at each end for positioning rod and hanger and locking each in place.
7) Pipe Hangers and Riser Clamps: Malleable iron or carbon steel. Pipe Hangers and riser clamps shall have a copper finish when supporting bare copper pipe or tubing.
8) Rollers: Cast iron.
9) Self-drilling type expansion shields shall be "Phillips" type, with case hardened steel expander plugs.
10) Hangers and supports utilized with insulated pipe and tubing shall have 180 degree (minimum) metal protection shield centered on and welded to the hanger and support. The shield thickness and length shall be engineered and sized for distribution of loads to preclude crushing of insulation without breaking the vapor barrier. The shield shall be sized for the insulation and have flared edges to protect vapor-retardant jacket facing. To prevent the shield from sliding out of the clevis hanger during pipe movement, center-ribbed shields shall be used.
11) Miscellaneous Materials: As specified, required, directed or as noted on the drawings for proper installation of hangers, supports and accessories. If the vertical distance exceeds 6.1 m (20 feet) for cast iron pipe additional support shall be provided in the center of that span. Provide all necessary auxiliary steel to provide that support.
12) With the installation of each flexible expansion joint, provide piping restraints for the upstream and downstream

section of the piping at the flexible expansion joint. Provide calculations supporting the restraint length design and type of selected restraints. Restraint calculations shall be based on the criteria from the manufacturer regarding their restraint design.

6. Install chrome plated cast brass escutcheon with set screw at each wall, floor and ceiling penetration in exposed finished locations and within cabinets and millwork.
7. Penetrations:
   a. Firestopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke, and gases as specified in Section 07 84 00, FIRESTOPPING. Completely fill and seal clearances between raceways and openings with the firestopping materials.
   b. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07 92 00, JOINT SEALANTS. Bio-based materials shall be utilized when possible.
   c. Acoustical sealant: Where pipes pass through sound rated walls, seal around the pipe penetration with an acoustical sealant that is compliant with ASTM C919.

B. Domestic Water piping shall conform to the following:
   1. Grade all lines to facilitate drainage. Provide drain valves at bottom of risers and all low points in system. Design domestic hot and cold water circulating lines with no traps.
   2. Connect branch lines at bottom of main serving fixtures below and pitch down so that main may be drained through fixture. Connect branch lines to top of main serving only fixtures located on floor above.

3.2 TESTS

A. General: Test system either in its entirety or in sections. Submit testing plan to COR 10 working days prior to test date.

B. Potable Water System: Test after installation of piping and domestic water heaters, but before piping is concealed, before covering is applied, and before plumbing fixtures are connected.

Option 1, Water Test: Fill systems with water and maintain hydrostatic pressure of 1035 kPa (150 psig) gage for two hours. No decrease in pressure is allowed. Provide a pressure gage with a shutoff and bleeder valve at the highest point of the piping being tested. Pressure gauge shall have 1 psig increments. Contractor shall submit testing plan to the COR for approval which includes chlorination and coliform testing and shall be conducted no more than 10 days prior to system being placed in service.

Option 2, Air Test: Alternate when hydraulic pressure test is not practical. Test system with compressed air in accordance with Ohio Plumbing Code. Contractor shall submit testing plan to the COR for approval.

C. All Other Piping Tests: Test new installed piping under 1-1/2 times actual operating conditions and prove tight.

D. The test pressure shall hold for the minimum time duration required by the applicable plumbing code or authority having jurisdiction.

3.3 DISINFECTION

A. After tests have been successfully completed, thoroughly flush and disinfect the interior domestic water distribution system in accordance with AWWA C651 (Disinfecting Water Mains) and M20-2006 (Water Chlorination & Chloramination Practices & Principles.

B. Use liquid chlorine or hypochlorite for continuous-feed method of chlorination as described in Section 4.4 of the AWWA C651. For large-diameter long mains, use slug method of chlorination to reduce the volume of heavily chlorinated water to be flushed to waste as described in Section 4.5 of the AWWA C651..

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SECTION 22 11 23
DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Hot water recirculation pump.

B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

D. Section 22 05 12, GENERAL MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT.

E. Section 26 29 11, MOTOR CONTROLLERS.

1.3 APPLICABLE PUBLICATIONS

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

B. American Society of Mechanical Engineers (ASME):

ASME Boiler and Pressure Code -

BPVC Section VIII-1-2015 Rules for Construction of Pressure Vessels, Division 1

BPVC Section VIII-2-2015 Rules for Construction of Pressure Vessels, Division 2-Alternative Rules

C. American Society for Testing and Materials (ASTM):

A48/A48M-2003 (R2012)...Standard Specification for Gray Iron Castings

B584-2014.....Standard Specification for Copper Alloy Sand Castings for General Applications

D. International Code Council (ICC)

IPC-2012.....International Plumbing Code

E. National Electrical Manufacturers Association (NEMA):

ICS 6-1993 (R2001, R2006) Industrial Control and Systems: Enclosures

250-2014.....Enclosures for Electrical Equipment (1000 Volts Maximum)

F. NSF International (NSF)
   61-2014a.....Drinking Water System Components – Health Effects
   372-2011.....Drinking Water System Components – Lead Content
G. Underwriters' Laboratories, Inc. (UL):
   508-1999 (R2013).....Standards for Industrial Control Equipment
   778-2010 (R2014).....Standard for Motor-Operated Water Pumps

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 11 23, DOMESTIC WATER PUMPS", with applicable paragraph identification.
C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.
   1. Pump:
      a. Manufacturer and model.
      b. Operating speed.
      c. Capacity.
      d. Characteristic performance curves.
D. Certified copies of all the factory and construction site test data sheets and reports.
E. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
   1. Include complete list indicating all components of the systems.
   2. Include complete diagrams of the internal wiring for each item of equipment.
   3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

1.5 QUALITY ASSURANCE

A. General:
   1. UL Compliance: Comply with UL 778 for motor-operated water pumps.

2. Design Criteria:
   a. Pump sizes, capacities, pressures, operating characteristics and efficiency shall be as scheduled.
   b. Head-capacity curves shall slope up to maximum head at shut-off. Select pumps near the midrange of the curve, and near the point of maximum efficiency, without approaching the pump curve end point and possible cavitation and unstable operation. Select pumps for open systems so that required net positive suction head (NPSHR) does not exceed the net positive head available (NPSHA).
   c. Pump Driver: Furnish with pump. Size shall be non-overloading at any point on the head-capacity curve, including in a parallel or series pumping installation with one pump in operation.
   d. Provide all pumps with motors, impellers, drive assemblies, bearings, coupling guard and other accessories specified. Statically and dynamically balance all rotating parts.
   e. Furnish each pump and motor with a nameplate giving the manufacturers name, serial number of pump, capacity in GPM and head in feet at design condition, horsepower, voltage, frequency, speed and full load current and motor efficiency.
   f. Test all pumps before shipment. The manufacturer shall certify all pump ratings.
   g. After completion of balancing, provide replacement of impellers or trim impellers to provide specified flow at actual pumping head, as installed.

B. Hot Water Recirculating Pumps: Components shall be assembled by a single manufacturer and the pump motor assembly shall be the standard cataloged product of the manufacturer.

C. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

1.6 AS-BUILT DOCUMENTATION

A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be in electronic PDF version via Electronic Transmittal and Hard Copy inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings are to be provided in electronic PDF version via Electronic Transmittal and Hard Copy inserted into a three ring binder. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.

D. Certification documentation shall be provided to COR 10 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certification that all results of tests were within limits specified.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Material or equipment containing a weighted average of greater than 0.25 percent lead shall be prohibited in any potable water system intended for human consumption, and shall be certified in accordance with NSF 61 or NSF 372.

2.2 HOT WATER RECIRCULATING PUMP

A. General:

1. Centrifugal, single stage, pump. Driver shall be electric motor, close coupled or connected by flexible or magnetic coupling. Pump for hot water system shall be designed for quiet, trouble-free operation at a minimum of 82 degrees C (180 degrees F) water service and 1,035 kPa (150 psig).
2. Mounting shall be in-line, vertical or horizontal as indicated on drawing schedules.
3. Stamped or engraved stainless steel nameplate.
4. Motors: Maximum 40 degrees C (104 degrees F) ambient temperature rise, drip-proof, for operation with current, voltage, phase and cycle shown in schedule on Electrical drawings, conforming to NEMA Type 4. Motors shall be equipped with thermal overload protection. When motor has cooled down it shall re-start automatically if the operating control has been left on and the system requires pump to start.
5. Pump shall operate continuously with on-off switch, or with an HOA switch for automatically controlled pumps, for manual shut down. In the inlet and outlet piping of the pump, shutoff valves shall be installed to permit service to the pump, strainer, and check valve without draining the system.
6. A check valve shall be installed in the pump discharge piping immediately downstream of the pump. A strainer with drain valve and removable strainer screen or basket shall be installed immediately upstream of the pump.

B. Horizontal, In-Line Pumps:
1. Flexibly-coupled pump and motor with maximum 1,800 rpm rotational speed.
2. Bronze body construction with solid steel shaft, and flanged connections. Pump shall be capable of pumping the capacity scheduled on drawings.
3. Bearings: Permanently oil lubricated and sealed, stainless steel ball bearings.
4. Impeller shall be high grade, cast brass or bronze, accurately machined and properly balanced.

5. Seal: Mechanical, with carbon-steel rotating ring, stainless steel spring, ceramic seat, and rubber bellows and gasket. Include water slinger on shaft between motor and seal.

C. Vertical, In-Line Pumps:

1. Close-coupled pump and motor with maximum 3,600 rpm rotational speed.
2. Bronze body construction with solid steel shaft and flanged connections. Pump shall be suitable for mounting in a vertical or horizontal position, and shall be capable of pumping the capacity scheduled on drawings.
3. Bearings: Permanently oil lubricated and sealed, stainless steel ball bearings.
4. Impeller shall be high grade, cast brass or bronze, accurately machined and properly balanced.
5. Seal: Mechanical, with carbon-steel rotating ring, stainless steel spring, ceramic seat, and rubber bellows and gasket. Include water slinger on shaft between motor and seal.

2.3 HOT WATER CIRCULATING PUMP – NOT USED

2.4 DOMESTIC WATER PRESSURE BOOSTER SYSTEM – NOT USED

PART 3 - EXECUTION

3.1 STARTUP AND TESTING

A. Make tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. System Test: After installation is completed provide an operational test of the completed system including flow rates, pressure compliance, alarms and all control functions.

C. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

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SECTION 22 40 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Plumbing fixtures, associated trim and fittings necessary to make a complete installation from wall or floor connections to rough piping, and certain accessories.

B. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 07 92 00, JOINT SEALANTS: Sealing between fixtures and other finish surfaces.

D. Section 08 31 13, ACCESS DOORS AND FRAMES: Flush panel access doors.

E. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.3 APPLICABLE PUBLICATIONS

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

B. The American Society of Mechanical Engineers (ASME):

A112.6.1M-1997 (R2012)..Supports for Off-the-Floor Plumbing Fixtures for Public Use

A112.19.1-2013.....Enameled Cast Iron and Enameled Steel Plumbing Fixtures

A112.19.2-2013.....Ceramic Plumbing Fixtures

A112.19.3-2008.....Stainless Steel Plumbing Fixtures

C. American Society for Testing and Materials (ASTM):

A276-2013a.....Standard Specification for Stainless Steel Bars and Shapes

B584-2008.....Standard Specification for Copper Alloy Sand Castings for General Applications

D. CSA Group:

B45.4-2008 (R2013).....Stainless Steel Plumbing Fixtures

E. National Association of Architectural Metal Manufacturers (NAAMM):

AMP 500-2006.....Metal Finishes Manual

F. American Society of Sanitary Engineering (ASSE):

1016-2011.....Automatic Compensating Valves for Individual Showers and Tub/Shower Combinations

G. NSF International (NSF):

14-2013.....Plastics Piping System Components and Related Materials

61-2013.....Drinking Water System Components – Health Effects

372-2011.....Drinking Water System Components – Lead Content

H. American with Disabilities Act (A.D.A)

I. International Code Council (ICC):

IPC-2015.....International Plumbing Code

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 22 40 00, PLUMBING FIXTURES", with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, connections, and capacity.

D. Operating Instructions: Comply with requirements in Section 01 00 00, GENERAL REQUIREMENTS.

1.5 QUALITY ASSURANCE

A. Bio-Based Materials: For products designated by the USDA's Bio-Preferred Program, provide products that meet or exceed USDA recommendations for bio-based content, so long as products meet all performance requirements in this specifications section. For more information regarding the product categories covered by the Bio-Preferred Program, visit http://www.biopreferred.gov.

1.6 AS-BUILT DOCUMENTATION

A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be in

electronic PDF version via Electronic Transmittal and Hard Copy inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

C. Certification documentation shall be provided to COR 10 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and certification that all results of tests were within limits specified.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Material or equipment containing a weighted average of greater than 0.25 percent lead is prohibited in any potable water system intended for human consumption, and shall be certified in accordance with NSF 61 or NSF 372. Endpoint devices used to dispense water for drinking shall meet the requirements of NSF 61.

B. Plastic pipe, fittings, and solvent cement shall meet NSF 14 and shall be NSF listed for the service intended.

2.2 STAINLESS STEEL

A. Corrosion-resistant Steel (CRS):

1. Plate, Sheet and Strip: CRS flat products shall conform to chemical composition requirements of any 300 series steel specified in ASTM A276.
2. Finish: Exposed surfaces shall have standard polish (ground and polished) equal to NAAMM finish Number 4.

B. Die-cast zinc alloy products are prohibited.

2.3 STOPS

A. Provide lock-shield loose key or screw driver pattern angle stops, straight stops or stops integral with faucet, with each compression type faucet whether specifically called for or not, including sinks in solid-surface, wood and metal casework, laboratory furniture and pharmacy furniture. Locate stops centrally above or below fixture in accessible location.

B. Furnish keys for lock shield stops to the COR.

C. Supply from stops not integral with faucet shall be chrome plated copper flexible tubing or flexible stainless steel with inner core of non-toxic polymer.

D. Supply pipe from wall to valve stop shall be rigid threaded IPS copper alloy pipe, i.e. red brass pipe nipple, chrome plated where exposed.

E. Mental Health Area: Provide stainless steel drain guard for all lavatories not installed in casework.

2.4 ESCUTCHEONS

A. Heavy type, chrome plated, with set screws. Provide for piping serving plumbing fixtures and at each wall, ceiling and floor penetrations in exposed finished locations and within cabinets and millwork.

2.5 LAMINAR FLOW CONTROL DEVICE

A. Smooth, bright stainless steel or satin finish, chrome plated metal laminar flow device shall provide non-aeration, clear, coherent laminar flow that will not splash in basin. Device shall also have a flow control restrictor and have vandal resistant housing. **Aerators are prohibited.**

B. Flow Control Restrictor:

1. Capable of restricting flow from 32 ml/s to 95 ml/s (0.5 gpm to 1.5 gpm).
2. Compensates for pressure fluctuation maintaining flow rate specified above within 10 percent between 170 kPa and 550 kPa (25 psig and 80 psig).
3. Operates by expansion and contraction, eliminates mineral/sediment build-up with self-cleaning action, and is capable of easy manual cleaning.

2.6 CARRIERS – NOT USED

2.7 WATER CLOSETS – NOT USED

2.8 URINALS – NOT USED

2.9 BATHTUBS – NOT USED

2.10 LAVATORIES – NOT USED

2.11 PROGRAMMABLE AUTOMATIC FLUSHING FAUCETS

A. Additional requirements shall be reviewed on drawings under scope of work description "Fixture Upgrades".
B. Deck mounted single outlet faucet with infrared sensor.
C. Programmable automatic flush schedule with adjustable flush duration.
D. Available as hardwired or battery operated (contractor shall hardwire if existing power available).
E. Laminar flow (non-aerating) outlet.
F. Capable of temporary high temperature flush (up to 180f)
G. Certified to nsf 61. Ada compliant. Installed with asse 1070 mixing valve.
H. Brass components in contact with water shall contain no more than 0.25 percent lead content by dry weight. Faucet flow rates shall be 3.9 L/m (1.5 gpm) for private lavatories and either 1.9 L/m (0.5 gpm) or 1.0 liter (0.25 gallons) per cycle for public lavatories.
I. Faucet: Solid cast brass construction, vandal resistant, heavy-duty single lever handle, center set. Control shall be washerless ceramic disc cartridge type. Provide laminar flow control device, adjustable hot water limit stop, and vandal proof screws. Flow shall be limited to 1.9 L/m (0.5 gpm).
J. Stops: Angle type, see paragraph "Stops". Provide cover per A.D.A 4-19.4.
K. Trap: Cast copper alloy, 38 mm by 32 mm (1 1/2 inches by 1 1/4 inches) P-trap, adjustable with connected elbow and 1.4 mm thick (17 gauge) tubing extension to wall. Set trap parallel to the wall. Exposed metal trap surface and connection hardware shall be chrome plated with a smooth bright finish.
L. Provide cover for exposed piping, drain, stops and trap per A.D.A.
M. Provide control hardware required for programming fixtures with software installed and ready to use.

2.12 SHOWER BATH FIXTURE

Contractor shall identify in the field the type of fixture that requires thermostatic and pressure balancing valve with respect to the types listed below to determine valve replacement requirements. Valve replacement shall be ASSE certified.

A. (P-701) Shower Bath Fixture (Detachable, Wall Mounted, Concealed Supplies, Type T/P Combination Valve):

1. Shower Installation: Wall mounted detachable spray assembly, 600 mm (24 inch) wall bar, elevated vacuum breaker, supply elbow and flange and valve. All external trim, chrome plated metal.
2. Shower Head Assembly: Not Used.
3. Valves: Type T/P combination thermostatic and pressure balancing, with chrome plated metal lever type operating handle adjustable for rough-in variations and chrome plated metal or CRS face plate. Valve body shall be any suitable copper alloy. Internal parts shall be copper, nickel alloy, CRS or thermoplastic material. Valve inlet and outlet shall be 13 mm (1/2 inch) IPS. Provide external screwdriver check stops, vacuum breaker and temperature limit stops. Set stops for a maximum temperature of 50 degrees C (122 degrees F). All exposed fasteners shall be vandal resistant. Valve shall provide a minimum of 9.5 l/m (2.5 gpm) at 310 kPa (45 psig) pressure drop.

B. (P-702) Shower Bath Fixture (Wall Mounted, Concealed Supplies, Type T/P Combination Valve):

1. Shower Installation: Wall mounted, shower head connected to shower arm. All external trim shall be chrome plated metal.
2. Shower Heads: Not Used.
3. Valves: Type T/P combination thermostatic and pressure balancing, with chrome plated metal lever with adjustment for rough-in variations, type operating handle and chrome plated brass or CRS face plate. Valve body shall be any suitable copper alloy. Internal parts shall be copper, nickel alloy, CRS or thermoplastic material. Valve inlet and outlet shall be 13 mm (1/2 inch) IPS. Provide external screwdriver check stops, and temperature limit stops. Set stops for a maximum temperature of 50 degrees C (122 degrees F). Install valve 1372 mm (54 inches) from bottom of shower receptor. All exposed fasteners shall be vandal resistant. Valve shall provide a minimum of 9.5 l/m (2.5 gpm) at 310 kPa (45 psig) pressure drop.

C. (P-703) Shower Bath Fixture (Wall Mounted, Concealed Supplies, Type T/P combination Valve):

1. Shower Installation: Wall mounted showerhead with integral back secured to wall, diverter valve and supply elbow with quick connect for hose assembly and wall hook for hose assembly.
2. Shower Heads: Not Used.
3. Valves: Type T/P combination thermostatic and pressure balancing. Valve body shall be any suitable copper alloy. Internal parts shall be copper, nickel alloy, CRS or thermoplastic material. Valve inlet and outlet shall be 13 mm (1/2 inch) IPS. Provide external combination screwdriver check stops, and temperature limit stops. Set stops for a maximum temperature of 50 degrees C (122 degrees F). One piece chrome plated brass or CRS faceplate, with chrome plated metal lever handle with adjustment for rough-in variation. Exposed fasteners shall be vandal resistant. Valve shall provide minimum of 9.5 l/m (2.5 gpm) at 310 kPa (45 psig) pressure drop.

D. (P-704) Shower Bath Fixture (Wall Mounted, Concealed Supplies, Hose Spray):

1. Shower Installation: Wall mounted showerhead connected to shower arm.
2. Shower Heads: Not Used.
3. Valves: Type T/P combination temperature and pressure balancing, with chrome plated metal lever type operating with adjustment for rough-in variations handle and chrome plated metal or CRS face plate. Install diverter selector valve and elevated vacuum breaker to provide tempered water to shower head and hose spray. Valve body shall be any suitable copper alloy. Internal parts shall be copper nickel alloy, CRS or thermoplastic material. Valve inlet and outlet shall be 13 mm (1/2 inch) IPS. Provide external screwdriver check stops, and temperature limit stops. Set stops for a maximum temperature of 50 degrees C (122 degrees F). All exposed fasteners shall be vandal resistant. Valve shall provide a minimum of 9.5 l/m (2.5 gpm) at 310 kPa (45 psig) pressure drop.
4. Spray Assembly: Not Used.

E. (P-705) Thermostatic Valve (Wall Mounted, Thermometer and Hose Assembly):

1. Installation: Wall mounted hose assembly connected to exposed wall mounted vacuum breaker, flow control valve, thermometer and thermostatic valve.
2. Valves: Type T/P combination temperature and pressure balancing for wall mounted hose assembly. Valve body shall be suitable copper alloy. Internal parts shall be copper, nickel alloy, CRS, or thermoplastic material. Valve inlet and outlet shall be 19 mm (3/4 inch) IPS. Provide external screwdriver

check stops and strainers. Install mixing valve 1219 mm (48 inches) above finished floor. Valve shall provide a minimum of 9.5 l/m (2.5 gpm) at 310 kPa (45 psig) pressure drop.

3. Thermometer: Stainless steel, 64 mm (2 1/2 inches) dial type range from 0 to 60 degrees C (32 to 140 degrees F).
4. Spray assembly: Not Used.

F. (P-711) Shower Bath Fixture (Detachable, Wall Mounted, Concealed Supplies, Type T/P Combination Valve and Thermometer):

1. Shower Installation: Wall mounted detachable spray assembly, 610 mm (24 inches) wall bar, elevated vacuum breaker, supply elbow and flange, concealed pipe to wall mounted thermometer, and valve. All external trim shall be chrome plated metal.
2. Shower Head Assembly: Not Used.
3. Valves: Type T/P combination thermostatic and pressure balancing, for wall mounted shower with chrome plated lever type operating handle with adjustment for rough-in variations and chrome plated metal or CRS face plate. Valve body for mixing valve and valve body for separate valves shall be any suitable copper alloy. Internal parts shall be copper, nickel alloy, CRS or thermoplastic material. Valve inlet and outlet shall be 13 mm (1/2 inch) IPS. Provide screwdriver check stops with strainers, vacuum breaker, flow control valve with four-arm or lever handle and temperature limit stops. Set stops for a maximum temperature of 50 degrees C (122 degrees F). All exposed fasteners shall be chrome plated. Valve shall provide a minimum of 190 ml/s at 310 kPa (3 gpm at 45 psig) pressure drop.
4. Thermometer: Stainless steel, 65 mm (2 1/2 inches) dial type range from 0 to 60 degrees C (32 to 140 degrees F).

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fixture Setting: Opening between fixture and floor and wall finish shall be sealed as specified under Section 07 92 00, JOINT SEALANTS. Bio-based materials shall be utilized when possible.

B. Supports and Fastening: Secure all fixtures, equipment and trimmings to partitions, walls and related finish surfaces. Exposed heads of bolts and nuts in finished rooms shall be hexagonal, polished chrome plated brass with rounded tops.

C. Through Bolts: For free standing marble and metal stud partitions refer to Section 10 21 13, TOILET COMPARTMENTS.

D. Toggle Bolts: For hollow masonry units, finished or unfinished.

E. Expansion Bolts: For brick or concrete or other solid masonry. Shall be 6 mm (1/4 inch) diameter bolts, and to extend at least 76 mm (3 inches) into masonry and be fitted with loose tubing or sleeves extending into masonry. Wood plugs, fiber plugs, lead or other soft metal shields are prohibited.

F. Power Set Fasteners: May be used for concrete walls, shall be 6 mm (1/4 inch) threaded studs, and shall extend at least 32 mm (1 1/4 inches) into wall.

G. Tightly cover and protect fixtures and equipment against dirt, water and chemical or mechanical injury.

H. Where water closet waste pipe has to be offset due to beam interference, provide correct and additional piping necessary to eliminate relocation of water closet.

I. Aerators are prohibited on lavatories and sinks.

J. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no cost or additional time to the Government.

3.2 CLEANING

A. At completion of all work, fixtures, exposed materials and equipment shall be thoroughly cleaned.

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SECTION 23 05 11
COMMON WORK RESULTS FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. The requirements of this Section apply to all sections of Division 23.

B. Definitions:

1. Exposed: Piping, ductwork, and equipment exposed to view in finished rooms.
2. Exterior: Piping, ductwork, and equipment exposed to weather be it temperature, humidity, precipitation, wind, or solar radiation.

C. Abbreviations/Acronyms:

1. ac: Alternating Current
2. ACR: Air Conditioning and Refrigeration
3. AI: Analog Input
4. AISI: American Iron and Steel Institute
5. AO: Analog Output
6. ASJ: All Service Jacket
7. AWG: American Wire Gauge
8. BACnet: Building Automation and Control Networking Protocol
9. BAg: Silver-Copper-Zinc Brazing Alloy
10. BAS: Building Automation System
11. BCuP: Silver-Copper-Phosphorus Brazing Alloy
12. bhp: Brake Horsepower
13. Btu: British Thermal Unit
14. Btu/h: British Thermal Unit Per Hour
15. CDA: Copper Development Association
16. C: Celsius
17. CD: Compact Disk
18. CFM: Cubic Foot Per Minute
19. CH: Chilled Water Supply
20. CHR: Chilled Water Return
21. CLR: Color
22. CO: Carbon Monoxide
23. COR: Contracting Officer’s Representative
24. CPD: Condensate Pump Discharge
25. CPM: Cycles Per Minute

26. CPVC: Chlorinated Polyvinyl Chloride
27. CRS: Corrosion Resistant Steel
28. CTPD: Condensate Transfer Pump Discharge
29. CTPS: Condensate Transfer Pump Suction
30. CW: Cold Water
31. CWP: Cold Working Pressure
32. CxA: Commissioning Agent
33. dB: Decibels
34. dB(A): Decibels (A weighted)
35. DDC: Direct Digital Control
36. DI: Digital Input
37. DO: Digital Output
38. DVD: Digital Video Disc
39. DN: Diameter Nominal
40. DWV: Drainage, Waste and Vent
41. EPDM: Ethylene Propylene Diene Monomer
42. EPT: Ethylene Propylene Terpolymer
43. ETO: Ethylene Oxide
44. F: Fahrenheit
45. FAR: Federal Acquisition Regulations
46. FD: Floor Drain
47. FED: Federal
48. FG: Fiberglass
49. FGR: Flue Gas Recirculation
50. FOS: Fuel Oil Supply
51. FOR: Fuel Oil Return
52. FSK: Foil-Scrim-Kraft facing
53. FWPD: Feedwater Pump Discharge
54. FWPS: Feedwater Pump Suction
55. GC: Chilled Glycol Water Supply
56. GCR: Chilled Glycol Water Return
57. GH: Hot Glycol Water Heating Supply
58. GHR: Hot Glycol Water Heating Return
59. gpm: Gallons Per Minute
60. HDPE: High Density Polyethylene
61. Hg: Mercury
62. HOA: Hands-Off-Automatic

63. hp: Horsepower
64. HPS: High Pressure Steam (414 kPa (60 psig) and above)
65. HPR: High Pressure Steam Condensate Return
66. HW: Hot Water
67. HWH: Hot Water Heating Supply
68. HWHR: Hot Water Heating Return
69. Hz: Hertz
70. ID: Inside Diameter
71. IPS: Iron Pipe Size
72. kg: Kilogram
73. klb: 1000 lb
74. kPa: Kilopascal
75. lb: Pound
76. lb/hr: Pounds Per Hour
77. L/s: Liters Per Second
78. L/min: Liters Per Minute
79. LPS: Low Pressure Steam (103 kPa (15 psig) and below)
80. LPR: Low Pressure Steam Condensate Gravity Return
81. MAWP: Maximum Allowable Working Pressure
82. MAX: Maximum
83. MBtu/h: 1000 Btu/h
84. MBtu: 1000 Btu
85. MED: Medical
86. m: Meter
87. MFG: Manufacturer
88. mg: Milligram
89. mg/L: Milligrams Per Liter
90. MIN: Minimum
91. MJ: Megajoules
92. ml: Milliliter
93. mm: Millimeter
94. MPS: Medium Pressure Steam (110 kPa (16 psig) through 414 kPa (60 psig))
95. MPR: Medium Pressure Steam Condensate Return
96. MW: Megawatt
97. NC: Normally Closed
98. NF: Oil Free Dry (Nitrogen)

99. Nm: Newton Meter
100. NO: Normally Open
101. NOx: Nitrous Oxide
102. NPT: National Pipe Thread
103. NPS: Nominal Pipe Size
104. OD: Outside Diameter
105. OSD: Open Sight Drain
106. OS&Y: Outside Stem and Yoke
107. PC: Pumped Condensate
108. PID: Proportional-Integral-Differential
109. PLC: Programmable Logic Controllers
110. PP: Polypropylene
111. PPE: Personal Protection Equipment
112. ppb: Parts Per Billion
113. ppm: Parts Per Million
114. PRV: Pressure Reducing Valve \
115. PSIA: Pounds Per Square Inch Absolute
116. psig: Pounds Per Square Inch Gauge
117. PTFE: Polytetrafluoroethylene
118. PVC: Polyvinyl Chloride
119. PVDC: Polyvinylidene Chloride Vapor Retarder Jacketing, White
120. PVDF: Polyvinylidene Fluoride
121. rad: Radians
122. RH: Relative Humidity
123. RO: Reverse Osmosis
124. rms: Root Mean Square
125. RPM: Revolutions Per Minute
126. RS: Refrigerant Suction
127. RTD: Resistance Temperature Detectors
128. RTRF: Reinforced Thermosetting Resin Fittings
129. RTRP: Reinforced Thermosetting Resin Pipe
130. SCFM: Standard Cubic Feet Per Minute
131. SPEC: Specification
132. SPS: Sterile Processing Services
133. STD: Standard
134. SDR: Standard Dimension Ratio
135. SUS: Saybolt Universal Second

136. SW: Soft water
137. SWP: Steam Working Pressure
138. TAB: Testing, Adjusting, and Balancing
139. TDH: Total Dynamic Head
140. TEFC: Totally Enclosed Fan-Cooled
141. TFE: Tetrafluoroethylene
142. THERM: 100,000 Btu
143. THHN: Thermoplastic High-Heat Resistant Nylon Coated Wire
144. THWN: Thermoplastic Heat & Water-Resistant Nylon Coated Wire
145. T/P: Temperature and Pressure
146. USDA: U.S. Department of Agriculture
147. V: Volt
148. VAC: Vacuum
149. VA: Veterans Administration
150. VAC: Voltage in Alternating Current
151. VA CFM: VA Construction & Facilities Management
152. VA CFM CSS: VA Construction & Facilities Management, Consulting Support Service
153. VAMC: Veterans Administration Medical Center
154. VHA OCAMES: Veterans Health Administration – Office of Capital Asset Management Engineering and Support
155. VR: Vacuum condensate return
156. WCB: Wrought Carbon Steel, Grade B
157. WG: Water Gauge or Water Column
158. WOG: Water, Oil, Gas

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.
B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
C. Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT.
D. Section 01 81 13, SUSTAINABLE CONSTRUCTION REQUIREMENTS
E. Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.
F. Section 03 30 53, CAST-IN-PLACE CONCRETE.
G. Section 05 50 00, METAL FABRICATIONS.
H. Section 07 84 00, FIRESTOPPING.
I. Section 07 92 00, JOINT SEALANTS.
J. Section 09 91 00, PAINTING.

K. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION.

L. Section 23 07 11, HVAC AND BOILER PLANT INSULATION.

M. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

N. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standard will govern.

B. Air Movement and Control Association (AMCA):

410-1996.....Recommended Safety Practices for Users and Installers of Industrial and Commercial Fans

C. American Society for Testing and Materials (ASTM):

A36/A36M-2014.....Standard Specification for Carbon Structural Steel

A575-1996(R2013)e1.....Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades

D. Manufacturers Standardization Society (MSS) of the Valve and Fittings Industry, Inc.:

SP-58-2009.....Pipe Hangers and Supports-Materials, Design, Manufacture, Selection, Application, and Installation

SP-127-2014a.....Bracing for Piping Systems: Seismic–Wind–Dynamic Design, Selection, and Application

E. National Fire Protection Association (NFPA):

70-2014.....National Electrical Code (NEC)

101-2015.....Life Safety Code

F. Department of Veterans Affairs (VA):

PG-18-10-2016.....Physical Security and Resiliency Design Manual

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 05 11, COMMON WORK RESULTS FOR HVAC", with applicable paragraph identification.

C. Contractor shall make all necessary field measurements and investigations to assure that the equipment and assemblies will meet contract requirements, and all equipment that requires regular maintenance, calibration, etc are accessable from the floor or permanent work platform. It is the Contractor's responsibility to ensure all submittals meet the VA specifications and requirements and it is assumed by the VA that all submittals do meet the VA specifications unless the Contractor has requested a variance in writing and approved by COR prior to the submittal. If at any time during the project it is found that any item does not meet the VA specifications and there was no variance approval the Contractor shall correct at no additional cost or time to the Government even if a submittal was approved.

D. If equipment is submitted which differs in arrangement from that shown, provide documentation proving equivalent performance, design standards and drawings that show the rearrangement of all associated systems. Additionally, any impacts on ancillary equipment or services such as foundations, piping, and electrical shall be the Contractor's responsibility to design, supply, and install at no additional cost or time to the Government. VA approval will be given only if all features of the equipment and associated systems, including accessibility, are equivalent to that required by the contract.

E. Prior to submitting shop drawings for approval, Contractor shall certify in writing that manufacturers of all major items of equipment have each reviewed contract documents, and have jointly coordinated and properly integrated their equipment and controls to provide a complete and efficient installation.

F. Submittals and shop drawings for interdependent items, containing applicable descriptive information, shall be furnished together. Coordinate and properly integrate materials and equipment to provide a completely compatible and efficient installation.

G. Manufacturer's Literature and Data: Include full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity. Submit under the pertinent section rather than under this section.

   1. Submit electric motor data with the driven equipment.

2. Equipment and materials identification.
3. Fire-stopping materials.
4. Hangers, inserts, supports and bracing. Provide complete stress analysis for variable spring and constant support hangers.
5. Wall, floor, and ceiling plates.

H. Rigging Plan: Provide documentation of the capacity and weight of the rigging and equipment intended to be used. The plan shall include the path of travel of the load, the staging area and intended access, and qualifications of the operator and signal person.

I. HVAC Maintenance Data and Operating Instructions:
1. Maintenance and operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS, Article, INSTRUCTIONS, for systems and equipment.
2. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:
   a. Include complete list indicating all components of the systems.
   b. Include complete diagrams of the internal wiring for each item of equipment.
   c. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.
3. Provide a listing of recommended replacement parts for keeping in stock supply, including sources of supply, for equipment.

1.5 QUALITY ASSURANCE

A. Mechanical, electrical and associated systems shall be safe, reliable, efficient, durable, easily and safely operable and maintainable, easily and safely accessible, and in compliance with applicable codes as specified. The systems shall be comprised of high quality institutional-class and industrial-class products of manufacturers that are experienced specialists in the required product lines. All construction firms and personnel shall be experienced and qualified specialists in industrial and institutional HVAC.

B. Equipment Vibration Tolerance:
1. Equipment shall be factory-balanced and re-balanced on site, as necessary.

C. Products Criteria:

1. Standard Products: Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 3 years (or longer as specified elsewhere). The design, model and size of each item shall have been in satisfactory and efficient operation on at least three installations for approximately three years. However, digital electronics devices, software and systems such as controls, instruments, computer work station, shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years. See other specification sections for any exceptions and/or additional requirements.
2. Refer to all other sections for quality assurance requirements for systems and equipment specified therein.
3. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
4. The products and execution of work specified in Division 33 shall conform to the referenced codes and standards as required by the specifications. Local codes and amendments shall be enforced, along with requirements of local utility companies. The most stringent requirements of these specifications, local codes, or utility company requirements shall always apply. Any conflicts shall be brought to the attention of the COR.
5. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be of the same manufacturer and model number, or if different models are required they shall be of the same manufacturer and identical to the greatest extent possible (i.e., same model series).
6. Assembled Units: Performance and warranty of all components that make up an assembled unit shall be the responsibility of the manufacturer of the completed assembly.
7. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

8. Use of asbestos products or equipment or materials containing asbestos is prohibited.

D. HVAC Equipment Service Providers: Service providers shall be authorized and trained by the manufacturers of the equipment supplied. These providers shall be capable of responding onsite and provide acceptable service to restore equipment operations within 24 hours of receipt of notification by phone, e-mail or fax in event of an emergency, such as the shutdown of equipment; or within 48 hours in a non-emergency. Submit names, mail and e-mail addresses and phone numbers of service personnel and companies providing service under these conditions for (as applicable to the project): fans, chillers, control systems, pumps, critical instrumentation, computer workstation and programming.

E. Manufacturer's Recommendations: Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the COR with submittals. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations can be cause for rejection of the material and removal by the Contractor and no additional cost or time to the Government.

F. Execution (Installation, Construction) Quality:

1. Apply and install all items in accordance with manufacturer's written instructions. Refer conflicts between the manufacturer's instructions and the contract documents to the COR for resolution. Provide written hard copies and computer files on CD or DVD of manufacturer’s installation instructions to the COR with submittals prior to commencing installation of any item. Installation of the item will not be allowed to proceed until the recommendations are received and approved by the VA. Failure to furnish these recommendations is a cause for rejection of the material.
2. All items that require access, such as for operating, cleaning, servicing, maintenance, and calibration, shall be easily and safely accessible by persons standing at floor level, or standing on permanent platforms, without the use of portable ladders. Examples of these items include, but are not limited to, all types of valves, filters and strainers, transmitters, control devices. Prior to commencing installation work, refer conflicts between this

requirement and contract documents to the COR for resolution. Failure of the Contractor to resolve, or point out any issues will result in the Contractor correcting at no additional cost or time to the Government.

3. Complete coordination/shop drawings shall be required in accordance with Paragraph, SUBMITTALS. Construction work shall not start on any system until the coordination/shop drawings have been approved by VA.
4. Workmanship/craftsmanship will be of the highest quality and standards. The VA reserves the right to reject any work based on poor quality of workmanship this work shall be removed and done again at no additional cost or time to the Government.

G. Upon request by Government, provide lists of previous installations for selected items of equipment. Include contact persons who will serve as references, with current telephone numbers and e-mail addresses.

H. Guaranty: Warranty of Construction, FAR Clause 52.246-21.

1.6 DELIVERY, STORAGE AND HANDLING

A. Protection of Equipment:

1. Equipment and material placed on the job site shall remain in the custody of the Contractor until phased acceptance, whether or not the Government has reimbursed the Contractor for the equipment and material. The Contractor is solely responsible for the protection of such equipment and material against any damage or theft.
2. Large equipment such as chillers, if shipped on open trailer trucks shall be covered with shrink on plastics or water proof tarpaulins that provide protection from exposure to rain, road salts and other transit hazards. Protection shall be kept in place until equipment is moved into a building or installed as designed.
3. Repair damaged equipment in first class, new operating condition and appearance; or, replace same as determined and directed by the COR. Such repair or replacement shall be at no additional cost or time to the Government.
4. Protect interiors of new equipment and piping systems against entry of foreign matter. Clean both inside and outside before painting or placing equipment in operation.

5. Existing equipment and piping being worked on by the Contractor shall be under the custody and responsibility of the Contractor and shall be protected as required for new work.
6. Protect plastic piping and tanks from ultraviolet light (sunlight).

B. Cleanliness of Piping and Equipment Systems:
1. Exercise care in storage and handling of equipment and piping material to be incorporated in the work. Remove debris arising from cutting, threading and welding of piping.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.
3. Clean interior of all tanks prior to delivery for beneficial use by the Government.
4. Contractor shall be fully responsible for all costs, damage, and delay arising from failure to provide clean systems.

1.7 AS-BUILT DOCUMENTATION

A. Submit manufacturer’s literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, VA approved substitutions and construction revisions shall be in electronic PDF version via Electronic Transmittal and Hard Copy inserted into a three ring binder. All aspects of system operation and maintenance procedures, including applicable piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

C. The installing Contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. Should the installing Contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or

breach of the 'third party testing company' requirement. Provide record drawings as follows:

1. Red-lined, hand-marked drawings are to be provided, in electronic PDF version via Electronic Transmittal and Hard Copy inserted into a three ring binder.

D. The as-built drawings shall indicate the location and type of all lockout/tagout points for all energy sources for all equipment and pumps to include breaker location and numbers, valve tag numbers, etc. Coordinate lockout/tagout procedures and practices with local VA requirements.

E. Certification documentation shall be provided to COR 21 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and provide documentation/certification that all results of tests were within limits specified. Test results shall contain written sequence of test procedure with written test results annotated at each step along with the expected outcome or setpoint. The results shall include all readings, including but not limited to data on device (make, model and performance characteristics_), normal pressures, switch ranges, trip points, amp readings, and calibration data to include equipment serial numbers or individual identifications, etc.

1.8 JOB CONDITIONS – WORK IN EXISTING BUILDING

A. Building Operation: Government employees will be continuously operating and managing all facilities, including temporary facilities that serve the VAMC.

B. Maintenance of Service: Schedule all work to permit continuous service as required by the VAMC.

C. Building Working Environment: Maintain the architectural and structural integrity of the building and the working environment at all times. Maintain the interior of occupied building at 18 degrees C (65 degrees F) minimum. Limit the opening of doors, windows or other access openings to brief periods as necessary for rigging purposes. Storm water or ground water leakage is prohibited. Provide daily clean-up of construction and demolition debris on all floor surfaces and on all

equipment being operated by VA. Maintain all egress routes and safety systems/devices.

D. Acceptance of Work for Government Operation: As new equipment, systems and facilities are made available for operation and these items are deemed of beneficial use to the Government, inspections will be made and tests will be performed. Based on the inspections, a list of contract deficiencies will be issued to the Contractor. After correction of deficiencies as necessary for beneficial use, the Contracting Officer will process necessary acceptance and the equipment will then be under the control and operation of Government personnel.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

A. Provide maximum standardization of components to reduce spare part requirements.

B. Performance and warranty of all components that make up an assembled unit shall be the responsibility of the manufacturer of the completed assembly.

1. All components of an assembled unit need not be products of same manufacturer.
2. Constituent parts that are alike shall be products of a single manufacturer.
3. Components shall be compatible with each other and with the total assembly for intended service.
4. Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

C. Equipment and components of equipment shall bear manufacturer's name and trademark, model number, serial number and performance data on a nameplate securely affixed in a conspicuous place, or cast integral with, stamped or otherwise permanently marked upon the components of the equipment.

D. Major items of equipment, which serve the same function, must be the same make and model. Exceptions must be approved by the VA, but may be permitted if performance requirements cannot be met.

2.2 COMPATIBILITY OF RELATED EQUIPMENT

A. Equipment and materials installed shall be compatible in all respects with other items being furnished and with existing items so that the

result will be a complete and fully operational plant that conforms to contract requirements.

2.3 LIFTING ATTACHMENTS

A. Provide equipment with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.4 ELECTRIC MOTORS

A. All material and equipment furnished and installation methods shall conform to the requirements of Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT; Section 26 29 11, MOTOR CONTROLLERS; and, Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES. Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide special energy efficient premium efficiency type motors as scheduled.

2.5 EQUIPMENT AND MATERIALS IDENTIFICATION

A. Use symbols, nomenclature and equipment numbers specified, shown on the contract documents and shown in the maintenance manuals. In addition, provide bar code identification nameplate for all equipment which will allow the equipment identification code to be scanned into the system for maintenance and inventory tracking. Identification for piping is specified in Section 09 91 00, PAINTING.

B. Interior (Indoor) Equipment: Engraved nameplates, with letters not less than 5 mm (3/16 inch) high of brass with black-filled letters, or rigid black plastic with white letters specified in Section 09 91 00, PAINTING permanently fastened to the equipment. Identify unit components such as coils, filters, fans, etc.

C. Exterior (Outdoor) Equipment: Brass nameplates, with engraved black filled letters, not less than 5 mm (3/16 inch) high riveted or bolted to the equipment.

D. Control Items: Label all instrumentation, temperature and humidity sensors, controllers and control dampers. Identify and label each item as they appear on the control diagrams.

E. Valve Tags and Lists:

1. HVAC and Mechanical Rooms: Provide for all valves other than for equipment in Section 23 82 00, CONVECTION HEATING AND COOLING UNITS and Section 23 36 00, AIR TERMNAL UNITS.
2. Valve tags: Engraved black filled numbers and letters not less than 15 mm (1/2 inch) high for number designation, and not less than 6 mm (1/4 inch) for service designation on 19-gauge 40 mm (1-1/2 inches) round brass disc, attached with brass "S" hook or brass chain.
3. Valve lists: Typed or printed plastic coated card(s), sized 215 mm (8-1/2 inches) by 275 mm (11 inches) showing tag number, valve function and area of control, for each service or system. Punch sheets for a 3-ring notebook.
4. Provide detailed plan for each floor of the building indicating the location and valve number for each valve. Identify location of each valve with a color-coded thumb tack in ceiling.

F. Ceiling Grid Labels:

1. 50 mm (2 inch) long by 15 mm (1/2 inch) wide by 0.025 mm (1 mil) thick UV resistant metalized polyester label with red border color and black custom lettering on white background interior. Peel and stick adhesive backing. Label and adhesive manufactured specifically for use in equipment inventory tagging.
2. Custom print labels with above ceiling HVAC equipment numbers.

2.6 FIRESTOPPING

A. Section 07 84 00, FIRESTOPPING specifies an effective barrier against the spread of fire, smoke and gases where penetrations occur for piping and ductwork. Refer to Section 23 07 11, HVAC AND BOILER PLANT INSULATION, for firestop pipe and duct insulation.

2.7 GALVANIZED REPAIR COMPOUND

A. Mil-P-21035B, paint form.

2.8 HVAC PIPE AND EQUIPMENT SUPPORTS AND RESTRAINTS

A. Vibration Isolators: Provide per manufacturer recommended insulation procedures.

B. Supports for Roof Mounted Items:

1. Equipment: Equipment rails shall be galvanized steel, minimum 1.3 mm (18 gauge), with integral baseplate, continuous welded corner seams, factory installed 50 by 100 mm (2 by 4 inches) treated wood nailer, 1.3 mm (18 gauge) galvanized steel counter flashing cap with screws,

built-in cant strip, (except for gypsum or tectum deck), minimum height 275 mm (11 inches). For surface insulated roof deck, provide raised cant strip to start at the upper surface of the insulation.

2. Pipe/duct pedestals: Provide a galvanized Unistrut channel welded to U-shaped mounting brackets which are secured to side of rail with galvanized lag bolts.

C. Pipe Supports: Comply with MSS SP-58. Type Numbers specified refer to this standard. For selection and application comply with MSS SP-58. Refer to Section 05 50 00, METAL FABRICATIONS, for miscellaneous metal support materials and prime coat painting requirements.

D. Attachment to Concrete Building Construction:

1. Concrete insert: MSS SP-58, Type 18.
2. Self-drilling expansion shields and machine bolt expansion anchors: Permitted in concrete not less than 100 mm (4 inches) thick when approved by the COR for each job condition.
3. Power-driven fasteners: Permitted in existing concrete or masonry not less than 100 mm (4 inches) thick when approved by the COR for each job condition.

E. Attachment to Steel Building Construction:

1. Welded attachment: MSS SP-58, Type 22.
2. Beam clamps: MSS SP-58, Types 20, 21, 28 or 29. Type 23 C-clamp may be used for individual copper tubing up to 23 mm (7/8 inch) outside diameter.

F. Attachment to existing structure: Support from existing floor/roof frame.

G. Attachment to Wood Construction: Wood screws or lag bolts.

H. Hanger Rods: Hot-rolled steel, ASTM A36/A36M or ASTM A575 for allowable load listed in MSS SP-58. For piping, provide adjustment means for controlling level or slope. Types 13 or 15 turn-buckles shall provide 40 mm (1-1/2 inches) minimum of adjustment and incorporate locknuts. All-thread rods are acceptable.

I. Hangers Supporting Multiple Pipes (Trapeze Hangers): Galvanized, cold formed, lipped steel channel horizontal member, not less than 41 mm by 41 mm (1-5/8 inches by 1-5/8 inches), 2.7 mm (12 gauge), designed to accept special spring held, hardened steel nuts. Trapeze hangers are prohibited for use for steam supply and condensate piping.

1. Allowable hanger load: Manufacturers rating less 91 kg (200 pounds).

2. Guide individual pipes on the horizontal member of every other trapeze hanger with 6 mm (1/4 inch) U-bolt fabricated from steel rod. Provide Type 40 insulation shield, secured by two 15 mm (1/2 inch) galvanized steel bands, or preinsulated calcium silicate shield for insulated piping at each hanger.

J. Supports for Piping Systems:

1. Select hangers sized to encircle insulation on insulated piping. Refer to Section 23 07 11, HVAC AND BOILER PLANT INSULATION for insulation thickness. To protect insulation, provide Type 39 saddles for roller type supports or preinsulated calcium silicate shields. Provide Type 40 insulation shield or preinsulated calcium silicate shield at all other types of supports and hangers including those for preinsulated piping.
2. Piping Systems except High and Medium Pressure Steam (MSS SP-58):
   a. Standard clevis hanger: Type 1; provide locknut.
   b. Riser clamps: Type 8.
   c. Wall brackets: Types 31, 32 or 33.
   d. Roller supports: Type 41, 43, 44 and 46.
   e. Saddle support: Type 36, 37 or 38.
   f. Turnbuckle: Types 13 or 15. Preinsulate.
   g. U-bolt clamp: Type 24.
   h. Copper Tube:
      1) Hangers, clamps and other support material in contact with tubing shall be painted with copper colored epoxy paint, plastic coated or taped with non-adhesive isolation tape to prevent electrolysis.
      2) For vertical runs use epoxy painted or plastic-coated riser clamps.
      3) For supporting tube to strut: Provide epoxy painted pipe straps for copper tube or plastic inserted vibration isolation clamps.
      4) Insulated Lines: Provide pre-insulated calcium silicate shields sized for copper tube.
   i. Supports for plastic piping: As recommended by the pipe manufacturer with black rubber tape extending one inch beyond steel support or clamp.

2.9 PIPE PENETRATIONS

A. Install sleeves during construction for other than blocked out floor openings for risers in mechanical bays.

B. To prevent accidental liquid spills from passing to a lower level, provide the following:

1. For sleeves: Extend sleeve 25 mm (1 inch) above finished floor and provide sealant for watertight joint.
2. For blocked out floor openings: Provide 40 mm (1-1/2 inch) angle set in silicone adhesive around opening.
3. For drilled penetrations: Provide 40 mm (1-1/2 inch) angle ring or square set in silicone adhesive around penetration.

C. Penetrations through beams or ribs are prohibited, but may be installed in concrete beam flanges. Any deviation from these requirements must receive prior approval of COR.

D. Sheet Metal, Plastic, or Moisture-resistant Fiber Sleeves: Provide for pipe passing through floors, interior walls, and partitions, unless brass or steel pipe sleeves are specifically called for below.

E. Cast Iron or Zinc Coated Pipe Sleeves: Provide for pipe passing through exterior walls below grade. Make space between sleeve and pipe watertight with a modular or link rubber seal. Seal shall be applied at both ends of sleeve.

F. Galvanized Steel or an alternate Black Iron Pipe with asphalt coating Sleeves: Provide for pipe passing through concrete beam flanges, except where brass pipe sleeves are called for. Provide sleeve for pipe passing through floor of mechanical rooms, laundry work rooms, and animal rooms above basement. Except in mechanical rooms, connect sleeve with floor plate.

G. Brass Pipe Sleeves: Provide for pipe passing through quarry tile, terrazzo or ceramic tile floors. Connect sleeve with floor plate.

H. Sleeves are not required for wall hydrants for fire department connections or in drywall construction.

I. Sleeve Clearance: Sleeve through floors, walls, partitions, and beam flanges shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation. Interior openings shall be caulked tight with fire stopping material and sealant to prevent the spread of fire, smoke, and gases.

J. Sealant and Adhesives: Shall be as specified in Section 07 92 00, JOINT SEALANTS.

2.10 DUCT PENETRATIONS

A. Provide curbs for roof mounted piping, ductwork and equipment. Curbs shall be 450 mm (18 inches) high with continuously welded seams, built-in cant strip, interior baffle with acoustic insulation, curb bottom, hinged curb adapter.

B. Provide firestopping for openings through fire and smoke barriers, maintaining minimum required rating of floor, ceiling or wall assembly. See section 07 84 00, FIRESTOPPING.

2.11 SPECIAL TOOLS AND LUBRICANTS

A. Furnish, and turn over to the COR, tools not readily available commercially, that are required for disassembly or adjustment of equipment and machinery furnished.

B. Grease Guns with Attachments for Applicable Fittings: One for each type of grease required for each motor or other equipment.

C. Refrigerant Tools: Provide system charging/Evacuation equipment, gauges, fittings, and tools required for maintenance of furnished equipment.

D. Tool Containers: Hardwood or metal, permanently identified for intended service and mounted, or located, where directed by the COR.

E. Lubricants: A minimum of 0.95 L (1 quart) of oil, and 0.45 kg (1 pound) of grease, of equipment manufacturer's recommended grade and type, in unopened containers and properly identified as to use for each different application.

2.12 WALL, FLOOR AND CEILING PLATES

A. Material and Type: Chrome plated brass or chrome plated steel, one piece or split type with concealed hinge, with set screw for fastening to pipe, or sleeve. Use plates that fit tight around pipes, cover openings around pipes and cover the entire pipe sleeve projection.

B. Thickness: Not less than 2.4 mm (3/32 inch) for floor plates. For wall and ceiling plates, not less than 0.64 mm (0.025 inch) for up to 80 mm (3-inch pipe), 0.89 mm (0.035 inch) for larger pipe.

C. Locations: Use where pipe penetrates floors, walls and ceilings in exposed locations, in finished areas only. Provide a watertight joint in spaces where brass or steel pipe sleeves are specified.

2.13 ASBESTOS

A. Materials containing asbestos are prohibited.

PART 3 - EXECUTION

3.1 GENERAL

A. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

3.2 ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING

A. Location of piping, sleeves, inserts, hangers, and equipment, access provisions shall be coordinated with the work of all trades. The coordination/shop drawings shall be submitted for review. Locate piping, sleeves, inserts, hangers, ductwork and equipment clear of windows, doors, openings, light outlets, and other services and utilities. Equipment coordination/shop drawings shall be prepared to coordinate proper location and personnel access of all facilities. The drawings shall be submitted for review. Follow manufacturer's published recommendations for installation methods not otherwise specified.

B. Operating Personnel Access and Observation Provisions: Select and arrange all equipment and systems to provide clear view and easy access, without use of portable ladders, for maintenance and operation of all devices including, but not limited to: all equipment items, valves, filters, strainers, transmitters, sensors, control devices. All gauges and indicators shall be clearly visible by personnel standing on the floor or on permanent platforms. Do not reduce or change maintenance and operating space and access provisions that are shown on the contract documents.

C. Equipment and Piping Support: Coordinate structural systems necessary for pipe and equipment support with pipe and equipment locations to permit proper installation.

D. Location of pipe sleeves, trenches and chases shall be accurately coordinated with equipment and piping locations.

E. Cutting Holes:

1. Cut holes through concrete and masonry by rotary core drill. Pneumatic hammer, impact electric, and hand or manual hammer type drill is prohibited, except as permitted by COR where working area space is limited.

2. Locate holes to avoid interference with structural members such as slabs, columns, ribs, beams or reinforcing. Holes shall be laid out in advance and drilling done only after approval by COR. If the Contractor considers it necessary to drill through structural members, this matter shall be referred to COR for approval.
3. Do not penetrate membrane waterproofing.

F. Minor Piping: Generally, small diameter pipe runs from drips and drains, water cooling, and other service are not shown but must be provided.

G. Electrical Interconnection of Instrumentation or Controls: This generally not shown but must be provided. This includes interconnections of sensors, transmitters, transducers, control devices, control and instrumentation panels, instruments and computer workstations. Devices shall be located so they are easily accessible for testing, maintenance, calibration, etc. The COR has the final determination on what is accessible and what is not. Comply with NFPA 70.

H. Protection and Cleaning:
1. Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations and as approved by the COR. Damaged or defective items in the opinion of the COR, shall be replaced.
2. Protect all finished parts of equipment, such as shafts and bearings where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water chemical, or mechanical injury. At completion of all work thoroughly clean fixtures, exposed materials and equipment.

I. Concrete and Grout: Use concrete and non-shrink grout 20 MPa (3000 psig) minimum, specified in Section 03 30 00, CAST-IN-PLACE CONCRETE.

J. Install gauges, thermometers, valves and other devices with due regard for ease in reading or operating and maintaining said devices. Locate and position thermometers and gauges to be easily read by operator or staff standing on floor or walkway provided. Servicing shall not require dismantling adjacent equipment or pipe work.

K. Install steam piping expansion joints as per manufacturer's recommendations.

L. Work in Existing Building:

1. Perform as specified in Article, OPERATIONS AND STORAGE AREAS, Article, ALTERATIONS, and Article, RESTORATION of the Section 01 00 00, GENERAL REQUIREMENTS for relocation of existing equipment, alterations and restoration of existing building(s).
2. As specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, OPERATIONS AND STORAGE AREAS, make alterations to existing service piping at times that will least interfere with normal operation of the facility.

M. Work in Animal Research Areas: Seal all pipe and duct penetrations with silicone sealant to prevent entrance of insects.

N. Switchgear/Electrical Equipment Drip Protection: Every effort shall be made to eliminate the installation of pipe above electrical and data/telephone switchgear. If this is not possible, encase pipe in a second pipe with a minimum of joints. Installation of piping, ductwork, leak protection apparatus or other installations foreign to the electrical installation shall not be located in the space equal to the width and depth of the equipment and extending from to a height of 1.8 m (6 feet) above the equipment or to ceiling structure, whichever is lower (NFPA 70).

O. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance or inspections, equipment shall be removed and reinstalled or remedial action performed as directed at no additional cost or time to the Government.
2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to motors, fans, pumps, belt guards, transformers, high voltage lines, conduit and raceways, piping, hot surfaces, and ductwork. The COR has final determination on whether an installation meets this requirement or not.

3.3 TEMPORARY PIPING AND EQUIPMENT

A. Continuity of operation of existing facilities will generally require temporary installation or relocation of equipment and piping.

B. The Contractor shall provide all required facilities in accordance with the requirements of phased construction and maintenance of service. All piping and equipment shall be properly supported, sloped to drain, operate without excessive stress, and shall be insulated where injury can occur to personnel by contact with operating facilities. The requirements of Paragraph, ARRANGEMENT AND INSTALLATION OF EQUIPMENT AND PIPING apply.

C. Temporary facilities and piping shall be completely removed and any openings in structures sealed. Provide necessary blind flanges and caps to seal open piping remaining in service.

3.4 RIGGING

A. Design is based on application of available equipment. Openings in building structures are planned to accommodate design scheme.

B. Alternative methods of equipment delivery may be offered by Contractor and will be considered by Government under specified restrictions of phasing and maintenance of service requirements as well as structural integrity of the building.

C. Close all openings in the building when not required for rigging operations to maintain proper environment in the facility for Government operation and maintenance of service.

D. Contractor shall provide all facilities required to deliver specified equipment and place on foundations. Attachments to structures for rigging purposes and support of equipment on structures shall be Contractor's full responsibility. Upon request, the Government will check structure adequacy and advise Contractor of recommended restrictions.

E. Contractor shall check all clearances, weight limitations and shall offer a rigging plan designed by a Registered Professional Engineer. All modifications to structures, including reinforcement thereof, shall be at Contractor's cost, time and responsibility.

F. Follow approved rigging plan.

G. Restore building to original condition upon completion of rigging work.

3.5 PIPE AND EQUIPMENT SUPPORTS

A. Where hanger spacing does not correspond with joist or rib spacing, use structural steel channels designed by a structural engineer, secured directly to joist and rib structure that will correspond to the required hanger spacing, and then suspend the equipment and piping from the channels. Drill or burn holes in structural steel only with the prior approval of the COR.

B. Use of chain pipe supports; wire or strap hangers; wood for blocking, stays and bracing; or, hangers suspended from piping above are prohibited. Replace or thoroughly clean rusty products and paint with zinc primer.

C. Hanger rods shall be used that are straight and vertical. Turnbuckles for vertical adjustments may be omitted where limited space prevents use. Provide a minimum of 15 mm (1/2 inch) clearance between pipe or piping covering and adjacent work.

D. HVAC Horizontal Pipe Support Spacing: Refer to MSS SP-58. Provide additional supports at valves, strainers, in-line pumps and other heavy components. Provide a support within one foot of each elbow.

E. HVAC Vertical Pipe Supports:

1. Up to 150 mm (6-inch pipe), 9 m (30 feet) long, bolt riser clamps to the pipe below couplings, or welded to the pipe and rests supports securely on the building structure.
2. Vertical pipe larger than the foregoing, support on base elbows or tees, or substantial pipe legs extending to the building structure.

F. Overhead Supports:

1. The basic structural system of the building is designed to sustain the loads imposed by equipment and piping to be supported overhead.
2. Provide steel structural members, in addition to those shown, of adequate capability to support the imposed loads, located in accordance with the final approved layout of equipment and piping.
3. Tubing and capillary systems shall be supported in channel troughs.

G. Floor Supports:

1. Provide concrete bases, concrete anchor blocks and pedestals, and structural steel systems for support of equipment and piping. Concrete bases and structural systems shall be anchored and doweled to resist forces under operating and seismic conditions (if applicable) without excessive displacement or structural failure.

2. Bases and supports shall not be located and installed until equipment mounted thereon has been approved. Bases shall be sized to match equipment mounted thereon plus 50 mm (2 inch) excess on all edges. Chiller foundations shall have horizontal dimensions that exceed chiller base frame dimensions by at least 150 mm (6 inches) on all sides. Structural contract documents shall be reviewed for additional requirements. Bases shall be neatly finished and smoothed, shall have chamfered edges at the top, and shall be suitable for painting.
3. All equipment shall be shimmed, leveled, firmly anchored, and grouted with epoxy grout. Anchor bolts shall be placed in sleeves, anchored to the bases. Fill the annular space between sleeves and bolts with a granular material to permit alignment and realignment.

3.6 MECHANICAL DEMOLITION

A. Rigging access, other than indicated on the contract documents, shall be provided by the Contractor after approval for structural integrity by the COR. Such access shall be provided without additional cost or time to the Government. Where work is in an operating plant, provide approved protection from dust and debris at all times for the safety of plant personnel and maintenance of plant operation and environment of the plant.

B. In an operating facility, maintain the operation, cleanliness and safety. Government personnel will be carrying on their normal duties of operating, cleaning and maintaining equipment and plant operation. Confine the work to the immediate area concerned; maintain cleanliness and wet down demolished materials to eliminate dust. Debris accumulated in the area to the detriment of plant operation is prohibited. Perform all flame cutting to maintain the fire safety integrity of this plant. Adequate fire extinguishing facilities shall be available at all times. Perform all work in accordance with recognized fire protection standards. Inspection will be made by personnel of the VAMC, and Contractor shall follow all directives of the COR with regard to rigging, safety, fire safety, and maintenance of operations.

C. Unless specified otherwise, all piping, wiring, conduit, and other devices associated with the equipment not re-used in the new work shall be completely removed from Government property per Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT. This includes all concrete pads, pipe,

valves, fittings, insulation, and all hangers including the top connection and any fastenings to building structural systems. All openings shall be sealed after removal of equipment, pipes, ducts, and other penetrations in roof, walls, floors, in an approved manner and in accordance with contract documents where specifically covered. Structural integrity of the building system shall be maintained. Reference shall also be made to the contract documents of the other disciplines in the project for additional facilities to be demolished or handled.

D. All indicated valves including gate, globe, ball, butterfly and check, all pressure gauges and thermometers with wells shall remain Government property and shall be removed and delivered to COR and stored as directed. The Contractor shall remove all other material and equipment, devices and demolition debris under these contract documents. Such material shall be removed from Government property expeditiously and shall not be allowed to accumulate.

E. Asbestos Insulation Removal: Conform to Section 02 82 11, TRADITIONAL ASBESTOS ABATEMENT.

3.7 CLEANING AND PAINTING

A. Prior to final inspection and acceptance of the plant and facilities for beneficial use by the Government, the plant facilities, equipment and systems shall be thoroughly cleaned and painted. Refer to Section 09 91 00, PAINTING.

B. In addition, the following special conditions apply:

1. Cleaning shall be thorough. Solvents, cleaning materials and methods recommended by the manufacturers shall be used for the specific tasks. All rust shall be removed prior to painting and from surfaces to remain unpainted. Repair scratches, scuffs, and abrasions prior to applying prime and finish coats.
2. The following material and equipment shall not be painted:
   a. Motors, controllers, control switches, and safety switches.
   b. Control and interlock devices.
   c. Regulators.
   d. Pressure reducing valves.
   e. Control valves and thermostatic elements.
   f. Lubrication devices and grease fittings.
   g. Copper, brass, aluminum, stainless steel and bronze surfaces.

h. Valve stems and rotating shafts.

i. Pressure gauges and thermometers.

j. Glass.

k. Nameplates.

3. Control and instrument panels shall be cleaned, damaged surfaces repaired, and shall be touched-up with matching paint obtained from panel manufacturer.
4. Pumps, motors, steel and cast-iron bases, and coupling guards shall be cleaned, and shall be touched-up with the same paint type and color as utilized by the pump manufacturer.
5. Temporary Facilities: Apply paint to surfaces that do not have existing finish coats. This may include painting exposed metals where hangers were removed or where equipment was moved or removed.
6. Paint shall withstand the following temperatures without peeling or discoloration:
   a. Condensate and Feedwater: 38 degrees C (100 degrees F) on insulation jacket surface and 121 degrees C (250 degrees F) on metal pipe surface.
   b. Steam: 52 degrees C (125 degrees F) on insulation jacket surface and 190 degrees C (374 degrees F) on metal pipe surface.
7. Final result shall be smooth, even-colored, even-textured factory finish on all items. Completely repaint the entire piece of equipment if necessary to achieve this.
8. Lead based paints are prohibited.

3.8 IDENTIFICATION SIGNS

A. Provide laminated plastic signs, with engraved lettering not less than 5 mm (3/16 inch) high, designating functions, for all equipment, switches, motor controllers, relays, meters, control devices, including automatic control valves. Nomenclature and identification symbols shall correspond to that used in maintenance manual, and in diagrams specified elsewhere. Attach by chain, adhesive, or screws.

B. Factory Built Equipment: Metal plate, securely attached, with name and address of manufacturer, serial number, model number, size, performance.

C. Pipe Identification: Refer to Section 09 91 00, PAINTING.

D. Attach ceiling grid label on ceiling grid location directly underneath above-ceiling air terminal, control system component, valve, filter unit, fan etc.

3.9 MOTOR AND DRIVES

A. Alignment of Direct-Connect Drives: Securely mount motor in accurate alignment so that shafts are per coupling manufacturer’s tolerances when both motor and driven machine are operating at normal temperatures.

3.10 LUBRICATION

A. All equipment and devices requiring lubrication shall be lubricated prior to initial operation. Field-check all devices for proper lubrication.

B. All devices and equipment shall be equipped with required lubrication fittings or devices. A minimum of 0.95 liter (1 quart) of oil and 0.45 kg (1 pound) of grease of manufacturer's recommended grade and type for each different application shall be provided; also provide 12 grease sticks for lubricated plug valves. Deliver all materials to COR in unopened containers that are properly identified as to application.

C. All lubrication points shall be accessible without disassembling equipment, except to remove access plates.

D. All lubrication points shall be extended to one side of the equipment.

3.11 STARTUP, TEMPORARY OPERATION AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

C. Startup of equipment shall be performed as described in equipment specifications. Vibration within specified tolerance shall be verified prior to extended operation. Temporary use of equipment is specified in Section 01 00 00, GENERAL REQUIREMENTS, Article, TEMPORARY USE OF MECHANICAL AND ELECTRICAL EQUIPMENT.

3.12 OPERATING AND PERFORMANCE TESTS

A. Prior to the final inspection, perform required tests as specified in Section 01 00 00, GENERAL REQUIREMENTS Article, TESTS, and in

individual Division 23 specification sections and submit the test reports and records to the COR.

B. Should evidence of malfunction in any tested system, or piece of equipment or component part thereof, occur during or as a result of tests, make proper corrections, repairs or replacements, and repeat tests at no additional cost or time to the Government.

C. When completion of certain work or system occurs at a time when final control settings and adjustments cannot be properly made to make performance tests, then conduct such performance tests and finalize control settings for heating systems and for cooling systems respectively during first actual seasonal use of respective systems following completion of work. Rescheduling of these tests shall be requested in writing to COR for approval.

D. No adjustments may be made during the acceptance inspection. All adjustments shall have been made by this point.

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SECTION 23 05 12
GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation and connection of motors for HVAC and steam generation equipment.

B. A complete listing of common acronyms and abbreviations are included in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

D. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only. Where conflicts occur these specifications and the VHA standard will govern.

B. American Bearing Manufacturers Association (ABMA):

9-2015.....Load Ratings and Fatigue Life for Ball Bearings

11-2015.....Load Ratings and Fatigue Life for Roller Bearings

C. American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE):

90.1-2013.....Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings

D. Institute of Electrical and Electronics Engineers (IEEE):

112-2004.....Standard Test Procedure for Polyphase Induction Motors and Generators

841-2009.....IEEE Standard for Petroleum and Chemical Industry-Premium-Efficiency, Severe-Duty, Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors--Up to and Including 370 kW (500 hp)

E. National Electrical Manufacturers Association (NEMA):

MG 1-2014.....Motors and Generators

MG 2-2014.....Safety Standard for Construction and Guide for Selection, Installation and Use of Electric Motors and Generators

250-2014.....Enclosures for Electrical Equipment (1000 Volts Maximum)

F. National Fire Protection Association (NFPA):

70-2014.....National Electrical Code (NEC)

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Information and material submitted under this section shall be marked "SUBMITTED UNDER SECTION 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC AND STEAM GENERATION EQUIPMENT", with applicable paragraph identification.

C. Submit motor submittals with driven equipment.

D. Shop Drawings:

1. Provide documentation to demonstrate compliance with contract documents.
2. Motor nameplate information shall be submitted including electrical ratings, efficiency, bearing data, power factor, frame size, dimensions, mounting details, materials, horsepower, voltage, phase, speed (RPM), enclosure, starting characteristics, torque characteristics, code letter, full load and locked rotor current, service factor, and lubrication method.

E. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights, materials, applications, standard compliance, model numbers, size, and capacity.

F. Complete operating and maintenance manuals including wiring diagrams, technical data sheets, information for ordering replacement parts, and troubleshooting guide:

1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

G. Certification: Two weeks prior to final inspection, unless otherwise noted, certification shall be submitted to the COR stating that the motors have been properly applied, installed, adjusted, lubricated, and tested.

1.5 AS-BUILT DOCUMENTATION

A. Submit manufacturer's literature and data updated to include submittal review comments and any equipment substitutions.

B. Submit operation and maintenance data updated to include submittal review comments, VA approved substitutions and construction revisions shall be in electronic PDF version via Electronic Transmittal and Hard Copy inserted into a three ring binder. All aspects of system operation and maintenance procedures, including applicable piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

C. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement. Provide record drawings as follows:

1. Red-lined, hand-marked drawings are to be provided in electronic PDF version via Electronic Transmittal and Hard Copy inserted into a three ring binder.

D. The as-built drawings shall indicate the location and type of all lockout/tagout points for all energy sources for all equipment and pumps to include breaker location and numbers, valve tag numbers, etc. Coordinate lockout/tagout procedures and practices with local VA requirements.

E. Certification documentation shall be provided to COR 21 working days prior to submitting the request for final inspection. The documentation shall include all test results, the names of individuals performing work for the testing agency on this project, detailed procedures followed for all tests, and provide documentation/certification that all results of tests were within limits specified. Test results shall contain written sequence of test procedure with written test results annotated at each step along with the expected outcome or setpoint. The results shall include all readings, including but not limited to data on device (make, model and performance characteristics), normal pressures, switch ranges, trip points, amp readings, and calibration data to include equipment serial numbers or individual identifications, etc.

PART 2 - PRODUCTS

2.1 MOTORS

A. For alternating current, fractional and integral horsepower motors, NEMA MG 1 and NEMA MG 2 shall apply.

B. For severe duty TEFC motors, IEEE 841 shall apply.

C. All material and equipment furnished and installation methods shall conform to the requirements of Section 26 29 11, MOTOR CONTROLLERS; and Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES. Provide all electrical wiring, conduit, and devices necessary for the proper connection, protection and operation of the systems. Provide premium efficiency type motors. Unless otherwise specified for a particular application, use electric motors with the following requirements.

D. Single-phase Motors: Motors for centrifugal fans and pumps may be split phase or permanent split capacitor (PSC) type. Provide capacitor-start type for hard starting applications.

E. Voltage ratings shall be as follows:

1. Single phase:

a. Motors connected to 120-volt systems: 115 volts.

b. Motors connected to 208-volt systems: 200 volts.

F. Number of phases shall be as follows:

1. Motors, less than 373 W (1/2 hp): Single phase.

G. Horsepower ratings shall be adequate for operating the connected loads continuously in the prevailing ambient temperatures in areas where the

motors are installed, without exceeding the NEMA standard temperature rises for the motor insulation.

H. Motor designs, as indicated by the NEMA code letters, shall be coordinated with the connected loads to assure adequate starting, acceleration, and running torque without exceeding nameplate ratings or considering service factor.

I. Motor Enclosures:

1. Shall be the NEMA types as specified and/or shown in the Contract Documents.
2. Where the types of motor enclosures are not shown on the drawings, they shall be the NEMA types per NEMA 250, which are most suitable for the environmental conditions where the motors are being installed. Enclosure requirements for certain conditions are as follows:
   a. Motors located outdoors, indoors in wet or high humidity locations, or in unfiltered airstreams shall be totally enclosed type.
   b. Where motors are located in an NEC 511 classified area, provide TEFC explosion proof motor enclosures.
   c. Where motors are located in a corrosive environment, provide TEFC enclosures with corrosion resistant finish.
3. Enclosures shall be primed and finish coated at the factory with manufacturer's prime coat and standard finish.

J. Electrical Design Requirements:

1. Motors shall be continuous duty.
2. The insulation system shall be rated minimum of Class B, 130 degrees C (266 degrees F).
3. The maximum temperature rise by resistance at rated power shall not exceed Class B limits, 80 degrees C (176 degrees F).
4. The speed/torque and speed/current characteristics shall comply with NEMA Design A or B, as specified.
5. Motors shall be suitable for full voltage starting, unless otherwise noted. Coordinate motor features with applicable motor controllers.
6. Motors for variable frequency drive applications shall adhere to NEMA MG 1, Part 30, Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and General-Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency

Controls or Both, or NEMA MG 1, Part 31, Definite-Purpose Inverter-Fed Polyphase Motors.

K. Mechanical Design Requirements:

1. Bearings shall be rated in accordance with ABMA 9 or ABMA 11 for a minimum fatigue life of 26,280 hours for belt-driven loads and 100,000 hours for direct-drive loads based on L10 (Basic Rating Life) at full load direct coupled. A minimum fatigue life of 40,000 hours is required for VFD drives.
2. Grease lubricated bearings shall be designed for electric motor use. Grease shall be capable of the temperatures associated with electric motors and shall be compatible with Polyurea based greases.
3. Grease fittings, if provided, shall be Alemite type or equivalent.
4. Oil lubricated bearings, when specified, shall have an externally visible sight glass to view oil level.
5. Vibration shall not exceed 3.8 mm (0.15 inch) per second, unfiltered peak.
6. Noise level shall meet the requirements of the application.
7. All external fasteners shall be corrosion resistant.
8. Grounding provisions shall be in the main terminal box.

L. Special Requirements:

1. Where motor power requirements of equipment furnished deviate from power shown on plans, provide electrical service designed under the requirements of NFPA 70 without additional cost or time to the Government.
2. Assemblies of motors, starters, controls and interlocks on factory assembled and wired devices shall be in accordance with the requirements of this specification.
3. Wire and cable materials specified in the electrical division of the specifications shall be modified as follows:
   a. Wiring material located where temperatures can exceed 71 degrees C (160 degrees F) shall be stranded copper with Teflon FEP insulation with jacket. This includes wiring on the boilers.
   b. Other wiring at boilers and to control panels shall be NFPA 70 designation THWN.
   c. Provide shielded conductors or wiring in separate conduits for all instrumentation and control systems where recommended by manufacturer of equipment.

4. Select motor sizes so that the motors do not operate into the service factor at maximum required loads on the driven equipment. Motors on pumps shall be sized for non-overloading at all points on the pump performance curves.
5. Motors utilized with variable frequency drives shall be rated "inverter-duty" per NEMA MG 1, Part 31, Definite-Purpose Inverter-Fed Polyphase Motors. Provide motor shaft grounding apparatus that will protect bearings from damage from stray currents.

M. Additional requirements for specific motors, as indicated in the other sections listed in paragraph, RELATED SECTIONS shall also apply.

N. Minimum Power Factor at Full Load and Rated Voltage: 90 percent at 1200 RPM, 1800 RPM, and 3600 RPM. Power factor correction capacitors shall be provided unless the motor meets the 0.90 requirement without it or if the motor is controlled by a variable frequency drive. The power factor correction capacitors shall be able to withstand high voltage transients and power line variations without breakdown.

O. Energy Efficiency of Small Motors (Motor Efficiencies): All motors under 746 W (1 hp) shall meet the requirements of the DOE Small Motor Regulation.

Polyphase Open Motors Average full load efficiency				**Capacitor-start capacitor-run and capacitor-start induction run open motors Average full load efficiency**			
Rating kW (hp)	**6 poles**	**4 poles**	**2 poles**	**Rating kW (hp)**	**6 poles**	**4 poles**	**2 poles**
0.18 (0.25)	67.5	69.5	65.6	0.18 (0.25)	62.2	68.5	66.6
0.25 (0.33)	71.4	73.4	69.5	0.25 (0.33)	66.6	72.4	70.5
0.37 (0.5)	75.3	78.2	73.4	0.37 (0.5)	76.2	76.2	72.4
0.55 (0.75)	81.7	81.1	76.8	0.55 (0.75)	80.2	81.8	76.2

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install motors in accordance with manufacturer's recommendations, the NEC, NEMA, as shown on the drawings and/or as required by other sections of these specifications.

B. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no additional cost or time to the Government.

3.2 FIELD TESTS

A. All tests shall be witnessed by the Commissioning Agent or by the COR.

B. Perform an electric insulation resistance Test using a megohmmeter on all motors after installation, before startup. All shall test free from grounds.

C. Perform Load test in accordance with IEEE 112, Test Method B, to determine freedom from electrical or mechanical defects and compliance with performance data.

D. Insulation Resistance: Not less than one-half meg-ohm between stator conductors and frame, to be determined at the time of final inspection.

E. All test data shall be complied into a report form for each motor and provided to the contracting officer or their representative.

3.3 STARTUP AND TESTING

A. Perform tests as recommended by product manufacturer and listed standards and under actual or simulated operating conditions and prove full compliance with design and specified requirements. Tests of the various items of equipment shall be performed simultaneously with the system of which each item is an integral part.

B. When any defects are detected, correct defects and repeat test at no additional cost or time to the Government.

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SECTION 23 09 23
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide all electrical wiring, both line voltage and low voltage, which is required to perform the automatic control functions.

B. Where power sources are required beyond sources explicitly shown on the Division 26 drawings, these shall be provided under the Division 23 Contract. Where auxiliary contacts are required on starters to perform the required functions these, too, shall be provided under the Division 23 Contract. Where not provided under Division 26, auxiliary external relays shall be provided in lieu of auxiliary contacts.

C. Wiring, both line and low voltage, shall comply with The National Electric Code (NEC) and shall be subject to approval of the local code enforcing authorities.

D. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.

E. Install all equipment in readily accessible locations as defined by the National Electrical Code (NEC).

F. Do not install Class 2 wiring in conduit containing Class 1 wiring. Boxes and panels containing high voltage shall not be used for low voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).

G. All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.

H. Provide tagging or labeling of conduit so that it is always readily observable which conduit was installed or used in implementation of this Work.

I. All wiring and cabling, including that within factory fabricated panels, shall be labeled at each end within 5 cm [2 inches] of termination with the DDC address or termination number.

J. Communication conduits shall not be installed closer than six feet from high power transformers or run parallel within six feet of electrical high power cables. Care shall be taken to route the cable as far from interference generating devices as possible. Where communication wire

shall cross high power wire (deemed as 110VAC or greater) it shall do so at right angles.

K. All shields shall be grounded (earth ground) at one point only to eliminate ground loops. All shield grounding shall be done at the controller location with the shield at the sensor/device end of the applicable wire being left long and "safed" off in an appropriate manner.

L. There shall be no power wiring, in excess of 30 VAC rms, run in conduit with communications wiring. In cases where signal wiring is run in conduit with communication wiring, all communication wiring and signal wiring shall be run using separate twisted pairs (24awg) in accordance with the manufacturer's wiring practices)

M. Physical connection of BACnet devices shall be via Ethernet (BACnet Ethernet/IP,) and/or RS-485 (BACnet MSTP) as specified.

N. In order for Modbus devices to show up on the BACnet network, utilize a Modbus to BACnet gateway.

O. The work administered by this Section of the technical specifications shall include all labor, materials, special tools, equipment, enclosures, power supplies, software, software licenses, Project specific software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, submittals, testing, verification, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, Warranty, specified services and items required for complete and fully functional Controls Systems.

P. This facility's existing direct-digital control system is Tridium-based, and its ECC is located at Maintenance shop in Building T39 (to be relocated by this project to Building 261). The existing system's top-end communications is via Ethernet IP. The existing system's ECC and top-end controllers were installed in 2012. The contractor administered by this Section of the technical specifications shall observe the capabilities, communication network, services, spare capacity of the existing control system and its ECC prior to beginning work. The contractor administered by this Specification shall provide only equipment and/or material that will integrate into the existing systems.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES.

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS.

E. Section 27 15 00, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

1.3 QUALITY ASSURANCE

A. Criteria:

1. Single Source Responsibility of subcontractor: The Contractor shall delegate the responsibility to a single source controls installation subcontractor. The controls subcontractor shall be responsible for the complete design, installation, and commissioning of the system. The controls subcontractor shall be in the business of design, installation and service of such building automation control systems similar in size and complexity.
2. Equipment and Materials: Equipment and materials shall be cataloged products of manufacturers regularly engaged in production and installation of HVAC control systems. Products shall be manufacturer's latest standard design and have been tested and proven in actual use.
3. The controls subcontractor shall have in-place facility within 90 miles with technical staff, spare parts inventory for the next five (5) years, and necessary test and diagnostic equipment to support the control systems.
4. The controls subcontractor shall have minimum of three years experience in design and installation of building automation systems similar in performance to those specified in this Section. Provide evidence of experience by submitting resumes of the project manager, the local branch manager, COR, the application engineering staff, and the electronic technicians who would be involved with the supervision, the engineering, and the installation of the control systems. Training and experience of these personnel shall not be less than three years. Failure to disclose this information shall be a ground for disqualification of the supplier.
5. Provide a competent and experienced Project Manager employed by the Controls Contractor. The Project Manager shall be supported as necessary by other Contractor employees in order to provide

professional engineering, technical and management service for the work. The Project Manager shall attend scheduled Project Meetings as required and shall be empowered to make technical, scheduling and related decisions on behalf of the Controls Contractor.

B. Codes and Standards:
   1. All work shall conform to the applicable Codes and Standards.
   2. Electronic equipment shall conform to the requirements of FCC Regulation, Part 15, Governing Radio Frequency Electromagnetic Interference, and be so labeled.

1.4 WARRANTY

A. Labor and materials for control systems shall be warranted for a period as specified under Warranty in FAR clause 52.246-21.

B. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no cost or reduction in service to the government. The system includes all computer equipment, transmission equipment, and all sensors and control devices.

D. Controls and Instrumentation subcontractor shall be responsible for temporary operations and maintenance of the control systems during the construction period until final commissioning, training of facility operators and acceptance of the project by VA.

1.5 APPLICABLE PUBLICATIONS

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

B. American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE):

Standard 135-08.....BACNET Building Automation and Control Networks

C. American Society of Mechanical Engineers (ASME):

B16.18-05.....Cast Copper Alloy Solder Joint Pressure Fittings.
B16.22-05.....Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

D. Federal Communication Commission (FCC):

Rules and Regulations Title 47 Chapter 1-2001 Part 15: Radio Frequency Devices.

E. Institute of Electrical and Electronic Engineers (IEEE):

802.3-05.....Information Technology-Telecommunications and Information Exchange between Systems-Local and

Metropolitan Area Networks- Specific Requirements-Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access method and Physical Layer Specifications

F. National Fire Protection Association (NFPA):

70-08.....National Electric Code
90A-09.....Standard for Installation of Air-Conditioning and Ventilation Systems

G. Underwriter Laboratories Inc (UL):

94-06.....Tests for Flammability of Plastic Materials for Parts and Devices and Appliances
294-05.....Access Control System Units
486A/486B-04-.....Wire Connectors
555S-06.....Standard for Smoke Dampers
916-07.....Energy Management Equipment
1076-05.....Proprietary Burglar Alarm Units and Systems

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use new products that the manufacturer is currently manufacturing and that have been installed in a minimum of 25 installations. Spare parts shall be available for at least five years after completion of this contract.

2.2 COMMUNICATION

A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a FOX TCP/IP internetwork..
   1. The Data link / physical layer protocol (for communication) acceptable to the VA throughout its facilities is Ethernet (ISO 8802-3).

B. Internetwork operator interface and value passing shall be transparent to internetwork architecture.
   1. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, reports, system software, and custom programs shall be viewable and editable from each internetwork controller.
   2. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute specified control system

operation. An authorized operator shall be able to edit cross-controller links by typing a standard object address.

2.3 BACNET PROTOCOL ANALYZERS

A. For ease of troubleshooting and maintenance, provide a BACnet protocol analyzer. Provide its associated fittings, cables and appurtenances, for connection to the communications network. The BACnet protocol analyzer shall be able to, at a minimum: capture and store to a file all data traffic on all network levels; measure bandwidth usage; filter out (ignore) selected traffic.

2.4 NETWORK AND DEVICE NAMING CONVENTION

A. Network Numbers

1. Network numbers shall be based on a "facility code, network" concept. The "facility code" is the VAMC's or VA campus' assigned numeric value assigned to a specific facility or building. The "network" typically corresponds to a "floor" or other logical configuration within the building.
2. The network numbers are thus formed as follows: "Net #" = "FFFNN" where:
   a. FFF = Facility code (see below)
   b. NN = 00-99 This allows up to 100 networks per facility or building

B. Device Instances

1. Using Agency's unique device instances are formed as follows: "Dev #" = "FFFNNDD" where:
   a. FFF and N are as above and
   b. DD = 00-99, this allows up to 100 devices per network.
2. Note Special cases, where the network architecture of limiting device numbering to DD causes excessive subnet works. The device number can be expanded to DDD and the network number N can become a single digit. In NO case shall the network number N and the device number D exceed 4 digits.
3. Facility code assignments:
4. 000-400 Building/facility number
5. Note that some facilities have a facility code with an alphabetic suffix to denote wings and related structures. The suffix shall be ignored. Network numbers for facility codes above 400 shall be assigned in the range 000-399.

C. Device Names

1. Name the control devices based on facility name, location within a facility, the system or systems that the device monitors and/or controls, or the area served. The intent of the device naming is to be easily recognized. Names can be up to 254 characters in length, without embedded spaces. Provide the shortest descriptive, but unambiguous, name. For example, in building #123 prefix the number with a “B” followed by the building number, if there is only one chilled water pump "CHWP-1", a valid name would be "B123.CHWP. 1.STARTSTOP". If there are two pumps designated "CHWP-1", one in a basement mechanical room (Room 0001) and one in a penthouse mechanical room (Room PH01), the names could be "B123.R0001.CHWP.1. STARTSTOP " or " B123.RPH01.CHWP.1.STARTSTOP". In the case of unitary controllers, for example a VAV box controller, a name might be "B123.R101.VAV". These names shall be used for the value of the "Object_Name" property of the controllers involved so that the controller name and the EMCS name are the same.

2.5 CONTROL CABLES

A. General:

1. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments. Comply with Sections 27 05 11 and 26 05 26.
2. Cable conductors to provide protection against induction in circuits. Crosstalk attenuation within the System shall be in excess of -80 dB throughout the frequency ranges specified.
3. Minimize the radiation of RF noise generated by the System equipment so as not to interfere with any audio, video, data, computer main distribution frame (MDF), telephone customer service unit (CSU), and electronic private branch exchange (EPBX) equipment the System shall service.
4. The as-installed drawings shall identify each cable as labeled, used cable, and bad cable pairs.
5. Label system’s cables on each end. Test and certify cables in writing to the COR before conducting proof-of-performance testing. Minimum cable test requirements are for impedance compliance, inductance, capacitance, signal level compliance, opens, shorts,

cross talk, noise, and distortion, and split pairs on all cables in the frequency ranges used. Make available all cable installation and test records at demonstration to the COR. All changes (used pair and failed pair) shall be posted in these records as the change occurs.

6. Power wiring shall not be run in conduit with communications trunk wiring or signal or control wiring operating at 100 volts or less.

B. Analogue control cabling shall be not less than No. 18 AWG solid, with thermoplastic insulated conductors as specified in Section 26 05 19.

C. Optical digital communication fiber, if used, shall be Multimode or Singlemode fiber, 62.5/125 micron for multimode or 10/125 micron for singlemode micron with SC or ST connectors as specified in TIA-568-C.1. Terminations, patch panels, and other hardware shall be compatible with the specified fiber and shall be as specified in Section 27 15 00. Fiber-optic cable shall be suitable for use with the 100Base-FX or the 100Base-SX standard (as applicable) as defined in IEEE Std 802.3.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. Examine project plans for control devices and equipment locations; and report any discrepancies, conflicts, or omissions to COR for resolution before proceeding with installation.
2. Work Coordination: As described in the GENERAL CONDITIONS.
3. Install equipment, piping, wiring /conduit parallel to or at right angles to building lines.
4. Install all equipment and piping in readily accessible locations. Do not run tubing and conduit concealed under insulation or inside ducts.
5. Mount control devices, tubing and conduit located on ducts and apparatus with external insulation on standoff support to avoid interference with insulation.
6. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
7. Run tubing and wire connecting devices on or in control cabinets parallel with the sides of the cabinet neatly racked to permit tracing.
8. Install equipment level and plum.

B. Electrical Wiring Installation:

1. All wiring & cabling shall be installed in conduits. Install conduits and wiring in accordance with Specification Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS. Conduits carrying control wiring and cabling shall be dedicated to the control wiring and cabling: these conduits shall not carry power wiring. Provide plastic end sleeves at all conduit terminations to protect wiring from burrs.
2. Install analog signal and communication cables in conduit and in accordance with Specification Section 26 05 19. Install digital communication cables in conduit and in accordance with Specification Section 27 15 00, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.
3. Install conduit and wiring between digital controllers, electrical panels, indicating devices, instrumentation, miscellaneous alarm points, thermostats, and relays as required under this section.
4. Install all electrical work required for a fully functional system and not shown on electrical plans or required by electrical specifications. Where low voltage (less than 50 volt) power is required, provide suitable Class B transformers.
5. Install all system components in accordance with local Building Code and National Electric Code.
   a. Splices: Splices in shielded and coaxial cables shall consist of terminations and the use of shielded cable couplers. Terminations shall be in accessible locations. Cables shall be harnessed with cable ties.
   b. Equipment: Fit all equipment contained in cabinets or panels with service loops, each loop being at least 300 mm (12 inches) long. Equipment for fiber optics system shall be rack mounted, as applicable, in ventilated, self-supporting, code gauge steel enclosure. Cables shall be supported for minimum sag.
   c. Cable Runs: Keep cable runs as short as possible. Allow extra length for connecting to the terminal board. Do not bend flexible coaxial cables in a radius less than ten times the cable outside diameter.
   d. Use vinyl tape, sleeves, or grommets to protect cables from vibration at points where they pass around sharp corners, through walls, and panel cabinets.

6. Conceal cables, except in mechanical rooms and areas where other conduits and piping are exposed.
7. Permanently label or code each point of all field terminal strips to show the instrument or item served. Color-coded cable with cable diagrams shall be used to accomplish cable identification.
8. Grounding: ground electrical systems per manufacturer's written requirements for proper and safe operation.

3.2 SYSTEM VALIDATION AND DEMONSTRATION

A. As part of final system acceptance, a system demonstration is required (see below). Prior to start of this demonstration, the Contractor is to perform a complete validation of all aspects of the controls and instrumentation system.

B. Validation

1. Prepare and submit for approval a validation test plan including test procedures for performance verification tests. Explain in detail actions and expected results used to demonstrate compliance with the requirements of this specification. Explain the method for simulating the necessary conditions of operation used to demonstrate performance of the system. Test plan shall include a test check list to be used by the Installer's agent to check and initial that each test has been successfully completed. Deliver test plan documentation for the performance verification tests to the COR 30 days prior to start of performance verification tests. Provide draft copy of operation and maintenance manual with performance verification test.
2. After approval of the validation test plan, installer shall carry out all tests and procedures therein. Installer shall completely check out, calibrate, and test all connected hardware and software to insure that system performs. Installer shall complete and submit Test Check List.

C. Demonstration

1. System operation and calibration shall be demonstrated by the installer in the presence of the COR or other VA representative on random samples of equipment as dictated by the COR or other VA representative. Shall random sampling indicate improper commissioning, the COR reserves the right to subsequently witness

complete calibration of the system at no additional cost to the Government.

2. Demonstrate to the COR or other VA representative that all required safeties and life safety functions are fully functional and complete.
3. The following witnessed demonstrations of field control equipment shall be included:
   a. Observe HVAC systems in shut down condition. Check dampers and valves for normal position.
   b. Test application software for its ability to communicate with digital controllers, operator workstation, and uploading and downloading of control programs.
   c. Demonstrate reporting of alarm conditions for each alarm and ensure that these alarms are received at the assigned location.

----- END -----

SECTION 23 34 00
HVAC FANS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Fans for heating, ventilating and air conditioning.

B. Product Definitions: AMCA Publication 99, Standard l-66.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

C. Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

D. Section 23 05 12, GENERAL MOTOR REQUIREMENTS FOR HVAC and STEAM GENERATION EQUIPMENT.

1.3 QUALITY ASSURANCE

A. Refer to paragraph, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION.

B. Fans and power ventilators shall be listed in the current edition of AMCA 26l, and shall bear the AMCA performance seal.

C. Operating Limits for Centrifugal Fans: AMCA 99 (Class I, II, and III).

D. Fans and power ventilators shall comply with the following standards:

1. Testing and Rating: AMCA 2l0.
2. Sound Rating: AMCA 300.

E. Performance Criteria:

1. The fan schedule shall show the design air volume and static pressure. Select the fan motor HP by increasing the fan BHP by 10 percent to account for the drive losses and field conditions.
2. Select the fan operating point as follows:
   a. Air Foil, Backward Inclined, or Tubular: At or near the peak static efficiency

F. Safety Criteria: Provide manufacturer's standard screen on fan inlet and discharge where exposed to operating and maintenance personnel.

G. Corrosion Protection:

1. Except for fans in fume hood exhaust service, all steel shall be mill-galvanized, or phosphatized and coated with minimum two coats, corrosion resistant enamel paint. Manufacturers paint and paint system shall meet the minimum specifications of: ASTM D1735 water fog; ASTM B117 salt spray; ASTM D3359 adhesion; and ASTM G152 and

G153 for carbon arc light apparatus for exposure of non-metallic material.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Manufacturers Literature and Data:

1. Fan sections, motors and drives.
2. Centrifugal fans, motors, drives, accessories and coatings.
3. Motorized dampers for power wall ventilators.
4. Power wall ventilators.

C. Certified Sound power levels for each fan.

D. Motor ratings types, electrical characteristics and accessories.

E. Maintenance and Operating manuals in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

F. Certified fan performance curves for each fan showing cubic feet per minute (CFM) versus static pressure, efficiency, and horsepower for design point of operation.

1.5 APPLICABLE PUBLICATIONS

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

B. Air Movement and Control Association International, Inc. (AMCA):

99-86.....Standards Handbook

210-06.....Laboratory Methods of Testing Fans for Aerodynamic Performance Rating

261-09.....Directory of Products Licensed to bear the AMCA Certified Ratings Seal - Published Annually

300-08.....Reverberant Room Method for Sound Testing of Fans

C. American Society for Testing and Materials (ASTM):

B117-07a.....Standard Practice for Operating Salt Spray (Fog) Apparatus

D1735-08.....Standard Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus

D3359-08.....Standard Test Methods for Measuring Adhesion by Tape Test

D. Underwriters Laboratories, Inc. (UL):

181-2005.....Factory Made Air Ducts and Air Connectors

PART 2 - PRODUCTS

2.1 POWER WALL VENTILATOR

A. Standards and Performance Criteria: Refer to Paragraph, QUALITY ASSURANCE.

B. Type: Centrifugal fan, backward inclined blades.

C. Construction: Steel or aluminum, completely weatherproof, for wall mounting, exhaust cowl or entire drive assembly readily removable for servicing, aluminum bird screen on discharge, UL approved safety disconnect switch, conduit for wiring, vibration isolators for wheel, motor and drive assembly. Provide motorized damper with limit switch and all controls equipment required to sequence operation as indicated on drawings.

D. Motor and Drive: Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC and STEAM GENERATION. Bearings shall be pillow block ball type with a minimum L-50 life of 200,000 hours. Motor shall be located out of air stream.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install fan, motor, drive, and damper in accordance with manufacturer's instructions.

3.2 PRE-OPERATION MAINTENANCE

A. Lubricate bearings, pulleys, belts and other moving parts with manufacturer recommended lubricants.

B. Rotate impeller by hand and check for shifting during shipment and check all bolts, collars, and other parts for tightness.

C. Clean fan interiors to remove foreign material and construction dirt and dust.

3.3 START-UP AND INSTRUCTIONS

A. Verify operation of motor, drive system and fan wheel according to the drawings and specifications.

B. Check vibration and correct as necessary for air balance work and to meet manufacturers installation and maintenance standards.

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SECTION 23 82 00
CONVECTION HEATING AND COOLING UNITS

PART 1 - GENERAL

1.1 DESCRIPTION

Unit heaters.

1.2 RELATED WORK

A. Section 23 05 11, COMMON WORK RESULTS FOR HVAC: General mechanical requirements and items, which are common to more than one section of Division 23.

1.3 QUALITY ASSURANCE

Refer to Paragraph, QUALITY ASSURANCE, in Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

1.4 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Manufacturer's Literature and Data:

3. Unit heaters.

C. Certificates:

1. Compliance with paragraph, QUALITY ASSURANCE.
2. Compliance with specified standards.

D. Operation and Maintenance Manuals: Submit in accordance with paragraph, INSTRUCTIONS, in Section 01 00 00, GENERAL REQUIREMENTS.

1.5 APPLICABLE PUBLICATIONS

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

B. American National Standards Institute / Air Conditioning, Heating and Refrigeration Institute (ANSI/AHRI):

440-08.....Performance Rating of Room Fan Coils

National Fire Protection Association (NFPA):

90A-09.....Standard for the Installation of Air Conditioning and Ventilating Systems

70-11.....National Electrical Code

C. Underwriters Laboratories, Inc. (UL):

181-08.....Standard for Factory-Made Air Ducts and Air Connectors

1995-05.....Heating and Cooling Equipment

1.6 GUARANTY

In accordance with FAR clause 52.246-21.

PART 2 - PRODUCTS

2.1 UNIT HEATERS

A. General: Horizontal discharge type, electric heating medium.

B. Casing: Steel sheet, phosphatized to resist rust and finished in baked enamel. Provide hanger supports.

C. Fan: Propeller type, direct driven by manufacturer's standard electric motor. Provide resilient mounting. Provide fan guard.

D. Discharge Air Control:

1. Horizontal discharge: Horizontal, adjustable louvers.

E. Electric Units: UL listed, factory wired to terminal strips for field connection of power and control wiring.

1. Heating elements: Nickel chromium alloy resistance wire embedded in a magnesium oxide insulating refractory and sealed in corrosion resisting metallic sheath with fins. Three phase heaters shall have balanced phases.
2. Thermal cutout: Manual reset type, which disconnects elements, and motor in the event normal operating temperatures are exceeded.
3. Magnetic contactor: Factory installed with low voltage relay for remote pilot duty thermostat operation.

F. Controls: Provide field installed remote wall mounted line voltage electric space thermostats to control the unit fan as required for control sequence indicated on drawing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Work shall be installed as shown and according to the manufacturer’s diagrams and recommendations.

B. Handle and install units in accordance with manufacturer's written instructions.

C. Support units rigidly so they remain stationary at all times. Cross-bracing or other means of stiffening shall be provided as necessary. Method of support shall be such that distortion and malfunction of units cannot occur.

3.2 OPERATIONAL TEST

Refer to Section 23 05 11, COMMON WORK RESULTS FOR HVAC.

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SECTION 26 05 11
REQUIREMENTS FOR ELECTRICAL INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section applies to all sections of Division 26.

B. Furnish and install electrical systems, materials, equipment, and accessories in accordance with the specifications and drawings. Capacities and ratings of motors, transformers, conductors and cable, switchboards, switchgear, panelboards, motor control centers, generators, automatic transfer switches, and other items and arrangements for the specified items are shown on the drawings.

C. Conductor ampacities specified or shown on the drawings are based on copper conductors, with the conduit and raceways sized per NEC. Aluminum conductors are prohibited.

1.2 MINIMUM REQUIREMENTS

A. The latest International Building Code (IBC), Underwriters Laboratories, Inc. (UL), Institute of Electrical and Electronics Engineers (IEEE), and National Fire Protection Association (NFPA) codes and standards are the minimum requirements for materials and installation.

B. The drawings and specifications shall govern in those instances where requirements are greater than those stated in the above codes and standards.

1.3 TEST STANDARDS

A. All materials and equipment shall be listed, labeled, or certified by a Nationally Recognized Testing Laboratory (NRTL) to meet Underwriters Laboratories, Inc. (UL), standards where test standards have been established. Materials and equipment which are not covered by UL standards shall be accepted, providing that materials and equipment are listed, labeled, certified or otherwise determined to meet the safety requirements of a NRTL. Materials and equipment which no NRTL accepts, certifies, lists, labels, or determines to be safe, shall be considered if inspected or tested in accordance with national industrial standards, such as ANSI, NEMA, and NETA. Evidence of compliance shall include certified test reports and definitive shop drawings.

B. Definitions:

1. Listed: Materials and equipment included in a list published by an organization that is acceptable to the Authority Having Jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production or listed materials and equipment or periodic evaluation of services, and whose listing states that the materials and equipment either meets appropriate designated standards or has been tested and found suitable for a specified purpose.
2. Labeled: Materials and equipment to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the Authority Having Jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled materials and equipment, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.
3. Certified: Materials and equipment which:
   a. Have been tested and found by a NRTL to meet nationally recognized standards or to be safe for use in a specified manner.
   b. Are periodically inspected by a NRTL.
   c. Bear a label, tag, or other record of certification.
4. Nationally Recognized Testing Laboratory: Testing laboratory which is recognized and approved by the Secretary of Labor in accordance with OSHA regulations.

1.4 QUALIFICATIONS (PRODUCTS AND SERVICES)

A. Manufacturer’s Qualifications: The manufacturer shall regularly and currently produce, as one of the manufacturer's principal products, the materials and equipment specified for this project, and shall have manufactured the materials and equipment for at least three years.
B. Product Qualification:
   1. Manufacturer's materials and equipment shall have been in satisfactory operation, on three installations of similar size and type as this project, for at least three years.
   2. The Government reserves the right to require the Contractor to submit a list of installations where the materials and equipment have been in operation before approval.
C. Service Qualifications: There shall be a permanent service organization maintained or trained by the manufacturer which shall render

satisfactory service to this installation within four hours of receipt of notification that service is needed. Submit name and address of service organizations.

1.5 APPLICABLE PUBLICATIONS

A. Applicable publications listed in all Sections of Division 26 shall be the latest issue, unless otherwise noted.

B. Products specified in all sections of Division 26 shall comply with the applicable publications listed in each section.

1.6 MANUFACTURED PRODUCTS

A. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, and for which replacement parts shall be available. Materials and equipment furnished shall be new, and shall have superior quality and freshness.

B. When more than one unit of the same class or type of materials and equipment is required, such units shall be the product of a single manufacturer.

C. Equipment Assemblies and Components:

1. Components of an assembled unit need not be products of the same manufacturer.
2. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.
3. Components shall be compatible with each other and with the total assembly for the intended service.
4. Constituent parts which are similar shall be the product of a single manufacturer.

D. Factory wiring and terminals shall be identified on the equipment being furnished and on all wiring diagrams.

E. When Factory Tests are specified, Factory Tests shall be performed in the factory by the equipment manufacturer, and witnessed by the contractor. In addition, the following requirements shall be complied with:

1. The Government shall have the option of witnessing factory tests. The Contractor shall notify the Government through the COR a minimum of thirty (30) days prior to the manufacturer’s performing of the factory tests.

2. When factory tests are successful, contractor shall furnish four (4) copies of the equipment manufacturer's certified test reports to the COR fourteen (14) days prior to shipment of the equipment, and not more than ninety (90) days after completion of the factory tests.
3. When factory tests are not successful, factory tests shall be repeated in the factory by the equipment manufacturer, and witnessed by the Contractor. The Contractor shall be liable for all additional expenses for the Government to witness factory re-testing.

1.7 VARIATIONS FROM CONTRACT REQUIREMENTS

A. Where the Government or the Contractor requests variations from the contract requirements, the connecting work and related components shall include, but not be limited to additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

1.8 MATERIALS AND EQUIPMENT PROTECTION

A. Materials and equipment shall be protected during shipment and storage against physical damage, vermin, dirt, corrosive substances, fumes, moisture, cold and rain.
1. Store materials and equipment indoors in clean dry space with uniform temperature to prevent condensation.
2. During installation, equipment shall be protected against entry of foreign matter, and be vacuum-cleaned both inside and outside before testing and operating. Compressed air shall not be used to clean equipment. Remove loose packing and flammable materials from inside equipment.
3. Damaged equipment shall be repaired or replaced, as determined by the COR.
4. Painted surfaces shall be protected with factory installed removable heavy kraft paper, sheet vinyl or equal.
5. Damaged paint on equipment shall be refinished with the same quality of paint and workmanship as used by the manufacturer so repaired areas are not obvious.

1.9 WORK PERFORMANCE

A. All electrical work shall comply with requirements of the latest NFPA 70 (NEC), NFPA 70B, NFPA 70E, NFPA 99, NFPA 110, OSHA Part 1910 subpart J – General Environmental Controls, OSHA Part 1910 subpart K – Medical

and First Aid, and OSHA Part 1910 subpart S – Electrical, in addition to other references required by contract.

B. Job site safety and worker safety is the responsibility of the Contractor.

C. Electrical work shall be accomplished with all affected circuits or equipment de-energized. However, energized electrical work shall be performed only for the non-destructive and non-invasive diagnostic testing(s), or when scheduled outage poses an imminent hazard to patient care, safety, or physical security. In such case, all aspects of energized electrical work, such as the availability of appropriate/correct personal protective equipment (PPE) and the use of PPE, shall comply with the latest NFPA 70E, as well as the following requirements:

1. Only Qualified Person(s) shall perform energized electrical work. Supervisor of Qualified Person(s) shall witness the work of its entirety to ensure compliance with safety requirements and approved work plan.
2. At least two weeks before initiating any energized electrical work, the Contractor and the Qualified Person(s) who is designated to perform the work shall visually inspect, verify and confirm that the work area and electrical equipment can safely accommodate the work involved.
3. At least two weeks before initiating any energized electrical work, the Contractor shall develop and submit a job specific work plan, and energized electrical work request to the COR, and Medical Center’s Chief Engineer or his/her designee. At the minimum, the work plan shall include relevant information such as proposed work schedule, area of work, description of work, name(s) of Supervisor and Qualified Person(s) performing the work, equipment to be used, procedures to be used on and near the live electrical equipment, barriers to be installed, safety equipment to be used, and exit pathways.
4. Energized electrical work shall begin only after the Contractor has obtained written approval of the work plan, and the energized electrical work request from the COR, and Medical Center’s Chief Engineer or his/her designee. The Contractor shall make these

approved documents present and available at the time and place of energized electrical work.

5. Energized electrical work shall begin only after the Contractor has invited and received acknowledgment from the COR, and Medical Center's Chief Engineer or his/her designee to witness the work.

D. For work that affects existing electrical systems, arrange, phase and perform work to assure minimal interference with normal functioning of the facility. Refer to Article OPERATIONS AND STORAGE AREAS under Section 01 00 00, GENERAL REQUIREMENTS.

E. New work shall be installed and connected to existing work neatly, safely and professionally. Disturbed or damaged work shall be replaced or repaired to its prior conditions, as required by Section 01 00 00, GENERAL REQUIREMENTS.

F. Coordinate location of equipment and conduit with other trades to minimize interference.

1.10 EQUIPMENT INSTALLATION AND REQUIREMENTS

A. Equipment location shall be as close as practical to locations shown on the drawings.

B. Working clearances shall not be less than specified in the NEC.

C. Inaccessible Equipment:

1. Where the Government determines that the Contractor has installed equipment not readily accessible for operation and maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Government.

2. "Readily accessible" is defined as being capable of being reached quickly for operation, maintenance, or inspections without the use of ladders, or without climbing or crawling under or over obstacles such as, but not limited to, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.

1.11 EQUIPMENT IDENTIFICATION

A. In addition to the requirements of the NEC, install an identification sign which clearly indicates information required for use and maintenance of items such as switchboards and switchgear, panelboards, cabinets, motor controllers, fused and non-fused safety switches, generators, automatic transfer switches, separately enclosed circuit breakers, individual breakers and controllers in switchboards,

switchgear and motor control assemblies, control devices and other significant equipment.

B. Identification signs for Normal Power System equipment shall be laminated black phenolic resin with a white core with engraved lettering. Identification signs for Essential Electrical System (EES) equipment, as defined in the NEC, shall be laminated red phenolic resin with a white core with engraved lettering. Lettering shall be a minimum of 12 mm (1/2 inch) high. Identification signs shall indicate equipment designation, rated bus amperage, voltage, number of phases, number of wires, and type of EES power branch as applicable. Secure nameplates with screws.

C. Install adhesive arc flash warning labels on all equipment as required by the latest NFPA 70E. Label shall show specific and correct information for specific equipment based on its arc flash calculations. Label shall show the followings:

1. Nominal system voltage.
2. Equipment/bus name, date prepared, and manufacturer name and address.
3. Arc flash boundary.
4. Available arc flash incident energy and the corresponding working distance.
5. Minimum arc rating of clothing.
6. Site-specific level of PPE.

1.12 SUBMITTALS

A. Submit to the COR in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. The Government's approval shall be obtained for all materials and equipment before delivery to the job site. Delivery, storage or installation of materials and equipment which has not had prior approval shall not be permitted.

C. All submittals shall include electronic copies of adequate descriptive literature, catalog cuts, shop drawings, test reports, certifications, samples, and other data necessary for the Government to ascertain that the proposed materials and equipment comply with drawing and specification requirements. Catalog cuts submitted for approval shall be legible and clearly identify specific materials and equipment being submitted.

D. Submittals for individual systems and equipment assemblies which consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals shall not be considered for approval.
   1. Mark the submittals, "SUBMITTED UNDER SECTION_____".
   2. Submittals shall be marked to show specification reference including the section and paragraph numbers.
   3. Submit each section separately.

E. The submittals shall include the following:
   1. Information that confirms compliance with contract requirements. Include the manufacturer's name, model or catalog numbers, catalog information, technical data sheets, shop drawings, manuals, pictures, nameplate data, and test reports as required.
   2. Submittals are required for all equipment anchors and supports. Submittals shall include weights, dimensions, center of gravity, standard connections, manufacturer's recommendations and behavior problems (e.g., vibration and thermal expansion) associated with equipment or piping so that the proposed installation can be properly reviewed. Include sufficient fabrication information so that appropriate mounting and securing provisions shall be designed and attached to the equipment.
   3. Elementary and interconnection wiring diagrams for communication and signal systems, control systems, and equipment assemblies. All terminal points and wiring shall be identified on wiring diagrams.
   4. Parts list which shall include information for replacement parts and ordering instructions, as recommended by the equipment manufacturer.

F. Maintenance and Operation Manuals:
   1. Submit as required for systems and equipment specified in the technical sections. Furnish in hardcover binders or an approved equivalent.
   2. Inscribe the following identification on the cover: the words "MAINTENANCE AND OPERATION MANUAL," the name and location of the system, material, equipment, building, name of Contractor, and contract name and number. Include in the manual the names, addresses, and telephone numbers of each subcontractor installing the system or equipment and the local representatives for the material or equipment.

3. Provide a table of contents and assemble the manual to conform to the table of contents, with tab sheets placed before instructions covering the subject. The instructions shall be legible and easily read, with large sheets of drawings folded in.
4. The manuals shall include:
   a. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of the equipment.
   b. A control sequence describing start-up, operation, and shutdown.
   c. Description of the function of each principal item of equipment.
   d. Installation instructions.
   e. Safety precautions for operation and maintenance.
   f. Diagrams and illustrations.
   g. Periodic maintenance and testing procedures and frequencies, including replacement parts numbers.
   h. Performance data.
   i. Pictorial "exploded" parts list with part numbers. Emphasis shall be placed on the use of special tools and instruments. The list shall indicate sources of supply, recommended spare and replacement parts, and name of servicing organization.
   j. List of factory approved or qualified permanent servicing organizations for equipment repair and periodic testing and maintenance, including addresses and factory certification qualifications.

G. Approvals shall be based on complete submission of shop drawings, manuals, test reports, certifications, and samples as applicable.

H. After approval and prior to installation, furnish the COR with one sample of each of the following:
1. A minimum 300 mm (12 inches) length of each type and size of wire and cable along with the tag from the coils or reels from which the sample was taken. The length of the sample shall be sufficient to show all markings provided by the manufacturer.
2. Each type of conduit coupling, bushing, and termination fitting.
3. Conduit hangers, clamps, and supports.
4. Duct sealing compound.
5. Each type of receptacle, toggle switch, lighting control sensor, outlet box, manual motor starter, device wall plate, engraved

nameplate, wire and cable splicing and terminating material, and branch circuit single pole molded case circuit breaker.

1.13 SINGULAR NUMBER

A. Where any device or part of equipment is referred to in these specifications in the singular number (e.g., "the switch"), this reference shall be deemed to apply to as many such devices as are required to complete the installation as shown on the drawings.

1.14 ACCEPTANCE CHECKS AND TESTS

A. The Contractor shall furnish the instruments, materials, and labor for tests.

B. Where systems are comprised of components specified in more than one section of Division 26, the Contractor shall coordinate the installation, testing, and adjustment of all components between various manufacturer’s representatives and technicians so that a complete, functional, and operational system is delivered to the Government.

C. When test results indicate any defects, the Contractor shall repair or replace the defective materials or equipment, and repeat the tests for the equipment. Repair, replacement, and re-testing shall be accomplished at no additional cost to the Government.

1.15 WARRANTY

A. All work performed and all equipment and material furnished under this Division shall be free from defects and shall remain so for a period of one year from the date of acceptance of the entire installation by the Contracting Officer for the Government.

1.16 INSTRUCTION

A. Instruction to designated Government personnel shall be provided for the particular equipment or system as required in each associated technical specification section.

B. Furnish the services of competent and factory-trained instructors to give full instruction in the adjustment, operation, and maintenance of the specified equipment and system, including pertinent safety requirements. Instructors shall be thoroughly familiar with all aspects of the installation, and shall be factory-trained in operating theory as well as practical operation and maintenance procedures.

C. A training schedule shall be developed and submitted by the Contractor and approved by the COR at least 30 days prior to the planned training.

1.17 DRAWINGS AND SPECIFICATIONS

A. The drawings indicate the general arrangement of the work and shall be followed insofar as possible. The word "provide", as used, shall mean "furnish and install". If significant deviations from the layout are necessitated by field conditions, detailed layouts of the proposed departures shall be submitted to the COR for approval before proceeding with the work.

B. Make all necessary field measurements to ensure correct fitting. Coordinate work with all other trades in such a manner as to cause a minimum of conflict or delay.

C. The drawings and specifications shall be carefully studied during the course of bidding and construction. Any errors, omissions or discrepancies encountered shall be referred immediately to the COR for interpretation or correction, so that misunderstandings at a later date shall be avoided. The contract drawings are not intended to show every vertical or horizontal offset which shall be necessary to complete the systems. Having bus duct, wireways and fittings fabricated and delivered in advance of making actual measurements shall not be sufficient cause to avoid making offsets and minor changes as shall be necessary to install bus duct, wireways, fittings and equipment.

D. The COR shall reserve the right to make minor adjustment in locations of system runs and components where he considers such adjustments desirable in the interest of protecting and concealing work or presenting a better appearance where exposed. Any such changes shall be anticipated and requested sufficiently in advance as to not cause extra work, or unduly delay the work. Coordinate work in advance with all other trades and report immediately any difficulties which can be anticipated.

E. Equipment, ductwork and piping shall not be installed in the dedicated electrical space above or in the working space required around electrical switchgear, motor control centers or panelboards as identified by NEC 110.26 Spaces About Electrical Equipment – 600 Volts Nominal or Less. For equipment rated over 600 volts nominal – 110.32 Work Space About Equipment – 110.33 Entrance and Access to Work Space – 110.34 Work Space and Guarding. The Electrical Contractor shall caution other trades to comply with this stipulation.

F. Where any system runs and components are so placed as to cause or contribute to a conflict, it shall be readjusted at the expense of the contractor causing such conflict. The COR's decision shall be final in regard to the arrangement of bus duct and conduit, where conflict arises.

G. Provide offsets in system runs, additional fittings, necessary conduit, pull boxes, conductors, switches and devices required to complete the installation, or for the proper operation of the system. Each Contractor shall exercise due and particular caution to determine that all parts of the work are made quickly and easily accessible.

H. Shall overlap of work among the trades become evident, this shall be called to the attention of the COR. In such event, none of the trades or their suppliers shall assume that he is relieved of the work which is specified under his branch until instructions in writing are received from the COR.

1.18 RECORD DRAWINGS

A. The Electrical Contractor shall maintain a separate set of prints of the contract documents and shall show all changes or variations, in a manner to be clearly discernible, which are made during construction. Upon completion of the work, these drawings shall be turned over to the Architect. This shall apply particularly to underground and concealed work, and to other systems where the installation varies to a degree which would justify recording the change.

1.19 FINAL INSPECTION AND PUNCH LIST

A. As the time of work completion approaches, the Contractor shall survey and inspect his work and develop his own punch list to confirm that it is complete and finished. He shall then notify the COR and request that a final inspection be made. It shall not be considered the COR’s obligation to perform a final inspection until the Contractor has inspected the work and so states at the time of the request for the final inspection.

B. Requests to the COR for final inspection shall be accompanied by a limited list of known deficiencies in completion, with appropriate explanation and schedule for completing these; this is in the interest of expediting acceptance for beneficial occupancy.

C. The Architect and/or Engineer shall inspect the work and prepare a punch list of items requiring correction, completion or verification.

Corrective action shall be taken by the Contractor to the satisfaction of Architect and Engineer within 30 days of receipt of the Architect/Engineer's punch list.

1.20 REMOVALS

A. Remove ALL existing work which shall be superfluous when the new system is installed and made operational. Not all items that need to be removed are necessarily shown on the drawings. Void unused conduit behind walls or below floors as necessary or as directed. No wire or conduit shall be removed which shall impair the functioning of the remaining work unless first replaced with a rerouted section of wire or conduit to ensure continuity. Remove inactive wiring back to the last active junction box, panelboard or piece of equipment.

B. Upon completion, no unused conduit or stub shall extend thru floors, walls or ceilings in finished areas. Abandoned conduit where remaining in place shall have any unused wiring removed. All accessible unused conduit shall be removed.

C. When it is necessary to reroute a section of an active circuit, the rerouted section shall be installed before removing the existing in order to minimize system down time. Rerouted sections shall be installed as required for new work.

D. Remove all existing backboxes not maintained for new work. Patch and repair all existing drywall associated with removal work to match existing conditions.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

---END---

SECTION 26 05 19
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of the electrical conductors and cables for use in electrical systems rated 600 V and below, indicated as cable(s), conductor(s), wire, or wiring in this section.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

B. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits for conductors and cables.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:
   a. Submit sufficient information to demonstrate compliance with drawings and specifications.
   b. Submit the following data for approval:
      1) Electrical ratings and insulation type for each conductor and cable.
      2) Splicing materials and pulling lubricant.
2. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the manufacturer that the conductors and cables conform to the requirements of the drawings and specifications.
   b. Certification by the Contractor that the conductors and cables have been properly installed, adjusted, and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are reference in the text by designation only.

B. American Society of Testing Material (ASTM):

D2301-10.....Standard Specification for Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

D2304-10.....Test Method for Thermal Endurance of Rigid Electrical Insulating Materials

D3005-10.....Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape

C. National Electrical Manufacturers Association (NEMA):

WC 70-09.....Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy

D. National Fire Protection Association (NFPA):

70-17.....National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):

44-14.....Thermoset-Insulated Wires and Cables

83-14.....Thermoplastic-Insulated Wires and Cables

467-13.....Grounding and Bonding Equipment

486A-486B-13.....Wire Connectors

486C-13.....Splicing Wire Connectors

486D-15.....Sealed Wire Connector Systems

486E-15.....Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors

493-07.....Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables

514B-12.....Conduit, Tubing, and Cable Fittings

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Conductors and cables shall be in accordance with ASTM, NEMA, NFPA, UL, as specified herein, and as shown on the drawings.

B. All conductors shall be copper.

C. Single Conductor and Cable:

1. No. 12 AWG: Minimum size, except where smaller sizes are specified herein or shown on the drawings.
2. No. 8 AWG and larger: Stranded.
3. No. 10 AWG and smaller: Solid; except shall be stranded for final connection to motors, transformers, and vibrating equipment.
4. Insulation: THHN-THWN and XHHW-2. XHHW-2 shall be used for isolated power systems.

D. Color Code:

1. No. 10 AWG and smaller: Solid color insulation or solid color coating.
2. No. 8 AWG and larger: Color-coded using one of the following methods:
   a. Solid color insulation or solid color coating.
   b. Stripes, bands, or hash marks of color specified.
   c. Color using 19 mm (0.75 inches) wide tape.
3. For modifications and additions to existing wiring systems, color coding shall conform to the existing wiring system.
4. Conductors shall be color-coded as follows:

208/120 V	Phase	480/277 V
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray *
* or white with colored (other than green) tracer.		

5. Lighting circuit “switch legs”, and 3-way and 4-way switch “traveling wires,” shall have color coding that is unique and distinct (e.g., pink and purple) from the color coding indicated above. The unique color codes shall be solid and in accordance with the NEC. Coordinate color coding in the field with the COR.

2.2 SPLICES

A. Splices shall be in accordance with NEC and UL.

B. Above Ground Splices for No. 10 AWG and Smaller:

1. Solderless, screw-on, reusable pressure cable type, with integral insulation, approved for copper and aluminum conductors.

2. The integral insulator shall have a skirt to completely cover the stripped conductors.
3. The number, size, and combination of conductors used with the connector, as listed on the manufacturer's packaging, shall be strictly followed.

C. Above Ground Splices for No. 8 AWG to No. 4/0 AWG:
1. Compression, hex screw, or bolt clamp-type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.
2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
3. Splice and insulation shall be product of the same manufacturer.
4. All bolts, nuts, and washers used with splices shall be cadmium-plated steel.

D. Above Ground Splices for 250 kcmil and Larger:
1. Long barrel “butt-splice” or “sleeve” type compression connectors, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.
2. Insulate with materials approved for the particular use, location, voltage, and temperature. Insulation level shall be not less than the insulation level of the conductors being joined.
3. Splice and insulation shall be product of the same manufacturer.

E. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.

2.3 CONNECTORS AND TERMINATIONS

A. Mechanical type of high conductivity and corrosion-resistant material, listed for use with copper and aluminum conductors.

B. Long barrel compression type of high conductivity and corrosion-resistant material, with minimum of two compression indents per wire, listed for use with copper and aluminum conductors.

C. All bolts, nuts, and washers used to connect connections and terminations to bus bars or other termination points shall be cadmium-plated steel.

2.4 CONTROL WIRING

A. Unless otherwise specified elsewhere in these specifications, control wiring shall be as specified herein, except that the minimum size shall be not less than No. 14 AWG.

B. Control wiring shall be sized such that the voltage drop under in-rush conditions does not adversely affect operation of the controls.

2.5 WIRE LUBRICATING COMPOUND

A. Lubricating compound shall be suitable for the wire insulation and conduit, and shall not harden or become adhesive.

B. Shall not be used on conductors for isolated power systems.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation shall be in accordance with the NEC, as shown on the drawings, and manufacturer’s instructions.

B. Install all conductors in raceway systems.

C. Splice conductors only in outlet boxes, junction boxes, pullboxes, manholes, or handholes.

D. Conductors of different systems (e.g., 120 V and 277 V) shall not be installed in the same raceway.

E. Install cable supports for all vertical feeders in accordance with the NEC. Provide split wedge type which firmly clamps each individual cable and tightens due to cable weight.

F. In panelboards, cabinets, wireways, switches, enclosures, and equipment assemblies, neatly form, train, and tie the conductors with non-metallic ties.

G. For connections to motors, transformers, and vibrating equipment, stranded conductors shall be used only from the last fixed point of connection to the motors, transformers, or vibrating equipment.

H. Use expanding foam or non-hardening duct-seal to seal conduits entering a building, after installation of conductors.

I. Conductor and Cable Pulling:

1. Provide installation equipment that shall prevent the cutting or abrasion of insulation during pulling. Use lubricants approved for the cable.
2. Use nonmetallic pull ropes.
3. Attach pull ropes by means of either woven basket grips or pulling eyes attached directly to the conductors.

4. All conductors in a single conduit shall be pulled simultaneously.
5. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

J. No more than three branch circuits shall be installed in any one conduit.

K. When stripping stranded conductors, use a tool that does not damage the conductor or remove conductor strands.

3.2 SPLICE AND TERMINATION INSTALLATION

A. Splices and terminations shall be mechanically and electrically secure, and tightened to manufacturer's published torque values using a torque screwdriver or wrench.

B. Where the Government determines that unsatisfactory splices or terminations have been installed, replace the splices or terminations at no additional cost to the Government.

3.3 CONDUCTOR IDENTIFICATION

A. When using colored tape to identify phase, neutral, and ground conductors larger than No. 8 AWG, apply tape in half-overlapping turns for a minimum of 75 mm (3 inches) from terminal points, and in junction boxes, pullboxes, and manholes. Apply the last two laps of tape with no tension to prevent possible unwinding. Where cable markings are covered by tape, apply tags to cable, stating size and insulation type.

3.4 FEEDER CONDUCTOR IDENTIFICATION

A. In each interior pullbox and each underground manhole and handhole, install brass tags on all feeder conductors to clearly designate their circuit identification and voltage. The tags shall be the embossed type, 40 mm (1-1/2 inches) in diameter and 40 mils thick. Attach tags with plastic ties.

3.5 EXISTING CONDUCTORS

A. Unless specifically indicated on the plans, existing conductors shall not be reused.

3.6 CONTROL WIRING INSTALLATION

A. Unless otherwise specified in other sections, install control wiring and connect to equipment to perform the required functions as specified or as shown on the drawings.

B. Install a separate power supply circuit for each system, except where otherwise shown on the drawings.

3.7 CONTROL WIRING IDENTIFICATION

A. Install a permanent wire marker on each wire at each termination.

B. Identifying numbers and letters on the wire markers shall correspond to those on the wiring diagrams used for installing the systems.

C. Wire markers shall retain their markings after cleaning.

D. In each manhole and handhole, install embossed brass tags to identify the system served and function.

3.8 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:

1. Visual Inspection and Tests: Inspect physical condition.
2. Electrical tests:
   a. After installation but before connection to utilization devices, such as fixtures, motors, or appliances, test conductors phase-to-phase and phase-to-ground resistance with an insulation resistance tester. Existing conductors to be reused shall also be tested.
   b. Applied voltage shall be 500 V DC for 300 V rated cable, and 1000 V DC for 600 V rated cable. Apply test for one minute or until reading is constant for 15 seconds, whichever is longer. Minimum insulation resistance values shall not be less than 25 megohms for 300 V rated cable and 100 megohms for 600 V rated cable.
   c. Perform phase rotation test on all three-phase circuits.

---END---

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of grounding and bonding equipment, indicated as grounding equipment in this section.

B. "Grounding electrode system" refers to grounding electrode conductors and all electrodes required or allowed by NEC, as well as made, supplementary, and lightning protection system grounding electrodes.

C. The terms "connect" and "bond" are used interchangeably in this section and have the same meaning.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

C. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:
   a. Submit sufficient information to demonstrate compliance with drawings and specifications.
   b. Submit plans showing the location of system grounding electrodes and connections, and the routing of aboveground and underground grounding electrode conductors.
2. Test Reports:
   a. Two weeks prior to the final inspection, submit ground resistance field test reports to the COR.
3. Certifications:

a. Certification by the Contractor that the grounding equipment has been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. American Society for Testing and Materials (ASTM):

B1-13.....Standard Specification for Hard-Drawn Copper Wire

B3-13.....Standard Specification for Soft or Annealed Copper Wire

B8-11.....Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft

C. Institute of Electrical and Electronics Engineers, Inc. (IEEE):

81-12.....IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements

D. National Fire Protection Association (NFPA):

70-17.....National Electrical Code (NEC)

70E-15.....National Electrical Safety Code

99-15.....Health Care Facilities

E. Underwriters Laboratories, Inc. (UL):

44-14 .....Thermoset-Insulated Wires and Cables

83-14 .....Thermoplastic-Insulated Wires and Cables

467-13 .....Grounding and Bonding Equipment

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment grounding conductors shall be insulated stranded copper, except that sizes No. 10 AWG and smaller shall be solid copper. Insulation color shall be continuous green for all equipment grounding conductors, except that wire sizes No. 4 AWG and larger shall be identified per NEC.

B. Bonding conductors shall be bare stranded copper, except that sizes No. 10 AWG and smaller shall be bare solid copper. Bonding conductors

shall be stranded for final connection to motors, transformers, and vibrating equipment.

C. Conductor sizes shall not be less than shown on the drawings, or not less than required by the NEC, whichever is greater.

D. Insulation: THHN-THWN and XHHW-2.

2.2 CONCRETE ENCASED ELECTRODE

A. Concrete encased electrode shall be No. 4 AWG bare copper wire, installed per NEC.

2.3 GROUND CONNECTIONS

A. Below Grade and Inaccessible Locations: Exothermic-welded type connectors.

B. Above Grade:

1. Bonding Jumpers: Listed for use with aluminum and copper conductors. For wire sizes No. 8 AWG and larger, use compression-type connectors. For wire sizes smaller than No. 8 AWG, use mechanical type lugs. Connectors or lugs shall use cadmium-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
2. Connection to Building Steel: Exothermic-welded type connectors.
3. Connection to Grounding Bus Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with cadmium-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.
4. Connection to Equipment Rack and Cabinet Ground Bars: Listed for use with aluminum and copper conductors. Use mechanical type lugs, with cadmium-plated steel bolts, nuts, and washers. Bolts shall be torqued to the values recommended by the manufacturer.

2.4 EQUIPMENT RACK AND CABINET GROUND BARS

A. Provide solid copper ground bars designed for mounting on the framework of open or cabinet-enclosed equipment racks. Ground bars shall have minimum dimensions of 6.3 mm (0.25 inch) thick x 19 mm (0.75 inch) wide, with length as required or as shown on the drawings. Provide insulators and mounting brackets.

2.5 GROUND TERMINAL BLOCKS

A. At any equipment mounting location (e.g., backboards and hinged cover enclosures) where rack-type ground bars cannot be mounted, provide mechanical type lugs, with cadmium-plated steel bolts, nuts, and

washers. Bolts shall be torqued to the values recommended by the manufacturer.

2.6 GROUNDING BUS BAR

A. Pre-drilled rectangular copper bar with stand-off insulators, minimum 6.3 mm (0.25 inch) thick x 100 mm (4 inches) high in cross-section, length as shown on the drawings, with hole size, quantity, and spacing per detail shown on the drawings. Provide insulators and mounting brackets.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation shall be in accordance with the NEC, as shown on the drawings, and manufacturer’s instructions.

B. System Grounding:

1. Separately derived systems (transformers downstream from the service entrance): Ground the secondary neutral.

C. Equipment Grounding: Metallic piping, building structural steel, electrical enclosures, raceways, junction boxes, outlet boxes, cabinets, machine frames, and other conductive items in close proximity with electrical circuits, shall be bonded and grounded.

3.2 INACCESSIBLE GROUNDING CONNECTIONS

A. Make grounding connections, which are normally buried or otherwise inaccessible, by exothermic weld.

3.3 SECONDARY VOLTAGE EQUIPMENT AND CIRCUITS

A. Main Bonding Jumper: Bond the secondary service neutral to the ground bus in the service equipment.

B. Metallic Piping, Building Structural Steel, and Supplemental Electrode(s):

1. Provide a grounding electrode conductor sized per NEC between the service equipment ground bus and all metallic water pipe systems, building structural steel, and supplemental or made electrodes. Provide jumpers across insulating joints in the metallic piping.
2. Provide a supplemental ground electrode as shown on the drawings and bond to the grounding electrode system.

C. Switchgear, Switchboards, Unit Substations, Panelboards, Motor Control Centers, Engine-Generators, Automatic Transfer Switches, and other electrical equipment:

1. Connect the equipment grounding conductors to the ground bus.

2. Connect metallic conduits by grounding bushings and equipment grounding conductor to the equipment ground bus.

D. Transformers:

1. Separately derived systems (transformers downstream from service equipment): Ground the secondary neutral at the transformer. Provide a grounding electrode conductor from the transformer to the nearest component of the grounding electrode system.

3.4 RACEWAY

A. Conduit Systems:

1. Ground all metallic conduit systems. All metallic conduit systems shall contain an equipment grounding conductor.
2. Non-metallic conduit systems, except non-metallic feeder conduits that carry a grounded conductor from exterior transformers to interior or building-mounted service entrance equipment, shall contain an equipment grounding conductor.
3. Metallic conduit that only contains a grounding conductor, and is provided for its mechanical protection, shall be bonded to that conductor at the entrance and exit from the conduit.
4. Metallic conduits which terminate without mechanical connection to an electrical equipment housing by means of locknut and bushings or adapters, shall be provided with grounding bushings. Connect bushings with an equipment grounding conductor to the equipment ground bus.

B. Feeders and Branch Circuits: Install equipment grounding conductors with all feeders, and power and lighting branch circuits.

C. Boxes, Cabinets, Enclosures, and Panelboards:

1. Bond the equipment grounding conductor to each pullbox, junction box, outlet box, device box, cabinets, and other enclosures through which the conductor passes (except for special grounding systems for intensive care units and other critical units shown).
2. Provide lugs in each box and enclosure for equipment grounding conductor termination.

D. Wireway Systems:

1. Bond the metallic structures of wireway to provide electrical continuity throughout the wireway system, by connecting a No. 6 AWG bonding jumper at all intermediate metallic enclosures and across all section junctions.

2. Install insulated No. 6 AWG bonding jumpers between the wireway system, bonded as required above, and the closest building ground at each end and approximately every 16 M (50 feet).
3. Use insulated No. 6 AWG bonding jumpers to ground or bond metallic wireway at each end for all intermediate metallic enclosures and across all section junctions.
4. Use insulated No. 6 AWG bonding jumpers to ground cable tray to column-mounted building ground plates (pads) at each end and approximately every 15 M (49 feet).

E. Receptacles shall not be grounded through their mounting screws. Ground receptacles with a jumper from the receptacle green ground terminal to the device box ground screw and a jumper to the branch circuit equipment grounding conductor.

F. Ground lighting fixtures to the equipment grounding conductor of the wiring system. Fixtures connected with flexible conduit shall have a green ground wire included with the power wires from the fixture through the flexible conduit to the first outlet box.

G. Fixed electrical appliances and equipment shall be provided with a ground lug for termination of the equipment grounding conductor.

H. Raised Floors: Provide bonding for all raised floor components as shown on the drawings.

3.5 CORROSION INHIBITORS

A. When making grounding and bonding connections, apply a corrosion inhibitor to all contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between the metals used.

3.6 CONDUCTIVE PIPING

A. Bond all conductive piping systems, interior and exterior, to the grounding electrode system. Bonding connections shall be made as close as practical to the equipment ground bus.

3.7 LIGHTNING PROTECTION SYSTEM

A. Bond the lightning protection system to the electrical grounding electrode system.

3.8 ACCEPTANCE CHECKS AND TESTS

A. Resistance of the grounding electrode system shall be measured using a four-terminal fall-of-potential method as defined in IEEE 81. Ground resistance measurements shall be made before the electrical distribution system is energized or connected to the electric utility

company ground system, and shall be made in normally dry conditions not fewer than 48 hours after the last rainfall.

B. Resistance measurements of separate grounding electrode systems shall be made before the systems are bonded together. The combined resistance of separate systems shall be used to meet the required resistance, but the specified number of electrodes shall still be provided.

---END---

SECTION 26 05 33
RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of conduit, fittings, and boxes, to form complete, coordinated, grounded raceway systems. Raceways are required for all wiring unless shown or specified otherwise.

B. Definitions: The term conduit, as used in this specification, shall mean any or all of the raceway types specified.

1.2 RELATED WORK

A. Section 06 10 00, ROUGH CARPENTRY: Mounting board for telephone closets.

B. Section 07 60 00, FLASHING AND SHEET METAL: Fabrications for the deflection of water away from the building envelope at penetrations.

C. Section 07 92 00, JOINT SEALANTS: Sealing around conduit penetrations through the building envelope to prevent moisture migration into the building.

D. Section 09 91 00, PAINTING: Identification and painting of conduit and other devices.

E. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements and items that are common to more than one section of Division 26.

F. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:
   a. Size and location of main feeders.
   b. Size and location of panels and pull-boxes.

c. Layout of required conduit penetrations through structural elements.

d. Submit the following data for approval:

1) Raceway types and sizes.

2) Conduit bodies, connectors and fittings.

3) Junction and pull boxes, types and sizes.

2. Certifications: Two weeks prior to final inspection, submit the following:

a. Certification by the manufacturer that raceways, conduits, conduit bodies, connectors, fittings, junction and pull boxes, and all related equipment conform to the requirements of the drawings and specifications.

b. Certification by the Contractor that raceways, conduits, conduit bodies, connectors, fittings, junction and pull boxes, and all related equipment have been properly installed.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. American Iron and Steel Institute (AISI):

S100-12.....North American Specification for the Design of Cold-Formed Steel Structural Members

C. National Electrical Manufacturers Association (NEMA):

C80.1-15.....Electrical Rigid Steel Conduit

C80.3-15.....Steel Electrical Metal Tubing

C80.6-05.....Electrical Intermediate Metal Conduit

FB1-14.....Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable

FB2.10-13.....Selection and Installation Guidelines for Fittings for use with Non-Flexible Conduit or Tubing (Rigid Metal Conduit, Intermediate Metallic Conduit, and Electrical Metallic Tubing)

FB2.20-14.....Selection and Installation Guidelines for Fittings for use with Flexible Electrical Conduit and Cable

TC-2-13.....Electrical Polyvinyl Chloride (PVC) Tubing and Conduit

TC-3-13.....PVC Fittings for Use with Rigid PVC Conduit and Tubing

D. National Fire Protection Association (NFPA):

70-17.....National Electrical Code (NEC)

E. Underwriters Laboratories, Inc. (UL):

1-05.....Flexible Metal Conduit

5-16.....Surface Metal Raceway and Fittings

6-07.....Electrical Rigid Metal Conduit - Steel

50-15.....Enclosures for Electrical Equipment

360-13.....Liquid-Tight Flexible Steel Conduit

467-13.....Grounding and Bonding Equipment

514A-13.....Metallic Outlet Boxes

514B-12.....Conduit, Tubing, and Cable Fittings

514C-14.....Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers

651-11.....Schedule 40 and 80 Rigid PVC Conduit and Fittings

651A-11.....Type EB and A Rigid PVC Conduit and HDPE Conduit

797-07.....Electrical Metallic Tubing

1242-14.....Electrical Intermediate Metal Conduit - Steel

PART 2 - PRODUCTS

2.1 MATERIAL

A. Conduit Size: In accordance with the NEC, but not less than 0.75” unless otherwise shown. Where permitted by the NEC, 13 mm (0.5-inch) flexible conduit shall be used for tap connections to recessed lighting fixtures.

B. Conduit:

1. Size: In accordance with the NEC, but not less than 0l75”.
2. Rigid Steel Conduit (RMC): Shall conform to UL 6 and NEMA C80.1.
3. Rigid Intermediate Steel Conduit (IMC): Shall conform to UL 1242 and NEMA C80.6.

4. Electrical Metallic Tubing (EMT): Shall conform to UL 797 and NEMA C80.3. Maximum size not to exceed 105 mm (4 inches) and shall be permitted only with cable rated 600 V or less.
5. Flexible Metal Conduit: Shall conform to UL 1.
6. Liquid-tight Flexible Metal Conduit: Shall conform to UL 360.
7. Surface Metal Raceway: Shall conform to UL 5.

C. Conduit Fittings:

1. Rigid Steel and Intermediate Metallic Conduit Fittings:
   a. Fittings shall meet the requirements of UL 514B and NEMA FB1.
   b. Standard threaded couplings, locknuts, bushings, conduit bodies, and elbows: Only steel or malleable iron materials are acceptable. Integral retractable type IMC couplings are also acceptable.
   c. Locknuts: Bonding type with sharp edges for digging into the metal wall of an enclosure.
   d. Bushings: Metallic insulating type, consisting of an insulating insert, molded or locked into the metallic body of the fitting. Bushings made entirely of metal or nonmetallic material are not permitted.
   e. Erickson (Union-Type) and Set Screw Type Couplings: Approved for use in concrete are permitted for use to complete a conduit run where conduit is installed in concrete. Use set screws of case-hardened steel with hex head and cup point to firmly seat in conduit wall for positive ground. Tightening of set screws with pliers is prohibited.
   f. Sealing Fittings: Threaded cast iron type. Use continuous drain-type sealing fittings to prevent passage of water vapor. In concealed work, install fittings in flush steel boxes with blank cover plates having the same finishes as that of other electrical plates in the room.
2. Electrical Metallic Tubing Fittings:
   a. Fittings and conduit bodies shall meet the requirements of UL 514B, NEMA C80.3, and NEMA FB1.
   b. Only steel or malleable iron materials are acceptable.
   c. Compression Couplings and Connectors: Concrete-tight and rain-tight, with connectors having insulated throats for conduit 2” and smaller.

d. Setscrew Couplings and Connectors: Use setscrews of case-hardened steel with hex head and cup point, to firmly seat in wall of conduit for positive grounding for conduit over 2”.

e. Indent-type connectors or couplings are prohibited.

f. Die-cast or pressure-cast zinc-alloy fittings or fittings made of "pot metal" are prohibited.

3. Flexible Metal Conduit Fittings:

a. Conform to UL 514B. Only steel or malleable iron materials are acceptable.

b. Clamp-type, with insulated throat.

4. Liquid-tight Flexible Metal Conduit Fittings:

a. Fittings shall meet the requirements of UL 514B and NEMA FB1.

b. Only steel or malleable iron materials are acceptable.

c. Fittings shall incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening. Connectors shall have insulated throats.

5. Surface Metal Raceway Fittings: As recommended by the raceway manufacturer. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, conduit entry fittings, accessories, and other fittings as required for complete system.

6. Expansion and Deflection Couplings:

a. Conform to UL 467 and UL 514B.

b. Accommodate a 19 mm (0.75-inch) deflection, expansion, or contraction in any direction, and allow 30 degree angular deflections.

c. Include internal flexible metal braid, sized to guarantee conduit ground continuity and a low-impedance path for fault currents, in accordance with UL 467 and the NEC tables for equipment grounding conductors.

d. Jacket: Flexible, corrosion-resistant, watertight, moisture and heat-resistant molded rubber material with stainless steel jacket clamps.

D. Conduit Supports:

1. Parts and Hardware: Zinc-coat or provide equivalent corrosion protection.

2. Individual Conduit Hangers: Designed for the purpose, having a pre-assembled closure bolt and nut, and provisions for receiving a hanger rod.
3. Multiple Conduit (Trapeze) Hangers: Not less than 38 mm x 38 mm (1.5 x 1.5 inches), 12-gauge steel, cold-formed, lipped channels; with not less than 9 mm (0.375-inch) diameter steel hanger rods.
4. Solid Masonry and Concrete Anchors: Self-drilling expansion shields, or machine bolt expansion.

E. Outlet, Junction, and Pull Boxes:
1. Comply with UL-50 and UL-514A.
2. Rustproof cast metal where required by the NEC or shown on drawings.
3. Sheet Metal Boxes: Galvanized steel, except where shown on drawings.

F. Metal Wireways: Equip with hinged covers, except as shown on drawings. Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for a complete system.

PART 3 - EXECUTION

3.1 PENETRATIONS

A. Cutting or Holes:
1. Cut holes in advance where they shall be placed in the structural elements, such as ribs or beams. Obtain the approval of the COR prior to drilling through structural elements.
2. Cut holes through concrete and masonry in new and existing structures with a diamond core drill or concrete saw. Pneumatic hammers, impact electric, hand, or manual hammer-type drills are not allowed, except when permitted by the COR where working space is limited.

B. Firestop: Where conduits, wireways, and other electrical raceways pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases.

C. Waterproofing: At floor, exterior wall, and roof conduit penetrations, completely seal the gap around conduit to render it watertight, as specified in Section 07 92 00, JOINT SEALANTS.

3.2 INSTALLATION, GENERAL

A. In accordance with NEC, NEMA, UL, as shown on drawings, and as specified herein.

B. Raceway systems used for Essential Electrical Systems (EES) shall be entirely independent of other raceway systems.

C. Install conduit as follows:

1. In complete mechanically and electrically continuous runs before pulling in cables or wires.
2. Unless otherwise indicated on the drawings or specified herein, installation of all conduits shall be concealed within finished walls, floors, and ceilings.
3. Flattened, dented, or deformed conduit is not permitted. Remove and replace the damaged conduits with new conduits.
4. Assure conduit installation does not encroach into the ceiling height head room, walkways, or doorways.
5. Cut conduits square, ream, remove burrs, and draw up tight.
6. Independently support conduit at 2.4 M (8 feet) on centers with specified materials and as shown on drawings.
7. Do not use suspended ceilings, suspended ceiling supporting members, lighting fixtures, other conduits, cable tray, boxes, piping, or ducts to support conduits and conduit runs.
8. Support within 300 mm (12 inches) of changes of direction, and within 300 mm (12 inches) of each enclosure to which connected.
9. Close ends of empty conduits with plugs or caps at the rough-in stage until wires are pulled in, to prevent entry of debris.
10. Conduit installations under fume and vent hoods are prohibited.
11. Secure conduits to cabinets, junction boxes, pull-boxes, and outlet boxes with bonding type locknuts. For rigid steel and IMC conduit installations, provide a locknut on the inside of the enclosure, made up wrench tight. Do not make conduit connections to junction box covers.
12. Flashing of penetrations of the roof membrane is specified in Section 07 60 00, FLASHING AND SHEET METAL.
13. Conduit bodies shall only be used for changes in direction, and shall not contain splices.

D. Conduit Bends:

1. Make bends with standard conduit bending machines.

2. Conduit hickey shall be used for slight offsets and for straightening stubbed out conduits.
3. Bending of conduits with a pipe tee or vise is prohibited.

E. Layout and Homeruns:
1. Install conduit with wiring, including homeruns, as shown on drawings.
2. Deviations: Make only where necessary to avoid interferences and only after drawings showing the proposed deviations have been submitted and approved by the COR.

F. Conduit shall be run concealed in all finished areas of new construction and elsewhere unless specifically indicated or upon specific permission by the COR. All conduit shall parallel building lines.

G. Conduit shall be run overhead and shall not be run below concrete slabs unless specifically indicated on the drawings and in the legend on the drawings.

H. Contractor shall record carefully on a set of "as built" prints the exact location of all feeder conduits.

I. Unless noted otherwise on the drawings, a maximum of 8 conductors shall be installed in a branch circuit conduit. This maximum is a count of all phase and neutral conductors only - ground conductors are not counted when determining maximum fill for this purpose.

3.3 CONCEALED WORK INSTALLATION

A. In Concrete:
1. Conduit: Rigid steel, IMC, or EMT. Do not install EMT in concrete slabs that are in contact with soil, gravel, or vapor barriers.
2. Align and run conduit in direct lines.
3. Install conduit through concrete beams only:
   a. Where shown on the structural drawings.
   b. As approved by the COR prior to construction, and after submittal of drawing showing location, size, and position of each penetration.
4. Installation of conduit in concrete that is less than 75 mm (3 inches) thick is prohibited.
   a. Conduit outside diameter larger than one-third of the slab thickness is prohibited.

b. Space between conduits in slabs: Approximately six conduit diameters apart, and one conduit diameter at conduit crossings.

c. Install conduits approximately in the center of the slab so that there shall be a minimum of 19 mm (0.75-inch) of concrete around the conduits.

5. Make couplings and connections watertight. Use thread compounds that are UL approved conductive type to ensure low resistance ground continuity through the conduits. Tightening setscrews with pliers is prohibited.

B. Above Furred or Suspended Ceilings and in Walls:

1. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. Mixing different types of conduits in the same system is prohibited.
2. Align and run conduit parallel or perpendicular to the building lines.
3. Connect recessed lighting fixtures to conduit runs with maximum 1.8 M (6 feet) of flexible metal conduit extending from a junction box to the fixture.
4. Tightening set screws with pliers is prohibited.
5. For conduits running through metal studs, limit field cut holes to no more than 70% of web depth. Spacing between holes shall be at least 457 mm (18 inches). Cuts or notches in flanges or return lips shall not be permitted.

3.4 EXPOSED WORK INSTALLATION

A. Unless otherwise indicated on drawings, exposed conduit is only permitted in mechanical and electrical rooms.

B. Conduit for Conductors 600 V and Below: Rigid steel, IMC, or EMT. Mixing different types of conduits in the system is prohibited.

C. Align and run conduit parallel or perpendicular to the building lines.

D. Install horizontal runs close to the ceiling or beams and secure with conduit straps.

E. Support horizontal or vertical runs at not over 2.4 M (8 feet) intervals.

F. Surface Metal Raceways: Use only where shown on drawings.

G. Painting:

1. Paint exposed conduit as specified in Section 09 91 00, PAINTING.
2. Paint all conduits containing cables rated over 600 V safety orange. Refer to Section 09 91 00, PAINTING for preparation, paint type, and

exact color. In addition, paint legends, using 50 mm (2 inch) high black numerals and letters, showing the cable voltage rating. Provide legends where conduits pass through walls and floors and at maximum 6 M (20 feet) intervals in between.

3.5 WET OR DAMP LOCATIONS

A. Use rigid steel or IMC conduits unless as shown on drawings.

B. Provide sealing fittings to prevent passage of water vapor where conduits pass from warm to cold locations, i.e., refrigerated spaces, constant-temperature rooms, air-conditioned spaces, building exterior walls, roofs, or similar spaces.

C. Use rigid steel or IMC conduit within 1.5 M (5 feet) of the exterior and below concrete building slabs in contact with soil, gravel, or vapor barriers, unless as shown on drawings. Conduit shall be half-lapped with 10 mil PVC tape before installation. After installation, completely recoat or retape any damaged areas of coating.

D. Conduits run on roof shall be supported with integral galvanized lipped steel channel, attached to UV-inhibited polycarbonate or polypropylene blocks every 2.4 M (8 feet) with 9 mm (3/8-inch) galvanized threaded rods, square washer and locknut. Conduits shall be attached to steel channel with conduit clamps.

3.6 MOTORS AND VIBRATING EQUIPMENT

A. Use flexible metal conduit for connections to motors and other electrical equipment subject to movement, vibration, misalignment, cramped quarters, or noise transmission.

B. Use liquid-tight flexible metal conduit for installation in exterior locations, moisture or humidity laden atmosphere, corrosive atmosphere, water or spray wash-down operations, inside airstream of HVAC units, and locations subject to seepage or dripping of oil, grease, or water.

C. Provide a green equipment grounding conductor with flexible and liquid-tight flexible metal conduit.

3.7 EXPANSION JOINTS

A. Conduits 75 mm (3 inch) and larger that are secured to the building structure on opposite sides of a building expansion joint require expansion and deflection couplings. Install the couplings in accordance with the manufacturer's recommendations.

B. Provide conduits smaller than 75 mm (3 inch) with junction boxes on both sides of the expansion joint. Connect flexible metal conduits to

junction boxes with sufficient slack to produce a 125 mm (5 inch) vertical drop midway between the ends of the flexible metal conduit. Flexible metal conduit shall have a green insulated copper bonding jumper installed. In lieu of this flexible metal conduit, expansion and deflection couplings as specified above are acceptable.

C. Install expansion and deflection couplings where shown.

D. Seismic Areas: In seismic areas, provide conduits rigidly secured to the building structure on opposite sides of a building expansion joint with junction boxes on both sides of the joint. Connect conduits to junction boxes with 375 mm (15 inches) of slack flexible conduit. Flexible conduit shall have a copper bonding jumper installed.

3.8 CONDUIT SUPPORTS

A. Safe working load shall not exceed one-quarter of proof test load of fastening devices.

B. Use pipe straps or individual conduit hangers for supporting individual conduits.

C. Support multiple conduit runs with trapeze hangers. Use trapeze hangers that are designed to support a load equal to or greater than the sum of the weights of the conduits, wires, hanger itself, and an additional 90 kg (200 lbs.). Attach each conduit with U-bolts or other approved fasteners.

D. Support conduit independently of junction boxes, pull-boxes, fixtures, suspended ceiling T-bars, angle supports, and similar items.

E. Fasteners and Supports in Solid Masonry and Concrete:

1. New Construction: Use steel or malleable iron concrete inserts set in place prior to placing the concrete.
2. Existing Construction:
   a. Steel expansion anchors not less than 6 mm (0.25-inch) bolt size and not less than 28 mm (1.125 inch) in embedment.
   b. Power set fasteners not less than 6 mm (0.25-inch) diameter with depth of penetration not less than 75 mm (3 inch).
   c. Use vibration and shock-resistant anchors and fasteners for attaching to concrete ceilings.

F. Hollow Masonry: Toggle bolts.

G. Bolts supported only by plaster or gypsum wallboard are not acceptable.

H. Metal Structures: Use machine screw fasteners or other devices specifically designed and approved for the application.

I. Attachment by wood plugs, rawl plug, plastic, lead or soft metal anchors, or wood blocking and bolts supported only by plaster is prohibited.

J. Chain, wire, or perforated strap shall not be used to support or fasten conduit.

K. Spring steel type supports or fasteners are prohibited for all uses except horizontal and vertical supports/fasteners within walls.

L. Vertical Supports: Vertical conduit runs shall have riser clamps and supports in accordance with the NEC and as shown. Provide supports for cable and wire with fittings that include internal wedges and retaining collars.

3.9 BOX INSTALLATION

A. Boxes for Concealed Conduits:
   1. Flush-mounted.
   2. Provide raised covers for boxes to suit the wall or ceiling, construction, and finish.

B. In addition to boxes shown, install additional boxes where needed to prevent damage to cables and wires during pulling-in operations or where more than the equivalent of 4-90 degree bends are necessary.

C. Locate pullboxes so that covers are accessible and easily removed. Coordinate locations with piping and ductwork where installed above ceilings.

D. Remove only knockouts as required. Plug unused openings. Use threaded plugs for cast metal boxes and snap-in metal covers for sheet metal boxes.

E. Outlet boxes mounted back-to-back in the same wall are prohibited. A minimum 600 mm (24 inch) center-to-center lateral spacing shall be maintained between boxes.

F. Flush-mounted wall or ceiling boxes shall be installed with raised covers so that the front face of raised cover is flush with the wall. Surface-mounted wall or ceiling boxes shall be installed with surface-style flat or raised covers.

G. Minimum size of outlet boxes for ground fault circuit interrupter (GFCI) receptacles is 100 mm (4 inches) square x 55 mm (2.125 inches) deep, with device covers for the wall material and thickness involved.

H. Stencil or install phenolic nameplates on covers of the boxes identified on riser diagrams; for example "SIG-FA JB No. 1."

I. On all branch circuit junction box covers, identify the circuits with black marker.

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SECTION 26 05 41
UNDERGROUND ELECTRICAL CONSTRUCTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of underground ducts and raceways, and precast manholes and pullboxes to form a complete underground electrical raceway system.

B. The terms "duct" and "conduit" are used interchangeably in this section.

1.2 RELATED WORK

A. Section 07 92 00, JOINT SEALANTS: Sealing of conduit penetrations.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

D. Section 31 20 00, EARTH MOVING: Trenching, backfill, and compaction.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

B. Coordinate layout and installation of ducts, manholes, and pullboxes with final arrangement of other utilities, site grading, and surface features.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:

   a. Submit sufficient information to demonstrate compliance with drawings and specifications.

   b. Submit information on manholes, pullboxes, ducts, and hardware. Submit manhole plan and elevation drawings, showing openings, pulling irons, cable supports, cover, ladder, sump, and other accessories.

   c. Proposed deviations from the drawings shall be clearly marked on the submittals. If it is necessary to locate manholes, pullboxes,

or duct banks at locations other than shown on the drawings, show the proposed locations accurately on scaled site drawings, and submit to the COR for approval prior to construction.

2. Certifications: Two weeks prior to the final inspection, submit the following.
   a. Certification by the manufacturer that the materials conform to the requirements of the drawings and specifications.
   b. Certification by the Contractor that the materials have been properly installed, connected, and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. American Concrete Institute (ACI):
Building Code Requirements for Structural Concrete
318-14/318M-14.....Building Code Requirements for Structural Concrete & Commentary
SP-66-04.....ACI Detailing Manual

C. American National Standards Institute (ANSI):
77-14.....Underground Enclosure Integrity

D. American Society for Testing and Materials (ASTM):
C478 REV A-15.....Standard Specification for Precast Reinforced Concrete Manhole Sections
C858-10.....Underground Precast Concrete Utility Structures
C990-09.....Joints for Concrete Pipe, Manholes and Precast Box Sections Using Preformed Flexible Joint Sealants.

E. National Electrical Manufacturers Association (NEMA):
TC 2-13.....Electrical Polyvinyl Chloride (PVC) Conduit
TC 3-15.....Polyvinyl Chloride (PVC) Fittings for Use With Rigid PVC Conduit And Tubing
TC 6 & 8-13.....Polyvinyl Chloride (PVC) Plastic Utilities Duct For Underground Installations
TC 9-04.....Fittings For Polyvinyl Chloride (PVC) Plastic Utilities Duct For Underground Installation

F. National Fire Protection Association (NFPA):

70-17.....National Electrical Code (NEC)

70E-15.....National Electrical Safety Code

G. Underwriters Laboratories, Inc. (UL):

6-07.....Electrical Rigid Metal Conduit-Steel

467-13.....Grounding and Bonding Equipment

651-11.....Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings

651A-11.....Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit

PART 2 - PRODUCTS

2.1 PULLBOXES

A. General: Size as indicated on the drawings. Provide pullboxes with weatherproof, non-skid covers with recessed hook eyes, secured with corrosion- and tamper-resistant hardware. Cover material shall be identical to pullbox material. Covers shall have molded lettering, ELECTRIC or SIGNAL as applicable. Pullboxes shall comply with the requirements of ANSI 77 Tier 8 loading. Provide pulling irons, 22 mm (0.875 inch) diameter galvanized steel bar with exposed triangular-shaped opening.

B. Polymer Concrete Pullboxes: Shall be molded of sand, aggregate, and polymer resin, and reinforced with steel, fiberglass, or both. Pullbox shall have open bottom.

2.2 DUCTS

A. Number and sizes shall be as shown on the drawings.

B. Ducts (concrete-encased):

1. Plastic Duct:

a. UL 651 and 651A Schedule 40 PVC conduit.

b. Duct shall be suitable for use with 90˚ C (194˚ F) rated conductors.

2. Conduit Spacers: Prefabricated plastic.

C. Ducts (direct-burial):

1. Plastic duct:

a. Schedule 40 PVC or HDPE conduit.

b. Duct shall be suitable for use with 75˚ C (167˚ F) rated conductors.

2. Rigid metal conduit: UL 6 and NEMA RN1 galvanized rigid metal, half-lap wrapped with 10 mil PVC tape.

2.3 GROUNDING

A. Ground Rods and Ground Wire: Per Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

2.4 WARNING TAPE

A. 4-mil polyethylene 75 mm (3 inches) wide detectable tape, red with black letters, imprinted with "CAUTION - BURIED ELECTRIC CABLE BELOW" or similar.

2.5 PULL ROPE FOR SPARE DUCTS

A. Plastic with 890 N (200 lb) minimum tensile strength.

PART 3 - EXECUTION

3.1 TRENCHING

A. Refer to Section 31 20 00, EARTH MOVING for trenching, backfilling, and compaction.

B. Before performing trenching work at existing facilities, a Ground Penetrating Radar Survey shall be carefully performed by a certified technician to reveal all existing underground ducts, conduits, cables, and other utility systems.

C. Work with extreme care near existing ducts, conduits, and other utilities to avoid damaging them.

D. Cut the trenches neatly and uniformly.

E. For Concrete-Encased Ducts:

1. After excavation of the trench, stakes shall be driven in the bottom of the trench at 1.2 M (4 feet) intervals to establish the grade and route of the duct bank.
2. Pitch the trenches uniformly toward manholes or both ways from high points between manholes for the required duct line drainage. Avoid pitching the ducts toward buildings wherever possible.
3. The walls of the trench shall be used to form the side walls of the duct bank, provided that the soil is self-supporting and that the concrete envelope can be poured without soil inclusions. Forms are required where the soil is not self-supporting.
4. After the concrete-encased duct has sufficiently cured, the trench shall be backfilled to grade with earth, and appropriate warning tape installed.

F. Individual conduits to be installed under existing paved areas and roads that cannot be disturbed shall be jacked into place using rigid

metal conduit, or bored using plastic utilities duct or PVC conduit, as approved by the COR.

G. Existing utilities encountered during excavation work shall be protected in a manner acceptable to the utility owner. Any utilities that are damaged shall be repaired or replaced by this Contractor to the full satisfaction of the utility owner.

3.2 DUCT INSTALLATION

A. General Requirements:

1. Ducts shall be in accordance with the NEC, as shown on the drawings, and as specified.
2. Join and terminate ducts with fittings recommended by the manufacturer.
3. Slope ducts to drain towards manholes and pullboxes, and away from building and equipment entrances. Pitch not less than 100 mm (4 inches) in 30 M (100 feet).
4. Underground conduit stub-ups and sweeps to equipment inside of buildings shall be galvanized rigid metal conduit half-lap wrapped with PVC tape, and shall extend a minimum of 1.5 M (5 feet) outside the building foundation. Tops of conduits below building slab shall be minimum 610 mm (24 inches) below bottom of slab.
5. Stub-ups and sweeps to equipment mounted on outdoor concrete slabs shall be galvanized rigid metal conduit half-lap wrapped with PVC tape, and shall extend a minimum of 1.5 M (5 feet) away from the edge of slab.
6. Install insulated grounding bushings on the conduit terminations.
7. Radius for sweeps shall be sufficient to accomplish pulls without damage. Minimum radius shall be six times conduit diameter.
8. All multiple conduit runs shall have conduit spacers. Spacers shall securely support and maintain uniform spacing of the duct assembly a minimum of 75 mm (3 inches) above the bottom of the trench during the concrete pour. Spacer spacing shall not exceed 1.5 M (5 feet). Secure spacers to ducts and earth to prevent floating during concrete pour. Provide nonferrous tie wires to prevent displacement of the ducts during concrete pour. Tie wires shall not act as substitute for spacers.
9. Duct lines shall be installed no less than 300 mm (12 inches) from other utility systems, such as water, sewer, chilled water.

10. Clearances between individual ducts:
    a. For similar services, not less than 75 mm (3 inches).
    b. For power and signal services, not less than 150 mm (6 inches).
11. Duct lines shall terminate at window openings in manhole walls as shown on the drawings. All ducts shall be fitted with end bells.
12. Couple the ducts with proper couplings. Stagger couplings in rows and layers to ensure maximum strength and rigidity of the duct bank.
13. Keep ducts clean of earth, sand, or gravel, and seal with tapered plugs upon completion of each portion of the work.
14. Spare Ducts: Where spare ducts are shown, they shall have a nylon pull rope installed. They shall be capped at each end and labeled as to location of the other end.
15. Duct Identification: Place continuous strip of warning tape approximately 300 mm (12 inches) above ducts before backfilling trenches. Warning tape shall be preprinted with proper identification.
16. Duct Sealing: Seal ducts, including spare ducts, at building entrances and at outdoor terminations for equipment, with a suitable non-hardening compound to prevent the entrance of foreign objects and material, moisture, and gases.
17. Use plastic ties to secure cables to insulators on cable arms. Use minimum two ties per cable per insulator.

B. Concrete-Encased Ducts:
1. Install concrete-encased ducts for medium-voltage systems, low-voltage systems, and signal systems, unless otherwise shown on the drawings.
2. Duct banks shall be single or multiple duct assemblies encased in concrete. Ducts shall be uniform in size and material throughout the installation.
3. Tops of concrete-encased ducts shall be:
    a. Not less than 600 mm (24 inches) and not less than shown on the drawings, below finished grade.
    b. Not less than 750 mm (30 inches) and not less than shown on the drawings, below roads and other paved surfaces.
    c. Additional burial depth shall be required in order to accomplish NEC-required minimum bend radius of ducts.

d. Conduits crossing under grade slab construction joints shall be installed a minimum of 1.2 M (4 feet) below slab.

4. Extend the concrete envelope encasing the ducts not less than 75 mm (3 inches) beyond the outside walls of the outer ducts.
5. Within 3 M (10 feet} of building and manhole wall penetrations, install reinforcing steel bars at the top and bottom of each concrete envelope to provide protection against vertical shearing.
6. Install reinforcing steel bars at the top and bottom of each concrete envelope of all ducts underneath roadways and parking areas.
7. Where new ducts and concrete envelopes shall be joined to existing manholes, pullboxes, ducts, and concrete envelopes, make the joints with the proper fittings and fabricate the concrete envelopes to ensure smooth durable transitions.
8. Duct joints in concrete shall be placed side by side horizontally, but shall be staggered at least 150 mm (6 inches) vertically.
9. Pour each run of concrete envelope between manholes or other terminations in one continuous pour. If more than one pour is necessary, terminate each pour in a vertical plane and install 19 mm (0.75 inch) reinforcing rod dowels extending 450 mm (18 inches) into concrete on both sides of joint near corners of envelope.
10. Pour concrete so that open spaces are uniformly filled. Do not agitate with power equipment unless approved by COR.

C. Connections to Manholes: Ducts connecting to manholes shall be flared to have an enlarged cross-section to provide additional shear strength. Dimensions of the flared cross-section shall be larger than the corresponding manhole opening dimensions by no less than 300 mm (12 inches) in each direction. Perimeter of the duct bank opening in the manhole shall be flared toward the inside or keyed to provide a positive interlock between the duct and the wall of the manhole. Use vibrators when this portion of the encasement is poured to ensure a seal between the envelope and the wall of the structure.

D. Connections to Existing Manholes: For duct connections to existing manholes, break the structure wall out to the dimensions required and preserve the 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.

E. Connections to Existing Ducts: Where connections to existing ducts are indicated, excavate around the ducts as necessary. Cut off the ducts and remove loose concrete from inside before installing new ducts. Provide a reinforced-concrete collar, poured monolithically with the new ducts, to take the shear at the joint of the duct banks.

F. Partially-Completed Ducts: During construction, wherever a construction joint is necessary in a duct bank, prevent debris such as mud and dirt from entering ducts by providing suitable plugs. Fit concrete envelope of a partially completed ducts with reinforcing steel extending a minimum of 600 mm (2 feet) back into the envelope and a minimum of 600 mm (2 feet) beyond the end of the envelope. Provide one No. 4 bar in each corner, 75 mm (3 inches) from the edge of the envelope. Secure corner bars with two No. 3 ties, spaced approximately 300 mm (12 inches) apart. Restrain reinforcing assembly from moving during pouring of concrete.

3.3 ACCEPTANCE CHECKS AND TESTS

A. Duct Testing and Cleaning:

1. Upon completion of the duct installation, a standard flexible mandrel shall be pulled through each duct to loosen particles of earth, sand, or foreign material left in the duct, and to test for out-of-round conditions.
2. The mandrel shall be not less than 300 mm (12 inches) long, and shall have a diameter not less than 13 mm (0.5 inch) less than the inside diameter of the duct. A brush with stiff bristles shall then be pulled through each duct to remove the loosened particles. The diameter of the brush shall be the same as, or slightly larger than, the diameter of the duct.
3. If testing reveals obstructions or out-of-round conditions, the Contractor shall replace affected section(s) of duct and retest to the satisfaction of the COR.
4. Mandrel pulls shall be witnessed by the COR.

---END---

SECTION 26 22 00
LOW-VOLTAGE TRANSFORMERS

PART 1 – GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of low-voltage dry-type general-purpose transformers, indicated as transformers in this section.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS.

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:
   a. Submit sufficient information to demonstrate compliance with drawings and specifications.
   b. Include electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, temperature rise, wiring and connection diagrams, plan, front, side, and rear elevations, accessories, and device nameplate data.
2. Manuals:
   a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals including technical data sheets and wiring diagrams.
      1) Schematic signal and control diagrams, with all terminals identified, matching terminal identification in the transformers.

2) Include information for testing, repair, troubleshooting, assembly, disassembly, and factory recommended/required periodic maintenance procedures and frequency.

b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.

3. Certifications: Two weeks prior to final inspection, submit the following.

a. Certification by the manufacturer that the transformers conform to the requirements of the drawings and specifications.

b. Certification by the Contractor that the transformers have been properly installed, adjusted, and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. International Code Council (ICC):
IBC-15.....International Building Code

C. National Fire Protection Association (NFPA):
70-17.....National Electrical Code (NEC)

D. National Electrical Manufacturers Association (NEMA):
TR 1-13.....Transformers, Step Voltage Regulators and Reactors
ST 20-14.....Dry Type Transformers for General Applications

E. Underwriters Laboratories, Inc. (UL):
UL 506-17.....Standard for Specialty Transformers
UL 1561-11.....Dry-Type General Purpose and Power Transformers

F. United States Department of Energy:
10 CFR Part 431.....Energy Efficiency Program for Certain Commercial and Industrial Equipment

PART 2 - PRODUCTS

2.1 TRANSFORMERS

A. Unless otherwise specified, transformers shall be in accordance with NEMA, NFPA, UL and as shown on the drawings.

B. Transformers shall have the following features:

1. Self-cooled by natural convection, isolating windings, indoor dry-type. Autotransformers shall not be accepted, except as specifically allowed for buck-boost applications.
2. Rating and winding connections shall be as shown on the drawings.
3. Ratings shown on the drawings are for continuous duty without the use of cooling fans.
4. Copper windings.
5. Insulation systems:
   a. Transformers 30 kVA and larger: UL rated 220 °C (428 °F) system with an average maximum rise by resistance of 150 °C (302 °F) in a maximum ambient of 40 °C (104 °F).
   b. Transformers below 30 kVA: Same as for 30 kVA and larger or UL rated 185 °C (365 °F) system with an average maximum rise by resistance of 115 °C (239 °F) in a maximum ambient of 40 °C (104 °F).
6. Core and coil assemblies:
   a. Rigidly braced to withstand the stresses caused by short-circuit currents and rough handling during shipment.
   b. Cores shall be grain-oriented, non-aging, and silicon steel.
   c. Coils shall be continuous windings without splices except for taps.
   d. Coil loss and core loss shall be minimized for efficient operation.
   e. Primary and secondary tap connections shall be brazed or pressure type.
   f. Coil windings shall have end filters or tie-downs for maximum strength.
7. Average audible sound levels shall comply with NEMA.
8. If not shown on drawings, nominal impedance shall be as permitted by NEMA.
9. Single phase transformers rated 15 kVA through 25 kVA shall have two 5% full capacity taps below normal rated primary voltage. All transformers rated 30 kVA and larger shall have two 2.5% full capacity taps above, and four 2.5% full capacity taps below normal rated primary voltage.
10. Core assemblies shall be grounded to their enclosures with adequate flexible ground straps.

11. Enclosures:
    a. Comprised of not less than code gauge steel.
    b. Outdoor enclosures shall be NEMA 3R.
    c. Temperature rise at hottest spot shall conform to NEMA Standards, and shall not bake and peel off the enclosure paint after the transformer has been placed in service.
    d. Ventilation openings shall prevent accidental access to live components.
    e. The enclosure at the factory shall be thoroughly cleaned and painted with manufacturer's prime coat and standard finish.
12. Standard NEMA features and accessories, including ground pad, lifting provisions, and nameplate with the wiring diagram and sound level indicated.
13. Dimensions and configurations shall conform to the spaces designated for their installations.
14. Transformers shall meet the energy conservation standards for transformers per the United States Department of Energy’s 10 CFR Part 431.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation of transformers shall be in accordance with the NEC, as recommended by the equipment manufacturer and as shown on the drawings.
B. Anchor transformers with rustproof bolts, nuts, and washers, in accordance with manufacturer’s instructions, and as shown on drawings.
C. Install transformers with manufacturer's recommended clearance from wall and adjacent equipment for air circulation. Minimum clearance shall be 150 mm (6 inches).
D. Install transformers on vibration pads designed to suppress transformer noise and vibrations.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform tests in accordance with the manufacturer's recommendations. In addition, include the following:
    1. Visual Inspection and Tests:
        a. Compare equipment nameplate data with specifications and approved shop drawings.
        b. Inspect physical and mechanical condition.

c. Inspect all field-installed bolted electrical connections, using the calibrated torque-wrench method to verify tightness of accessible bolted electrical connections.

d. Perform specific inspections and mechanical tests as recommended by manufacturer.

e. Verify correct equipment grounding.

f. Verify proper secondary phase-to-phase and phase-to-neutral voltage after energization and prior to connection to loads.

3.3 FOLLOW-UP VERIFICATION

A. Upon completion of acceptance checks, settings, and tests, the contractor shall demonstrate that the transformers are in good operating condition, and properly performing the intended function.

---END---

SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, and connection of panelboards.

1.2 RELATED WORK

A. Section 09 91 00, PAINTING: Painting of panelboards.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

C. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path for possible ground fault currents.

E. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduits.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:
   a. Submit sufficient information to demonstrate compliance with drawings and specifications.
   b. Include electrical ratings, dimensions, mounting details, materials, required clearances, terminations, weight, circuit breakers, wiring and connection diagrams, accessories, and nameplate data.

2. Manuals:
   a. Submit, simultaneously with the shop drawings, complete maintenance and operating manuals including technical data sheets, wiring diagrams, and information for ordering circuit breakers and replacement parts.

1) Include schematic diagrams, with all terminals identified, matching terminal identification in the panelboards.
2) Include information for testing, repair, troubleshooting, assembly, and disassembly.

b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.

3. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the manufacturer that the panelboards conform to the requirements of the drawings and specifications.
   b. Certification by the Contractor that the panelboards have been properly installed, adjusted, and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. International Code Council (ICC):
IBC-15.....International Building Code

C. National Electrical Manufacturers Association (NEMA):
PB 1-11.....Panelboards
250-14.....Enclosures for Electrical Equipment (1,000V Maximum)

D. National Fire Protection Association (NFPA):
70-17.....National Electrical Code (NEC)
70E-18.....Standard for Electrical Safety in the Workplace

E. Underwriters Laboratories, Inc. (UL):
50-15.....Enclosures for Electrical Equipment
67-09.....Panelboards
489-16.....Molded Case Circuit Breakers and Circuit Breaker Enclosures

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Panelboards shall be in accordance with NEC, NEMA, UL, as specified, and as shown on the drawings.

B. Panelboards shall have main breaker or main lugs, bus size, voltage, phases, number of circuit breaker mounting spaces, top or bottom feed, flush or surface mounting, branch circuit breakers, and accessories as shown on the drawings.

C. Panelboards shall be completely factory-assembled with molded case circuit breakers and integral accessories as shown on the drawings or specified herein.

D. Non-reduced size copper bus bars, rigidly supported on molded insulators, and fabricated for bolt-on type circuit breakers.

E. Bus bar connections to the branch circuit breakers shall be the "distributed phase" or "phase sequence" type.

F. Mechanical lugs furnished with panelboards shall be cast, stamped, or machined metal alloys listed for use with the conductors to which they shall be connected.

G. Neutral bus shall be 100rated, mounted on insulated supports.

H. Grounding bus bar shall be equipped with screws or lugs for the connection of equipment grounding conductors.

I. Bus bars shall be braced for the available short-circuit current as shown on the drawings, but not be less than 10,000 A symmetrical for 120/208 V and 120/240 V panelboards, and 14,000 A symmetrical for 277/480 V panelboards.

J. In two-section panelboards, the main bus in each section shall be full size. The first section shall be furnished with subfeed lugs on the line side of main lugs only, or through-feed lugs for main breaker type panelboards, and have field-installed cable connections to the second section as shown on the drawings. Panelboard sections with tapped bus or crossover bus are not acceptable.

K. Series-rated panelboards are not permitted.

2.2 ENCLOSURES AND TRIMS

A. Enclosures:

1. Provide galvanized steel enclosures, with NEMA rating as shown on the drawings or as required for the environmental conditions in which installed.
2. Enclosures shall not have ventilating openings.
3. Enclosures shall be of one-piece formed steel or of formed sheet steel with end and side panels welded, riveted, or bolted as required.

4. Provide manufacturer's standard option for prepunched knockouts on top and bottom endwalls.
5. Include removable inner dead front cover, independent of the panelboard cover.

B. Trims:
1. Hinged "door-in-door" type.
2. Interior hinged door with hand-operated latch or latches, as required to provide access only to circuit breaker operating handles, not to energized parts.
3. Outer hinged door shall be securely mounted to the panelboard enclosure with factory bolts, screws, clips, or other fasteners, requiring a key or tool for entry. Hand-operated latches are not acceptable.
4. Inner and outer doors shall open left to right.
5. Trims shall be flush or surface type as shown on the drawings.

2.3 MOLDED CASE CIRCUIT BREAKERS

A. Circuit breakers shall be per UL, NEC, as shown on the drawings, and as specified.
B. Circuit breakers shall be bolt-on type.
C. Circuit breakers shall have minimum interrupting rating as required to withstand the available fault current, but not less than:
1. 120/208 V Panelboard: 10,000 A symmetrical.
2. 120/240 V Panelboard: 10,000 A symmetrical.
3. 277/480 V Panelboard: 14,000 A symmetrical.

C. Circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips for less than 400 A frame. Circuit breakers with 400 A frames and above shall have magnetic trip, adjustable from 5x to 10x. Breaker magnetic trip setting shall be set to maximum, unless otherwise noted.
D. Circuit breaker features shall be as follows:
1. A rugged, integral housing of molded insulating material.
2. Silver alloy contacts.
3. Arc quenchers and phase barriers for each pole.
4. Quick-make, quick-break, operating mechanisms.
5. A trip element for each pole, thermal magnetic type with long time delay and instantaneous characteristics, a common trip bar for all poles and a single operator.

6. Electrically and mechanically trip free.
7. An operating handle which indicates closed, tripped, and open positions.
8. An overload on one pole of a multi-pole breaker shall automatically cause all the poles of the breaker to open.
9. Ground fault current interrupting breakers, shunt trip breakers, lighting control breakers (including accessories to switch line currents), or other accessory devices or functions shall be provided where shown on the drawings.
10. For circuit breakers being added to existing panelboards, coordinate the breaker type with existing panelboards. Modify the panel directory accordingly.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the manufacturer’s instructions, the NEC, as shown on the drawings, and as specified.
B. Locate panelboards so that the present and future conduits can be conveniently connected.
C. Install a printed schedule of circuits in each panelboard after approval by the COR. Schedules shall reflect final load descriptions, room numbers, and room names connected to each circuit breaker. Schedules shall be printed on the panelboard directory cards and be installed in the appropriate panelboards
D. Mount panelboards such that the maximum height of the top circuit breaker above the finished floor shall not exceed 1980 mm (78 inches).
E. Provide blank cover for each unused circuit breaker mounting space.
F. Panelboard enclosures shall not be used for conductors feeding through, spliced, or tapping off to other enclosures or devices.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform in accordance with the manufacturer's recommendations. In addition, include the following:
   1. Visual Inspection and Tests:
      a. Compare equipment nameplate data with specifications and approved shop drawings.
      b. Inspect physical, electrical, and mechanical condition.
      c. Verify appropriate anchorage and required area clearances.

d. Verify that circuit breaker sizes and types correspond to approved shop drawings.

e. To verify tightness of accessible bolted electrical connections, use the calibrated torque-wrench method or perform thermographic survey after energization.

f. Vacuum-clean enclosure interior. Clean enclosure exterior.

3.3 FOLLOW-UP VERIFICATION

A. Upon completion of acceptance checks, settings, and tests, the Contractor shall demonstrate that the panelboards are in good operating condition and properly performing the intended function.

---END---

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies the furnishing, installation, connection, and testing of wiring devices.

1.2 RELATED WORK

A. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: General electrical requirements that are common to more than one section of Division 26.

B. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Cables and wiring.

C. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

D. Section 26 05 33, RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS: Conduit and boxes.

E. Section 26 51 00, INTERIOR LIGHTING: Fluorescent ballasts and LED drivers for use with manual dimming controls.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:
   a. Submit sufficient information to demonstrate compliance with drawings and specifications.
   b. Include electrical ratings, dimensions, mounting details, construction materials, grade, and termination information.
2. Manuals:
   a. Submit, simultaneously with the shop drawings, companion copies of complete maintenance and operating manuals, including technical data sheets and information for ordering replacement parts.

b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.

3. Certifications: Two weeks prior to final inspection, submit the following.
   a. Certification by the manufacturer that the wiring devices conform to the requirements of the drawings and specifications.
   b. Certification by the Contractor that the wiring devices have been properly installed and adjusted.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by basic designation only.

B. National Electrical Manufacturers Association (NEMA):
WD 1-99(R2015).....General Color Requirements for Wiring Devices
WD 6-16 .....Wiring Devices – Dimensional Specifications

C. National Fire Protection Association (NFPA):
70-17.....National Electrical Code (NEC)
99-18.....Health Care Facilities

D. Underwriter’s Laboratories, Inc. (UL):
5-16.....Surface Metal Raceways and Fittings
20-10.....General-Use Snap Switches
231-16.....Power Outlets
467-13.....Grounding and Bonding Equipment
498-17.....Attachment Plugs and Receptacles
943-16.....Ground-Fault Circuit-Interrupters
1449-14.....Surge Protective Devices
1472-15.....Solid State Dimming Controls

PART 2 - PRODUCTS

2.1 RECEPTACLES

A. General: All receptacles shall comply with NEMA, NFPA, UL, and as shown on the drawings.
   1. Mounting straps shall be nickel plated brass, brass, nickel plated steel or galvanize steel with break-off plaster ears, and shall include a self-grounding feature. Terminal screws shall be brass, brass plated or a copper alloy metal.

2. Receptacles shall have provisions for back wiring with separate metal clamp type terminals (four minimum) and side wiring from four captively held binding screws.

B. Duplex Receptacles – Non-hospital Grade.

1. Bodies shall be ivory nylon, red if on an emergency circuit.

C. Receptacles - 20, 30, and 50 ampere, 250 Volts: Shall be complete with appropriate cord grip plug.

D. Weatherproof Receptacles: Shall consist of a duplex receptacle, mounted in box with a gasketed, weatherproof, cast metal cover plate and cap over each receptacle opening. The cap shall be permanently attached to the cover plate by a spring-hinged flap. The weatherproof integrity shall not be affected when heavy duty specification or hospital grade attachment plug caps are inserted. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner.

2.2 TOGGLE SWITCHES

A. Toggle switches shall be totally enclosed tumbler type with nylon bodies. Handles shall be ivory in color unless otherwise specified or shown on the drawings.

1. Switches installed in hazardous areas shall be explosion-proof type in accordance with the NEC and as shown on the drawings.
2. Shall be single unit toggle, butt contact, quiet AC type, heavy-duty general-purpose use with an integral self grounding mounting strap with break-off plasters ears and provisions for back wiring with separate metal wiring clamps and side wiring with captively held binding screws.
3. Switches shall be rated 20 amperes at 120-277 Volts AC.

2.4 WALL PLATES

A. Wall plates for switches and receptacles shall be type 302 stainless steel. Oversize plates are not acceptable.

B. For receptacles or switches mounted adjacent to each other, wall plates shall be common for each group of receptacles or switches.

C. In areas requiring tamperproof wiring devices, wall plates shall be type 302 stainless steel, and shall have tamperproof screws and beveled edges.

D. Duplex Receptacles on Emergency Circuit: Wall plates shall be type 302 stainless steel.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC and as shown as on the drawings.

B. Install wiring devices after wall construction and painting is complete.

C. The ground terminal of each wiring device shall be bonded to the outlet box with an approved green bonding jumper, and also connected to the branch circuit equipment grounding conductor.

D. Outlet boxes for toggle switches and manual dimming controls shall be mounted on the strike side of doors.

E. Provide barriers in multi-gang outlet boxes to comply with the NEC.

F. Coordinate the electrical work with the work of other trades to ensure that wiring device flush outlets are positioned with box openings aligned with the face of the surrounding finish material. Pay special attention to installations in cabinet work, and in connection with laboratory equipment.

G. Exact field locations of floors, walls, partitions, doors, windows, and equipment may vary from locations shown on the drawings. Prior to locating sleeves, boxes and chases for roughing-in of conduit and equipment, the Contractor shall coordinate exact field location of the above items with other trades.

H. Install wall switches 1.2 M (46 inches) above floor, with the toggle OFF position down.

I. Install wall dimmers 1.2 M (46 inches) above floor.

J. Install receptacles 450 mm (18 inches) above floor, and 152 mm (6 inches) above counter backsplash or workbenches. Install specific-use receptacles at heights shown on the drawings.

K. Install horizontally mounted receptacles with the ground pin to the right.

L. When required or recommended by the manufacturer, use a torque screwdriver. Tighten unused terminal screws.

M. Label device plates with a permanent adhesive label listing panel and circuit feeding the wiring device.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform manufacturer’s required field checks in accordance with the manufacturer's recommendations, and the latest NFPA 99. In addition, include the following:

1. Visual Inspection and Tests:
   a. Inspect physical and electrical conditions.
   b. Vacuum-clean surface metal raceway interior. Clean metal raceway exterior.
   c. Test wiring devices for damaged conductors, high circuit resistance, poor connections, inadequate fault current path, defective devices, or similar problems using a portable receptacle tester. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.
   d. Test GFCI receptacles.

---END---

SECTION 26 51 00
INTERIOR LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION:

A. This section specifies the furnishing, installation, and connection of the interior lighting systems. The terms "lighting fixture," "fixture," and "luminaire" are used interchangeably.

1.2 RELATED WORK

A. Section 01 74 19, CONSTRUCTION WASTE MANAGEMENT: Disposal of lamps.

B. Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS: Requirements that apply to all sections of Division 26.

C. Section 26 05 19, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES: Low-voltage conductors.

D. Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS: Requirements for personnel safety and to provide a low impedance path to ground for possible ground fault currents.

E. Section 26 27 26, WIRING DEVICES: Wiring devices used for control of the lighting systems.

1.3 QUALITY ASSURANCE

A. Quality Assurance shall be in accordance with Paragraph, QUALIFICATIONS (PRODUCTS AND SERVICES) in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.4 SUBMITTALS

A. Submit in accordance with Paragraph, SUBMITTALS in Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS, and the following requirements:

1. Shop Drawings:
   a. Submit the following information for each type of lighting fixture designated on the LIGHTING FIXTURE SCHEDULE, arranged in order of lighting fixture designation.
   b. Material and construction details, include information on housing and optics system.
   c. Physical dimensions and description.
   d. Wiring schematic and connection diagram.
   e. Installation details.
   f. Energy efficiency data.

g. Photometric data based on laboratory tests complying with IES Lighting Measurements testing and calculation guides.

h. Lamp data including lumen output (initial and mean), color rendition index (CRI), rated life (hours), and color temperature (degrees Kelvin).

i. For LED lighting fixtures, submit US DOE LED Lighting Facts label, and IES L70 rated life.

2. Manuals:

a. Submit, simultaneously with the shop drawings, complete maintenance and operating manuals, including technical data sheets, wiring diagrams, and information for ordering replacement parts.

b. If changes have been made to the maintenance and operating manuals originally submitted, submit updated maintenance and operating manuals two weeks prior to the final inspection.

3. Certifications: Two weeks prior to final inspection, submit the following.

a. Certification by the Contractor that the interior lighting systems have been properly installed and tested.

1.5 APPLICABLE PUBLICATIONS

A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form a part of this specification to the extent referenced. Publications are referenced in the text by designation only.

B. American Society for Testing and Materials (ASTM):
C635/C635M REV A-13.....Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings

C. Environmental Protection Agency (EPA):
40 CFR 261.....Identification and Listing of Hazardous Waste

D. Federal Communications Commission (FCC):
CFR Title 47, Part 15...Radio Frequency Devices
CFR Title 47, Part 18...Industrial, Scientific, and Medical Equipment

E. Illuminating Engineering Society of North America (IESNA):
LM-79-08.....Electrical and Photometric Measurements of Solid-State Lighting Products

LM-80-15.....Measuring Lumen Maintenance of LED Light Sources

LM-82-12.....Characterization of LED Light Engines and LED Lamps for Electrical and Photometric Properties as a Function of Temperature

F. Institute of Electrical and Electronic Engineers (IEEE):

C62.41-91(R1995).....Surge Voltages in Low Voltage AC Power Circuits

G. International Code Council (ICC):

IBC-15.....International Building Code

H. National Electrical Manufacturer's Association (NEMA):

C78.376-14.....Chromaticity of Fluorescent Lamps

C82.1-04(R2015).....Lamp Ballasts – Line Frequency Fluorescent Lamp Ballasts

C82.2-02(R2016).....Method of Measurement of Fluorescent Lamp Ballasts

C82.4-17.....Lamp Ballasts - Ballasts for High-Intensity Discharge and Low-Pressure Sodium (LPS) Lamps (Multiple-Supply Type)

C82.11-17.....Lamp Ballasts - High Frequency Fluorescent Lamp Ballasts

LL 9-11.....Dimming of T8 Fluorescent Lighting Systems

SSL 1-16.....Electronic Drivers for LED Devices, Arrays, or Systems

I. National Fire Protection Association (NFPA):

70-17.....National Electrical Code (NEC)

101-18.....Life Safety Code

J. Underwriters Laboratories, Inc. (UL):

496-17.....Lampholders

542-05.....Fluorescent Lamp Starters

844-12.....Luminaires for Use in Hazardous (Classified) Locations

924-16.....Emergency Lighting and Power Equipment

935-01.....Fluorescent-Lamp Ballasts

1029-94.....High-Intensity-Discharge Lamp Ballasts

1029A-06.....Ignitors and Related Auxiliaries for HID Lamp Ballasts

1598-08.....Luminaires

1574-04.....Track Lighting Systems

2108-15.....Low-Voltage Lighting Systems

8750-15.....Light Emitting Diode (LED) Light Sources for Use in Lighting Products

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES

A. Shall be in accordance with NFPA, UL, as shown on drawings, and as specified.

B. Sheet Metal:

1. Shall be formed to prevent warping and sagging. Housing, trim and lens frame shall be true, straight (unless intentionally curved), and parallel to each other as designed.
2. Wireways and fittings shall be free of burrs and sharp edges, and shall accommodate internal and branch circuit wiring without damage to the wiring.
3. When installed, any exposed fixture housing surface, trim frame, door frame, and lens frame shall be free of light leaks.
4. Hinged door frames shall operate smoothly without binding. Latches shall function easily by finger action without the use of tools.

C. Lamps shall be serviceable while the fixture is in its normally installed position.

D. Recessed fixtures mounted in an insulated ceiling shall be listed for use in insulated ceilings.

E. Mechanical Safety: Lighting fixture closures (lens doors, trim frame, hinged housings) shall be retained in a secure manner by captive screws, chains, aircraft cable, captive hinges, or fasteners such that they cannot be accidentally dislodged during normal operation or routine maintenance.

F. Metal Finishes:

1. The manufacturer shall apply standard finish (unless otherwise specified) over a corrosion-resistant primer, after cleaning to free the metal surfaces of rust, grease, dirt and other deposits. Edges of pre-finished sheet metal exposed during forming, stamping or shearing processes shall be finished in a similar corrosion resistant manner to match the adjacent surface(s). Fixture finish shall be free of stains or evidence of rusting, blistering, or flaking, and shall be applied after fabrication.

2. Interior light reflecting finishes shall be white with not less than 85 percent reflectances, except where otherwise shown on the drawing.
3. Exterior finishes shall be as shown on the drawings.

G. Lighting fixtures shall have a specific means for grounding metallic wireways and housings to an equipment grounding conductor.

H. Light Transmitting Components for Fluorescent Fixtures:
1. Shall be 100 percent virgin acrylic.
2. Flat lens panels shall have not less than 3 mm (1/8 inch) of average thickness.
3. Unless otherwise specified, lenses, reflectors, diffusers, and louvers shall be retained firmly in a metal frame by clips or clamping ring in such a manner as to allow expansion and contraction without distortion or cracking.

I. Lighting fixtures in hazardous areas shall be suitable for installation in Class and Division areas as defined in NFPA 70.

2.2 EMERGENCY LIGHTING UNIT

A. Complete, self-contained unit with batteries, battery charger, one or more local or remote lamp heads with lamps, under-voltage relay, and test switch.
1. Enclosure: Shall be impact-resistant thermoplastic. Enclosure shall be suitable for the environmental conditions in which installed.
2. Lamp Heads: Horizontally and vertically adjustable, mounted on the face of the unit, except where otherwise indicated.
3. Lamps: Shall be sealed-beam MR-16 halogen, rated not less than 12 watts at the specified DC voltage.
4. Battery: Shall be maintenance-free nickel-cadmium. Minimum normal life shall be minimum of 10 years.
5. Battery Charger: Dry-type full-wave rectifier with charging rates to maintain the battery in fully-charged condition during normal operation, and to automatically recharge the battery within 12 hours following a 1-1/2 hour continuous discharge.
6. Integral Self-Test: Automatically initiates test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing LED.

2.3 LED EXIT LIGHT FIXTURES

A. Exit light fixtures shall meet applicable requirements of NFPA and UL.

B. Housing and door shall be die-cast aluminum.

C. For general purpose exit light fixtures, door frame shall be hinged, with latch. For vandal-resistant exit light fixtures, door frame shall be secured with tamper-resistant screws.

D. Finish shall be satin or fine-grain brushed aluminum.

E. There shall be no radioactive material used in the fixtures.

F. Fixtures:

1. Inscription panels shall be cast or stamped aluminum a minimum of 2.25 mm (0.090 inch) thick, stenciled with 150 mm (6 inch) high letters, baked with red color stable plastic or fiberglass. Lamps shall be luminous Light Emitting Diodes (LED) mounted in center of letters on red color stable plastic or fiberglass.
2. Double-Faced Fixtures: Provide double-faced fixtures where required or as shown on drawings.
3. Directional Arrows: Provide directional arrows as part of the inscription panel where required or as shown on drawings. Directional arrows shall be the "chevron-type" of similar size and width as the letters and meet the requirements of NFPA 101.

G. Voltage: Multi-voltage (120 – 277V).

2.4 LED LIGHT FIXTURES

A. General:

1. LED light fixtures shall be in accordance with IES, NFPA, UL, as shown on the drawings, and as specified.
2. LED light fixtures shall be Reduction of Hazardous Substances (RoHS)-compliant.
3. LED drivers shall include the following features unless otherwise indicated:
   a. Minimum efficiency: 85% at full load.
   b. Minimum Operating Ambient Temperature: -20˚ C. (-4˚ F.)
   c. Input Voltage: 120 - 277V (±10%) at 60 Hz.
   d. Integral short circuit, open circuit, and overload protection.
   e. Power Factor: ≥ 0.95.
   f. Total Harmonic Distortion: ≤ 20%.
   g. Comply with FCC 47 CFR Part 15.
4. LED modules shall include the following features unless otherwise indicated:
   a. Comply with IES LM-79 and LM-80 requirements.

b. Minimum CRI 80 and color temperature 3000˚ K unless otherwise specified in LIGHTING FIXTURE SCHEDULE.

c. Minimum Rated Life: 50,000 hours per IES L70.

d. Light output lumens as indicated in the LIGHTING FIXTURE SCHEDULE.

B. LED Downlights:

1. Housing, LED driver, and LED module shall be products of the same manufacturer.

C. LED Troffers:

1. LED drivers, modules, and reflector shall be accessible, serviceable, and replaceable from below the ceiling.

2. Housing, LED driver, and LED module shall be products of the same manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be in accordance with the NEC, manufacturer's instructions, and as shown on the drawings or specified.

B. Align, mount, and level the lighting fixtures uniformly.

C. Wall-mounted fixtures shall be attached to the studs in the walls, or to a 20 gauge metal backing plate that is attached to the studs in the walls. Lighting fixtures shall not be attached directly to gypsum board.

D. Lighting Fixture Supports:

1. Shall provide support for all of the fixtures. Supports shall be anchored to channels of the ceiling construction, to the structural slab or to structural members within a partition, or above a suspended ceiling.

2. Shall maintain the fixture positions after cleaning.

3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.

4. Hardware for recessed fixtures:

a. Where the suspended ceiling system is supported at the four corners of the fixture opening, hardware devices shall clamp the fixture to the ceiling system structural members, or plaster frame at not less than four points in such a manner as to resist spreading of the support members and safely lock the fixture into the ceiling system.

b. Where the suspended ceiling system is not supported at the four corners of the fixture opening, hardware devices shall independently support the fixture from the building structure at four points.

5. Hardware for surface mounting fixtures to suspended ceilings:
   a. In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than 6 mm (1/4 inch) secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs shall be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.
   b. In addition to being secured to any required outlet box, fixtures shall be bolted to ceiling structural members at four points spaced near the corners of each fixture. Pre-positioned 6 mm (1/4 inch) studs or threaded plaster inserts secured to ceiling structural members shall be used to bolt the fixtures to the ceiling. In lieu of the above, 6 mm (1/4 inch) toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.
6. Hardware for recessed lighting fixtures:
   a. All fixture mounting devices connecting fixtures to the ceiling system or building structure shall have a capacity for a horizontal force of 100 percent of the fixture weight and a vertical force of 400 percent of the fixture weight.
   b. Mounting devices shall clamp the fixture to the ceiling system structure (main grid runners or fixture framing cross runners) at four points in such a manner as to resist spreading of these supporting members. Each support point device shall utilize a screw or approved hardware to "lock" the fixture housing to the ceiling system, restraining the fixture from movement in any direction relative to the ceiling. The screw (size No. 10 minimum) or approved hardware shall pass through the ceiling member (T-bar, channel or spline), or it may extend over the

inside of the flange of the channel (or spline) that faces away from the fixture, in a manner that prevents any fixture movement.

c. In addition to the above, the following is required for fixtures exceeding 9 kg (20 pounds) in weight.

1) Where fixtures mounted in ASTM Standard C635 "Intermediate Duty" and "Heavy Duty" ceilings and weigh between 9 kg and 25 kg (20 pounds and 56 pounds), provide two 12 gauge safety hangers hung slack between diagonal corners of the fixture and the building structure.

2) Where fixtures weigh over 25 kg (56 pounds), they shall be independently supported from the building structure by approved hangers. Two-way angular bracing of hangers shall be provided to prevent lateral motion.

d. Where ceiling cross runners are installed for support of lighting fixtures, they shall have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.

7. Surface mounted lighting fixtures:

a. Fixtures shall be bolted against the ceiling independent of the outlet box at four points spaced near the corners of each unit. The bolts (or stud-clips) shall be minimum 6 mm (1/4 inch) bolt, secured to main ceiling runners and/or secured to cross runners. Non-turning studs may be attached to the main ceiling runners and cross runners with special non-friction clip devices designed for the purpose, provided they bolt through the runner, or are also secured to the building structure by 12 gauge safety hangers. Studs or bolts securing fixtures weighing in excess of 25 kg (56 pounds) shall be supported directly from the building structure.

b. Where ceiling cross runners are installed for support of lighting fixtures, they shall have a carrying capacity equal to that of the main ceiling runners and be rigidly secured to the main runners.

c. Fixtures less than 6.8 kg (15 pounds) in weight and occupying less than 3715 sq cm (two square feet) of ceiling area may, when designed for the purpose, be supported directly from the outlet box when all the following conditions are met.

1) Screws attaching the fixture to the outlet box pass through round holes (not key-hole slots) in the fixture body.
2) The outlet box is attached to a main ceiling runner (or cross runner) with approved hardware.
3) The outlet box is supported vertically from the building structure.

d. Fixtures mounted in open construction shall be secured directly to the building structure with approved bolting and clamping devices.

8. Single or double pendant-mounted lighting fixtures:
   a. Each stem shall be supported by an approved outlet box mounted swivel joint and canopy which holds the stem captive and provides spring load (or approved equivalent) dampening of fixture oscillations. Outlet box shall be supported vertically from the building structure.
9. Outlet boxes for support of lighting fixtures (where permitted) shall be secured directly to the building structure with approved devices or supported vertically in a hung ceiling from the building structure with a nine gauge wire hanger, and be secured by an approved device to a main ceiling runner or cross runner to prevent any horizontal movement relative to the ceiling.

E. Furnish and install the new lamps as specified for all lighting fixtures installed under this project, and for all existing lighting fixtures reused under this project.

F. The electrical and ceiling trades shall coordinate to ascertain that approved lighting fixtures are furnished in the proper sizes and installed with the proper devices (hangers, clips, trim frames, flanges), to match the ceiling system being installed.

G. Bond lighting fixtures to the grounding system as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

H. At completion of project, replace all defective components of the lighting fixtures at no cost to the Government.

3.2 ACCEPTANCE CHECKS AND TESTS

A. Perform the following:
   1. Visual Inspection:
      a. Verify proper operation by operating the lighting controls.

b. Visually inspect for damage to fixtures, lenses, reflectors, diffusers, and louvers. Clean fixtures, lenses, reflectors, diffusers, and louvers that have accumulated dust, dirt, or fingerprints during construction.

2. Electrical tests:

a. Exercise dimming components of the lighting fixtures over full range of dimming capability by operating the control devices(s) in the presence of the COR. Observe for visually detectable flicker over full dimming range, and replace defective components at no cost to the Government.

b. Burn-in all lamps that require specific aging period to operate properly, prior to occupancy by Government. Burn-in period to be 40 hours minimum, unless specifically recommended otherwise by the lamp manufacturer. Burn-in dimmed fluorescent and compact fluorescent lamps for at least 100 hours at full voltage, unless specifically recommended otherwise by the lamp manufacturer. Replace any lamps and ballasts which fail during burn-in.

3.3 FOLLOW-UP VERIFICATION

A. Upon completion of acceptance checks and tests, the Contractor shall show by demonstration in service that the lighting systems are in good operating condition and properly performing the intended function.

---END---

SECTION 27 05 11
REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section includes common requirements to communications installations and applies to all sections of Division 27.

B. Provide completely functioning communications systems.

C. Comply with VAAR 852.236.91 and FAR clause 52.236-21 in circumstance of a need for additional detail or conflict between drawings, specifications, reference standards or code.

1.2 REFERENCES

A. Abbreviations and Acronyms

1. Refer to http://www.cfm.va.gov/til/sdetail.asp for Division 00, ARCHITECTURAL ABBREVIATIONS.
2. Additional Abbreviations and Acronyms:

A	Ampere
AC	Alternating Current
AE	Architect and Engineer
AFF	Above Finished Floor
AHJ	Authority Having Jurisdiction
ANSI	American National Standards Institute
AWG	American Wire Gauge (refer to STP and UTP)
AWS	Advanced Wireless Services
BCT	Bonding Conductor for Telecommunications (also Telecommunications Bonding Conductor (TBC))
BDA	Bi-Directional Amplifier
BICSI	Building Industry Consulting Service International
BIM	Building Information Modeling
BOM	Bill of Materials
BTU	British Thermal Units
BUCR	Back-up Computer Room
BTS	Base Transceiver Station
CAD	AutoCAD
CBOPC	Community Based Out Patient Clinic

CBC	Coupled Bonding Conductor
CBOC	Community Based Out Patient Clinic (refer to CBOPC, OPC, VAMC)
CCS	TIP's Cross Connection System (refer to VCCS and HCCS)
CFE	Contractor Furnished Equipment
CFM	US Department of Veterans Affairs Office of Construction and Facilities Management
CFR	Consolidated Federal Regulations
CIO	Communication Information Officer (Facility, VISN or Region)
cm	Centimeters
CO	Central Office
COR	Contracting Officer Representative
CPU	Central Processing Unit
CSU	Customer Service Unit
CUP	Conditional Use Permit(s) - Federal/GSA for VA
dB	Decibel
dBm	Decibel Measured
dBmV	Decibel per milli-Volt
DC	Direct Current
DEA	United States Drug Enforcement Administration
DSU	Data Service Unit
EBC	Equipment Bonding Conductor
ECC	Engineering Control Center (refer to DCR, EMCR)
EDGE	Enhanced Data (Rates) for GSM Evolution
EDM	Electrical Design Manual
EMCR	Emergency Management Control Room (refer to DCR, ECC)
EMI	Electromagnetic Interference (refer to RFI)
EMS	Emergency Medical Service
EMT	Electrical Metallic Tubing or thin wall conduit
ENTR	Utilities Entrance Location (refer to DEMARC, POTS, LEC)

EPBX	Electronic Digital Private Branch Exchange
ESR	Vendor's Engineering Service Report
FA	Fire Alarm
FAR	Federal Acquisition Regulations in Chapter 1 of Title 48 of Code of Federal Regulations
FMS	VA's Headquarters or Medical Center Facility's Management Service
FR	Frequency (refer to RF)
FTS	Federal Telephone Service
GFE	Government Furnished Equipment
GPS	Global Positioning System
GRC	Galvanized Rigid Metal Conduit
GSM	Global System (Station) for Mobile
HCCS	TIP's Horizontal Cross Connection System (refer to CCS & VCCS)
HDPE	High Density Polyethylene Conduit
HDTV	Advanced Television Standards Committee High-Definition Digital Television
HEC	Head End Cabinets(refer to HEIC, PA)
HEIC	Head End Interface Cabinets(refer to HEC, PA)
HF	High Frequency (Radio Band; Re FR, RF, VHF & UHF)
HSPA	High Speed Packet Access
HZ	Hertz
IBT	Intersystem Bonding Termination (NEC 250.94)
IC	Intercom
ICRA	Infectious Control Risk Assessment
IDEN	Integrated Digital Enhanced Network
IDC	Insulation Displacement Contact
IDF	Intermediate Distribution Frame
ILSM	Interim Life Safety Measures
IMC	Rigid Intermediate Steel Conduit
IRM	Department of Veterans Affairs Office of Information Resources Management

ISDN	Integrated Services Digital Network
ISM	Industrial, Scientific, Medical
IWS	Intra-Building Wireless System
LAN	Local Area Network
LBS	Location Based Services, Leased Based Systems
LEC	Local Exchange Carrier (refer to DEMARC, PBX & POTS)
LED	Light Emitting Diode
LMR	Land Mobile Radio
LTE	Long Term Evolution, or 4G Standard for Wireless Data Communications Technology
M	Meter
MAS	Medical Administration Service
MATV	Master Antenna Television
MCR	Main Computer Room
MCOR	Main Computer Operators Room
MDF	Main Distribution Frame
MH	Manholes or Maintenance Holes
MHz	Megaherts (10^6 Hz)
mm	Millimeter
MOU	Memorandum of Understanding
MW	Microwave (RF Band, Equipment or Services)
NID	Network Interface Device (refer to DEMARC)
NEC	National Electric Code
NOR	Network Operations Room
NRTL	OSHA Nationally Recognized Testing Laboratory
NS	Nurse Stations
NTIA	U.S. Department of Commerce National Telecommunications and Information Administration
OEM	Original Equipment Manufacturer
OI&T	Office of Information and Technology
OPC	VA’s Outpatient Clinic (refer to CBOC, VAMC)
OSH	Department of Veterans Affairs Office of Occupational Safety and Health

OSHA	United States Department of Labor Occupational Safety and Health Administration
OTDR	Optical Time-Domain Reflectometer
PA	Public Address System (refer to HE, HEIC, RPEC)
PBX	Private Branch Exchange (refer to DEMARC, LEC, POTS)
PCR	Police Control Room (refer to SPCC, could be designated SCC)
PCS	Personal Communications Service (refer to UPCS)
PE	Professional Engineer
PM	Project Manager
PoE	Power over Ethernet
POTS	Plain Old Telephone Service (refer to DEMARC, LEC, PBX)
PSTN	Public Switched Telephone Network
PSRAS	Public Safety Radio Amplification Systems
PTS	Pay Telephone Station
PVC	Poly-Vinyl Chloride
PWR	Power (in Watts)
RAN	Radio Access Network
RBB	Rack Bonding Busbar
RF	Radio Frequency (refer to FR)
RFI	Radio Frequency Interference (refer to EMI)
RFID	RF Identification (Equipment, System or Personnel)
RMC	Rigid Metal Conduit
RMU	Rack Mounting Unit
RPEC	Radio Paging Equipment Cabinets(refer to HEC, HEIC, PA)
RTLS	Real Time Location Service or System
RUS	Rural Utilities Service
SCC	Security Control Console (refer to PCR, SPCC)
SMCS	Spectrum Management and Communications Security (COMSEC)
SFO	Solicitation for Offers

SME	Subject Matter Experts (refer to AHJ)
SMR	Specialized Mobile Radio
SMS	Security Management System
SNMP	Simple Network Management Protocol
SPCC	Security Police Control Center (refer to PCR, SMS)
STP	Shielded Balanced Twisted Pair (refer to UTP)
STR	Stacked Telecommunications Room
TAC	VA's Technology Acquisition Center, Austin, Texas
TCO	Telecommunications Outlet
TER	Telephone Equipment Room
TGB	Telecommunications Grounding Busbar (also Secondary Bonding Busbar (SBB))
TIP	Telecommunications Infrastructure Plant
TMGB	Telecommunications Main Grounding Busbar (also Primary Bonding Busbar (PBB))
TMS	Traffic Management System
TOR	Telephone Operators Room
TP	Balanced Twisted Pair (refer to STP and UTP)
TR	Telecommunications Room (refer to STR)
TWP	Twisted Pair
UHF	Ultra High Frequency (Radio)
UMTS	Universal Mobile Telecommunications System
UPCS	Unlicensed Personal Communications Service (refer to PCS)
UPS	Uninterruptible Power Supply
USC	United States Code
UTP	Unshielded Balanced Twisted Pair (refer to TP and STP)
UV	Ultraviolet
V	Volts
VAAR	Veterans Affairs Acquisition Regulation
VACO	Veterans Affairs Central Office
VAMC	VA Medical Center (refer to CBOC, OPC, VACO)

VCCS	TIP's Vertical Cross Connection System (refer to CCS and HCCS)
VHF	Very High Frequency (Radio)
VISN	Veterans Integrated Services Network (refers to geographical region)
VSWR	Voltage Standing Wave Radio
W	Watts
WEB	World Electronic Broadcast
WiMAX	Worldwide Interoperability (for MW Access)
WI-FI	Wireless Fidelity
WMTS	Wireless Medical Telemetry Service
WSP	Wireless Service Providers

B. Definitions:

1. Access Floor: Pathway system of removable floor panels supported on adjustable pedestals to allow cable placement in area below.
2. BNC Connector (BNC): United States Military Standard MIL-C-39012/21 bayonet-type coaxial connector with quick twist mating/unmating, and two lugs preventing accidental disconnection from pulling forces on cable.
3. Bond: Permanent joining of metallic parts to form an electrically conductive path to ensure electrical continuity and capacity to safely conduct any currents likely to be imposed to earth ground.
4. Bundled Microducts: All forms of jacketed microducts.
5. Conduit: Includes all raceway types specified.
6. Conveniently Accessible: Capable of being reached without use of ladders, or without climbing or crawling under or over obstacles such as, motors, pumps, belt guards, transformers, piping, ductwork, conduit and raceways.
7. DEMARC, Extended DMARC or ENTR: Service provider's main point of demarcation owned by LEC or service provider and establishes a physical point where service provider's responsibilities for service and maintenance end. This point is called NID, in data networks.
8. Effectively Grounded: Intentionally bonded to earth through connections of low impedance having current carrying capacity to prevent buildup of currents and voltages resulting in hazard to equipment or persons.

9. Electrical Supervision: Analyzing a system's function and components (i.e. cable breaks / shorts, inoperative stations, lights, LEDs and states of change, from primary to backup) on a 24/7/365 basis; provide aural and visual emergency notification signals to minimum two remote designated or accepted monitoring stations.
10. Electrostatic Interference (ESI) or Electrostatic Discharge Interference: Refer to EMI and RFI.
11. Emergency Call Systems: Wall units (in parking garages and stairwells) and pedestal mounts (in parking lots) typically provided with a strobe, camera and two-way audio communication functions.
12. Project 25 (2014) (P25 (TIA-102 Series)): Set of standards for local, state and Federal public safety organizations and agencies digital LMR services. P25 is applicable to LMR equipment authorized or licensed under the US Department of Commerce National Telecommunications and Information Administration or FCC rules and regulations, and is a required standard capability for all LMR equipment and systems.
13. Grounding Electrode Conductor: (GEC) Conductor connected to earth grounding electrode.
14. Grounding Electrode System: Electrodes through which an effective connection to earth is established, including supplementary, communications system grounding electrodes and GEC.
15. Grounding Equalizer or Backbone Bonding Conductor (BBC): Conductor that interconnects elements of telecommunications grounding infrastructure.
16. Head End (HE): Equipment, hardware and software, or a master facility at originating point in a communications system designed for centralized communications control, signal processing, and distribution that acts as a common point of connection between equipment and devices connected to a network of interconnected equipment, possessing greatest authority for allowing information to be exchanged, with whom other equipment is subordinate.
17. Microducts: All forms of air blown fiber pathways.
18. Ohm: A unit of restive measurement.
19. Received Signal Strength Indication (RSSI): A measurement of power present in a received RF signal.

20. Service Provider Demarcation Point (SPDP): Not owned by LEC or service provider, but designated by Government as point within facility considered the DEMARC.
21. Sound (SND): Changing air pressure to audible signals over given time span.
22. System: Specific hardware, firmware, and software, functioning together as a unit, performing task for which it was designed.
23. Telecommunications Bonding Backbone (TBB): Conductors of appropriate size (minimum 53.49 mm2 [1/0 AWG]) stranded copper wire, that connect to Grounding Electrode System and route to telecommunications main grounding busbar (TMGB) and circulate to interconnect various TGBs and other locations shown on drawings.
24. Voice over Internet Protocol (VoIP): A telephone system in which voice signals are converted to packets and transmitted over LAN network using Transmission Control Protocol (TCP)/Internet Protocol (IP). VA'S VoIP is not listed or coded for life and public safety, critical, emergency or other protection functions. When VoIP system or equipment is provided instead of PBX system or equipment, each TR (STR) and DEMARC requires increased AC power provided to compensate for loss of PBX's telephone instrument line power; and, to compensate for absence of PBX's UPS capability.
25. Wide Area Network (WAN): A digital network that transcends localized LANs within a given geographic location. VA'S WAN/LAN is not nationally listed or coded for life and public safety, critical, emergency or other safety functions.

1.3 APPLICABLE PUBLICATIONS

A. Applicability of Standards: Unless documents include more stringent requirements, applicable construction industry standards have same force and effect as if bound or copied directly into the documents to extent referenced. Such standards are made a part of these documents by reference.
   1. Each entity engaged in construction shall be familiar with industry standards applicable to its construction activity.
   2. Obtain standards directly from publication source, where copies of standards are needed to perform a required construction activity.

B. Government Codes, Standards and Executive Orders: Refer to http://www.cfm.va.gov/TIL/cPro.asp:

1. Federal Communications Commission, (FCC) CFR, Title 47:

Part 15	Restrictions of use for Part 15 listed RF Equipment in Safety of Life Emergency Functions and Equipment Locations
Part 47	Chapter A, Paragraphs 6.1-6.23, Access to Telecommunications Service, Telecommunications Equipment and Customer Premises Equipment
Part 58	Television Broadcast Service
Part 73	Radio and Television Broadcast Rules
Part 90	Rules and Regulations, Appendix C
Form 854	Antenna Structure Registration
Chapter XXIII	National Telecommunications and Information Administration (NTIA, P/O Commerce, Chapter XXIII) the 'Red Book'- Chapters 7, 8 & 9 compliments CFR, Title 47, FCC Part 15, RF Restriction of Use and Compliance in "Safety of Life" Functions & Locations

2. US Department of Agriculture, (Title 7, USC, Chapter 55, Sections 2201, 2202 & 2203:RUS 1755 Telecommunications Standards and Specifications for Materials, Equipment and Construction:

RUS Bull 1751F-630	Design of Aerial Cable Plants
RUS Bull 1751F-640	Design of Buried Cable Plant, Physical Considerations
RUS Bull 1751F-643	Underground Plant Design
RUS Bull 1751F-815	Electrical Protection of Outside Plants,
RUS Bull 1753F-201	Acceptance Tests of Telecommunications Plants (PC-4)
RUS Bull 1753F-401	Splicing Copper and Fiber Optic Cables (PC-2)
RUS Bull 345-50	Trunk Carrier Systems (PE-60)
RUS Bull 345-65	Shield Bonding Connectors (PE-65)
RUS Bull 345-72	Filled Splice Closures (PE-74)
RUS Bull 345-83	Gas Tube Surge Arrestors (PE-80)

3. US Department of Commerce/National Institute of Standards Technology,(NIST):

FIPS PUB 1-1	Telecommunications Information Exchange
FIPS PUB 100/1	Interface between Data Terminal Equipment (DTE) Circuit Terminating Equipment for operation

	with Packet Switched Networks, or Between Two DTEs, by Dedicated Circuit
FIPS PUB 140/2	Telecommunications Information Security Algorithms
FIPS PUB 143	General Purpose 37 Position Interface between DTE and Data Circuit Terminating Equipment
FIPS 160/2	Electronic Data Interchange (EDI),
FIPS 175	Federal Building Standard for Telecommunications Pathway and Spaces
FIPS 191	Guideline for the Analysis of Local Area Network Security
FIPS 197	Advanced Encryption Standard (AES)
FIPS 199	Standards for Security Categorization of Federal Information and Information Systems

4. US Department of Defense, (DoD):

MIL-STD-188-110	Interoperability and Performance Standards for Data Modems
MIL-STD-188-114	Electrical Characteristics of Digital Interface Circuits
MIL-STD-188-115	Communications Timing and Synchronizations Subsystems
MIL-C-28883	Advanced Narrowband Digital Voice Terminals
MIL-C-39012/21	Connectors, Receptacle, Electrical, Coaxial, Radio Frequency, (Series BNC (Uncabled), Socket Contact, Jam Nut Mounted, Class 2)

5. US Department of Health and Human Services:
   The Health Insurance Portability and Accountability Act of 1996 (HIPAA) Privacy, Security and Breach Notification Rules
6. US Department of Justice:
   2010 Americans with Disabilities Act Standards for Accessible Design (ADAAD).
7. US Department of Labor, (DoL) - Public Law 426-62 – CFR, Title 29, Part 1910, Chapter XVII - Occupational Safety and Health Administration (OSHA), Occupational Safety and Health Standards):

Subpart 7	Approved NRTLs; obtain a copy at http://www.osha.gov/dts/otpca/nrtl/faq_nrtl.html)

Subpart 35	Compliance with NFPA 101, Life Safety Code
Subpart 36	Design and Construction Requirements for Exit Routes
Subpart 268	Telecommunications
Subpart 305	Wiring Methods, Components, and Equipment for General Use
Subpart 508	Americans with Disabilities Act Accessibility Guidelines; technical requirement for accessibility to buildings and facilities by individuals with disabilities

8. US Department of Transportation, (DoT):
   a. Public Law 85-625, CFR, Title 49, Part 1, Subpart C – Federal Aviation Administration (FAA):AC 110/460-ID & AC 707 / 460-2E – Advisory Circulars Standards for Construction of Antenna Towers, and 7450 and 7460-2 – Antenna Construction Registration Forms.
9. US Department of Veterans Affairs (VA): Office of Telecommunications (OI&T), MP-6, PART VIII, TELECOMMUNICATIONS, CHAPTER 5, AUDIO, RADIO AND TELEVISION (and COMSEC) COMMUNICATIONS SYSTEMS: Spectrum Management and COMSEC Service (SMCS), AHJ for:
   a. CoG, “Continuance of Government” communications guidelines and compliance.
   b. COMSEC,“VA wide coordination and control of security classified communication assets.”
   c. COOP, “Continuance of Operations” emergency communications guidelines and compliance.
   d. FAA, FCC, and US Department of Commerce National Telecommunications and Information Administration, “VA wide RF Co-ordination, Compliance and Licensing.”
   e. Handbook 6100 – Telecommunications: Cyber and Information Security Office of Cyber and Information Security, and Handbook 6500 – Information Security Program.
   f. Low Voltage Special Communications Systems “Design, Engineering, Construction Contract Specifications and Drawings Conformity, Proof of Performance Testing, VA Compliance and Life Safety Certifications for CFM and VA Facility Low Voltage Special Communications Projects (except Fire Alarm, Telephone and Data Systems).”

g. SATCOM, "Satellite Communications" guidelines and compliance, and Security and Law Enforcement Systems – "Coordinates the Design, Engineering, Construction Contract Specifications and Drawings Conformity, Proof of Performance Testing, VA Compliance, DEA and Public Safety Certification(s) for CFM and VA Facility Security Low Voltage Special Communications and Physical Security Projects.

h. VHA's National Center for Patient Safety – Veterans Health Administration (VHA) Warning System, Failure of Medical Alarm Systems using Paging Technology to Notify Clinical Staff, July 2004.

i. VA's CEOSH, concurrence with warning identified in VA Directive 7700.

j. Wireless and Handheld Devices, "Guidelines and Compliance,"

k. Office of Security and Law Enforcement: VA Directive 0730 and Health Special Presidential Directive (HSPD)-12.

C. NRTL Standards: Refer to https://www.osha.gov/dts/otpca/nrtl/index.html

1. Canadian Standards Association (CSA); same tests as presented by UL
2. Communications Certifications Laboratory (CEL); same tests as presented by UL.
3. Intertek Testing Services NA, Inc., (ITSNA), formerly Edison Testing Laboratory (ETL) same tests as presented by UL).
4. Underwriters Laboratory (UL):

1-2005	Flexible Metal Conduit
5-2011	Surface Metal Raceway and Fittings
6-2007	Rigid Metal Conduit
44-010	Thermoset-Insulated Wires and Cables
50-1995	Enclosures for Electrical Equipment
65-2010	Wired Cabinets
83-2008	Thermoplastic-Insulated Wires and Cables
96-2005	Lightning Protection Components
96A-2007	Installation Requirements for Lightning Protection Systems
360-2013	Liquid-Tight Flexible Steel Conduit
444-2008	Communications Cables
467-2013	Grounding and Bonding Equipment
486A-486B-2013	Wire Connectors

486C-2013	Splicing Wire Connectors
486D-2005	Sealed Wire Connector Systems
486E-2009	Standard for Equipment Wiring Terminals for Use with Aluminum and/or Copper Conductors
493-2007	Thermoplastic-Insulated Underground Feeder and Branch Circuit Cable
497/497A/497B/497C	
497D/497E	Protectors for Paired Conductors/Communications Circuits/Data Communications and Fire Alarm Circuits/coaxial circuits/voltage protections/Antenna Lead In
510-2005	Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape
514A-2013	Metallic Outlet Boxes
514B-2012	Fittings for Cable and Conduit
514C-1996	Nonmetallic Outlet Boxes, Flush-Device Boxes and Covers
651-2011	Schedule 40 and 80 Rigid PVC Conduit
651A-2011	Type EB and A Rigid PVC Conduit and HDPE Conduit
797-2007	Electrical Metallic Tubing
884-2011	Underfloor Raceways and Fittings
1069-2007	Hospital Signaling and Nurse Call Equipment
1242-2006	Intermediate Metal Conduit
1449-2006	Standard for Transient Voltage Surge Suppressors
1479-2003	Fire Tests of Through-Penetration Fire Stops
1480-2003	Speaker Standards for Fire Alarm, Emergency, Commercial and Professional use
1666-2007	Standard for Wire/Cable Vertical (Riser) Tray Flame Tests
1685-2007	Vertical Tray Fire Protection and Smoke Release Test for Electrical and Fiber Optic Cables
1861-2012	Communication Circuit Accessories
1863-2013	Standard for Safety, communications Circuits Accessories

1865-2007	Standard for Safety for Vertical-Tray Fire Protection and Smoke-Release Test for Electrical and Optical-Fiber Cables
2024-2011	Standard for Optical Fiber Raceways
2024-2014	Standard for Cable Routing Assemblies and Communications Raceways
2196-2001	Standard for Test of Fire Resistive Cable
60950-1 ed. 2-2014	Information Technology Equipment Safety

D. Industry Standards:

1. Advanced Television Systems Committee (ATSC):

A/53 Part 1: 2013	ATSC Digital Television Standard, Part 1, Digital Television System
A/53 Part 2: 2011	ATSC Digital Television Standard, Part 2, RF/Transmission System Characteristics
A/53 Part 3: 2013	ATSC Digital Television Standard, Part 3, Service Multiplex and Transport System Characteristics
A/53 Part 4: 2009	ATSC Digital Television Standard, Part 4, MPEG-2 Video System Characteristics
A/53 Part 5: 2014	ATSC Digital Television Standard, Part 5, AC-3 Audio System Characteristics
A/53 Part 6: 2014	ATSC digital Television Standard, Part 6, Enhanced AC-3 Audio System Characteristics

2. American Institute of Architects (AIA): 2006 Guidelines for Design & Construction of Health Care Facilities.
3. American Society of Mechanical Engineers (ASME):

A17.1 (2013)	Safety Code for Elevators and Escalators Includes Requirements for Elevators, Escalators, Dumbwaiters, Moving Walks, Material Lifts, and Dumbwaiters with Automatic Transfer Devices
17.3 (2011)	Safety Code for Existing Elevators and Escalators
17.4 (2009)	Guide for Emergency Personnel
17.5 (2011)	Elevator and Escalator Electrical Equipment

4. American Society for Testing and Materials (ASTM):

B1 (2001)	Standard Specification for Hard-Drawn Copper Wire
B8 (2004)	Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft
D1557 (2012)	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort 56,000 ft-lbf/ft3 (2,700 kN-m/m3)
D2301 (2004)	Standard Specification for Vinyl Chloride Plastic Pressure Sensitive Electrical Insulating Tape
B258-02 (2008)	Standard Specification for Standard Nominal Diameters and Cross-Sectional Areas of AWG Sizes of Solid Round Wires Used as Electrical Conductors
D709-01(2007)	Standard Specification for Laminated Thermosetting Materials
D4566 (2008)	Standard Test Methods for Electrical Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable

5. American Telephone and Telegraph Corporation (AT&T) - Obtain following AT&T Publications at https://ebiznet.sbc.com/SBCNEBS/):

ATT-TP-76200 (2013)	Network Equipment and Power Grounding, Environmental, and Physical Design Requirements
ATT-TP-76300(2012)	Merged AT&T Affiliate Companies Installation Requirements
ATT-TP-76305 (2013)	Common Systems Cable and Wire Installation and Removal Requirements - Cable Racks and Raceways
ATT-TP-76306 (2009)	Electrostatic Discharge Control
ATT-TP-76400 (2012)	Detail Engineering Requirements
ATT-TP-76402 (2013)	AT&T Raised Access Floor Engineering and Installation Requirements
ATT-TP-76405 (2011)	Technical Requirements for Supplemental Cooling Systems in Network Equipment Environments
ATT-TP-76416 (2011)	Grounding and Bonding Requirements for Network Facilities
ATT-TP-76440 (2005)	Ethernet Specification

ATT-TP-76450 (2013) Common Systems Equipment Interconnection Standards for AT&T Network Equipment Spaces

ATT-TP-76461 (2008) Fiber Optic Cleaning

ATT-TP-76900 (2010) AT&T Installation Testing Requirement

ATT-TP-76911 (1999) AT&T LEC Technical Publication Notice

6. British Standards Institution (BSI):

BS EN 50109-2 Hand Crimping Tools - Tools for The Crimp Termination of Electric Cables and Wires for Low Frequency and Radio Frequency Applications – All Parts & Sections. October 1997

7. Building Industry Consulting Service International(BICSI):

ANSI/BICSI 002-2011 Data Center Design and Implementation Best Practices

ANSI/BICSI 004-2012 Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities

ANSI/NECA/BICSI 568-2006 Standard for Installing Commercial Building Telecommunications Cabling

NECA/BICSI 607-2011 Standard for Telecommunications Bonding and Grounding Planning and Installation Methods for Commercial Buildings

ANSI/BICSI 005-2013 Electronic Safety and Security (ESS) System Design and Implementation Best Practices

8. Electronic Components Assemblies and Materials Association,(ECA).

ECA EIA/RS-270 (1973) Tools, Crimping, Solderless Wiring Devices – Recommended Procedures for User Certification

EIA/ECA 310-E (2005) Cabinets, and Associated Equipment

9. Facility Guidelines Institute: 2010 Guidelines for Design and Construction of Health Care Facilities.

10. Insulated Cable Engineers Association (ICEA):

ANSI/ICEA S-80-576-2002 Category 1 & 2 Individually Unshielded Twisted-Pair Indoor Cables for Use in Communications Wiring Systems

ANSI/ICEA

S-84-608-2010	Telecommunications Cable, Filled Polyolefin Insulated Copper Conductor, S-87-640(2011) Optical Fiber Outside Plant Communications Cable
ANSI/ICEA	
S-90-661-2012	Category 3, 5, & 5e Individually Unshielded Twisted-Pair Indoor Cable for Use in General Purpose and LAN Communication Wiring Systems
S-98-688 (2012)	Broadband Twisted Pair Cable Aircore, Polyolefin Insulated, Copper Conductors
S-99-689 (2012)	Broadband Twisted Pair Cable Filled, Polyolefin Insulated, Copper Conductors
ICEA S-102-700 (2004)	Category 6 Individually Unshielded Twisted Pair Indoor Cables (With or Without an Overall Shield) for use in Communications Wiring Systems Technical Requirements

11. Institute of Electrical and Electronics Engineers (IEEE):

ISSN 0739-5175	March-April 2008 Engineering in Medicine and Biology Magazine, IEEE (Volume: 27, Issue:2) Medical Grade-Mission Critical-Wireless Networks
IEEE C2-2012	National Electrical Safety Code (NESC)
C62.41.2-2002/ Cor 1-2012 IEEE	Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and Less) AC Power Circuits 4)
C62.45-2002	IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and Less) AC Power Circuits
81-2012 IEEE	Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System
100-1992	IEEE the New IEEE Standards Dictionary of Electrical and Electronics Terms
602-2007	IEEE Recommended Practice for Electric Systems in Health Care Facilities

1100-2005	IEEE Recommended Practice for Powering and Grounding Electronic Equipment

12. International Code Council:

AC193 (2014)	Mechanical Anchors in Concrete Elements

13. International Organization for Standardization (ISO):

ISO/TR 21730 (2007)	Use of Mobile Wireless Communication and Computing Technology in Healthcare Facilities - Recommendations for Electromagnetic Compatibility (Management of Unintentional Electromagnetic Interference) with Medical Devices

14. National Electrical Manufacturers Association (NEMA):

NEMA 250 (2008)	Enclosures for Electrical Equipment (1,000V Maximum)
ANSI C62.61 (1993)	American National Standard for Gas Tube Surge Arresters on Wire Line Telephone Circuits
ANSI/NEMA FB 1 (2012)	Fittings, Cast Metal Boxes and Conduit Bodies for Conduit, Electrical Metallic Tubing EMT) and Cable
ANSI/NEMA OS 1 (2009)	Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports
NEMA SB 19 (R2007)	NEMA Installation Guide for Nurse Call Systems
TC 3 (2004)	Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing
NEMA VE 2 (2006)	Cable Tray Installation Guidelines

15. National Fire Protection Association (NFPA):

70E-2015	Standard for Electrical Safety in the Workplace
70-2014	National Electrical Code (NEC)
72-2013	National Fire Alarm Code
75-2013	Standard for the Fire Protection of Information Technological Equipment
76-2012	Recommended Practice for the Fire Protection of Telecommunications Facilities
77-2014	Recommended Practice on Static Electricity
90A-2015	Standard for the Installation of Air Conditioning and Ventilating Systems
99-2015	Health Care Facilities Code

101-2015	Life Safety Code
241	Safeguarding construction, alternation and Demolition Operations
255-2006	Standard Method of Test of Surface Burning Characteristics of Building Materials
262 - 2011	Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces
780-2014	Standard for the Installation of Lightning Protection Systems
1221-2013	Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems
5000-2015	Building Construction and Safety Code

16. Society for Protective Coatings (SSPC):
    SSPC SP 6/NACE No.3 (2007) Commercial Blast Cleaning
17. Society of Cable Telecommunications Engineers (SCTE):

ANSI/SCTE 15 2006	Specification for Trunk, Feeder and Distribution Coaxial Cable

18. Telecommunications Industry Association (TIA):

TIA-120 Series	Telecommunications Land Mobile communications (APCO/Project 25) (January 2014)
TIA TSB-140	Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems (2004)
TIA-155	Guidelines for the Assessment and Mitigation of Installed Category 6 Cabling to Support 10GBASE-T (2010)
TIA TSB-162-A	Telecommunications Cabling Guidelines for Wireless Access Points (2013)
TIA-222-G	Structural Standard for Antenna Supporting Structures and Antennas (2014)
TIA/EIA-423-B	Electrical Characteristics of Unbalanced Voltage Digital Interface Circuits (2012)
TIA-455-C	General Requirements for Standard Test Procedures for Optical Fibers, Cables, Transducers, Sensors, Connecting and

	Terminating Devices, and other Fiber Optic Components (August 2014)
TIA-455-53-A	FOTP-53 Attenuation by Substitution Measurements for Multimode Graded-Index Optical Fibers in Fiber Assemblies (Long Length) (September 2001)
TIA-455-61-A	FOTP-61 Measurement of Fiber of Cable Attenuation Using an OTDR (July 2003)
TIA-472D000-B	Fiber Optic Communications Cable for Outside Plant Use (July 2007)
ANSI/TIA-492-B	62.5-µ Core Diameter/125-um Cladding Diameter Class 1a Graded-Index Multimode Optical Fibers (November 2009)
ANSI/TIA-492AAAB-A	50-um Core Diameter/125-um Cladding Diameter Class IA Graded-Index Multimode Optically Optimized American Standard Fibers (November 2009
TIA-492CAAA	Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers (September 2002)
TIA-492E000	Sectional Specification for Class IVd Nonzero-Dispersion Single-Mode Optical Fibers for the 1,550 nm Window (September 2002)
TIA-526-7-B	Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant – OFSTP-7 (December 2008)
TIA-526.14-A	Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant – SFSTP-14 (August 1998)
TIA-568	Revision/Edition: C Commercial Building Telecommunications Cabling Standard Set: (TIA-568-C.0-2 Generic Telecommunications Cabling for Customer Premises (2012), TIA-568-C.1-1 Commercial Building Telecommunications Cabling Standard Part 1: General Requirements (2012), TIA-568-C.2 Commercial Building Telecommunications Cabling Standard—Part 2:

	Balanced Twisted Pair Cabling Components (2009), TIA-568-C.3-1 Optical Fiber Cabling Components Standard, (2011) AND TIA-568-C.4 Broadband Coaxial Cabling and Components Standard (2011) with addendums and erratas
TIA-569	Revision/Edition C Telecommunications Pathways and Spaces (March 2013)
TIA-574	Position Non-Synchronous Interface between Data Terminal equipment and Data Circuit Terminating Equipment Employing Serial Binary Interchange (May 2003)
TIA/EIA-590-A	Standard for Physical Location and Protection of Below Ground Fiber Optic Cable Plant (July 2001)
TIA-598-D	Optical Fiber Cable Color Coding (January 2005)
TIA-604-10-B	Fiber Optic Connector Intermateablility Standard (August 2008)
ANSI/TIA-606-B	Administration Standard for Telecommunications Infrastructure (2012)
TIA-607-B	Generic Telecommunications Bonding and Grounding (Earthing) For Customer Premises (January 2013)
TIA-613	High Speed Serial Interface for Data Terminal Equipment and Data Circuit Terminal Equipment (September 2005)
ANSI/TIA-758-B	Customer-owned Outside Plant Telecommunications Infrastructure Standard (April 2012)
ANSI/TIA-854	A Full Duplex Ethernet Specification for 1000 Mb/s (1000BASE-TX) Operating over Category 6 Balanced Twisted-Pair Cabling (2001)
ANSI/TIA-862-A	Building Automation Systems Cabling Standard (April 2011)
TIA-942-A	Telecommunications Infrastructure Standard for Data Centers (March 2014)
TIA-1152	Requirements for Field Testing Instruments and Measurements for Balanced Twisted Pair Cabling (September 2009)

TIA-1179 Healthcare Facility Telecommunications Infrastructure Standard (July 2010)

1.4 SINGULAR NUMBER

A. Where any device or part of equipment is referred in singular number (such as " rack"), reference applies to as many such devices as are required to complete installation.

1.5 RELATED WORK

A. Specification Order of Precedence: FAR Clause 52.236-21, VAAR Clause 852.236-71.
   1. Field Cutting and Patching: Section 09 91 00, PAINTING.
   2. Additional submittal requirements: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
   3. Availability and source of references and standards specified in applicable publications: Section 01 42 19, REFERENCE STANDARDS.
   4. Sealant and caulking materials and their application: Section 07 92 00, JOINT SEALANTS.
   5. General electrical requirements that are common to more than one section of Division 26: Section 26 05 11, REQUIREMENTS FOR ELECTRICAL INSTALLATIONS.

1.6 ADMINISTRATIVE REQUIREMENTS

A. Assign a single communications project manager to serve as point of contact for Government, contractor, and design professional.

B. Be proactive in scheduling work.
   1. Use of premises is restricted at times directed by COR.
   2. Movement of materials: Unload materials and equipment delivered to site.
   3. Coordinate installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
   4. Sequence, coordinate, and integrate installations of materials and equipment for efficient flow of Work.
   5. Coordinate connection of materials, equipment, and systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies; provide required connection for each service.

6. Initiate and maintain discussion regarding schedule for ceiling construction and install cables to meet that schedule.

C. Contact the Office of Telecommunications, Special Communications Team (005OP2H3) (202)461-5310 to have a Government-accepted Telecommunications COR assigned to project for telecommunications review, equipment and system approval and coordination with other VA personnel.

D. Communications Project Manager Responsibilities:
1. Assume responsibility for overall telecommunications system integration and coordination of work among trades, subcontractors, and authorized system installers.
2. Coordinate with related work indicated on drawings or specified.
3. Manage work related to telecommunications system installation in a manner approved by manufacturer.

1.7 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Provide parts list including quantity of spare parts.

C. Provide manufacturer product information. Government reserves the right to require a list of installations where products have been in operation.

D. Installer Qualifications: Submit three installations of similar size and complexity furnished and installed by installer; include:
1. Installation location and name.
2. Owner’s name and contact information including, address, telephone and email.
3. Date of project start and date of final acceptance.
4. System project number.
5. Three paragraph description of each system related to this project; include function, operation, and installation.

E. Test Equipment List:
1. Supply test equipment of accuracy better than parameters to be tested.
2. Submit test equipment list including make and model number:
a. Fiber optic insertion loss power meter with light source.
b. Optical time domain reflectometer (OTDR).

3. Supply only test equipment with a calibration tag from Government-accepted calibration service dated not more than 12 months prior to test.

F. Submittal Drawings:

1. Telecommunications Site Plan and Space Plans/Elevations: Provide enlarged floor plans of telecommunication spaces indicating layout of equipment and devices, including receptacles and grounding provisions. Submit detailed plan views and elevations of telecommunication spaces showing racks, termination blocks, and cable paths. Include following rooms:
   a. Telecommunications rooms.
   b. Building BAS Fiber Loop Entrance Facility/Demarcation rooms.
2. Logical Drawings: Provide logical riser or schematic drawings for all systems.
   a. Provide riser diagrams systems and interconnection drawings for equipment assemblies; show termination points and identify wiring connections.

G. Furnish electronic certified test reports to COR prior to final inspection and not more than 90 days after completion of tests.

1.8 CLOSEOUT SUBMITTALS

A. Provide following closeout submittals prior to project closeout date:

1. Warranty certificate.
2. Evidence of compliance with requirements such as low voltage certificate of inspection.
3. Project record documents.

B. Maintenance and Operation Manuals: Submit in accordance with Section 01 00 00, GENERAL REQUIREMENTS.

1. Prepare a manual for each system and equipment specified.
2. Furnish on portable storage drive in PDF format or equivalent accepted by COR.
3. Furnish complete manual as specified in specification section, fifteen days prior to performance of systems or equipment test.
4. Furnish remaining manuals prior to final completion.
5. Identify storage drive "MAINTENANCE AND OPERATION MANUAL" and system name.

6. Include name, contact information and emergency service numbers of each subcontractor installing system or equipment and local representatives for system or equipment.
7. Provide a Table of Contents and assemble files to conform to Table of Contents.
8. Operation and Maintenance Data includes:
   a. Approved shop drawing for each item of equipment.
   b. Internal and interconnecting wiring and control diagrams with data to explain detailed operation and control of equipment.
   c. Installation and maintenance instructions.
   d. Safety precautions.
   e. Diagrams and illustrations.
   f. Test Results and testing methods.
   g. Performance data.
   h. Warranty documentation indicating end date and equipment protected under warranty.

C. Record Wiring Diagrams:
1. Red Line Drawings: Keep one E size 91.44 cm x 121.92 cm (36 inches x 48 inches) set of floor plans, on site during work hours, showing installation progress marked and backbone cable labels noted. Make these drawings available for examination during construction meetings or field inspections.
2. General Drawing Specifications: Detail and elevation drawings to be D size 61 cm x 91.44 cm (24 inches x 36 inches) with a minimum scale of 0.635 cm = 30.48 cm (1/4 inch = 12 inches). ER, TR and other enlarged detail floor plan drawings to be D size 61 cm x 91.44 cm (24” x 36”) with a minimum scale of 0.635 cm = 30.48 cm (1/4 inch = 12 inches). Building composite floor plan drawings to be D size 61 cm x 91.44 cm (24 inches x 36 inches) with a minimum scale of 3.175 mm = 30.48 cm (1/8 inch = 1’ 0 inch).
3. Site Composite Campus Plans: Provide building campus site plan with all included buildings showing fiber loop configuration, distance for each cable, and cable routing locations.
4. Building Composite Floor Plans: Provide building floor plans showing work area outlet locations and configuration, types of jacks, distance for each cable, and cable routing locations.
5. Floor plans to include:

a. Final room numbers and actual backbone cabling and pathway locations and labeling.
b. Inputs and outputs of equipment identified according to labels installed on cables and equipment
c. Device locations with labels.
d. Conduit.
e. Head-end equipment.
f. Wiring diagram.
g. Labeling and administration documentation.

6. Submit Record Wiring Diagrams within five business days after final cable testing.
7. Deliver Record Wiring Diagrams as CAD files in .dwg formats as determined by COR.
8. Deliver four complete sets of electronic record wiring diagrams to COR on portable storage drive.

D. Service Qualifications: Submit name and contact information of service organizations providing service to this installation within four hours of receipt of notification service is needed.

1.9 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Manufacturer shall produce, as a principal product, the equipment and material specified for this project, and have manufactured item for at least three years.
B. Product and System Qualification:
1. OEM shall have three installations of equipment submitted presently in operation of similar size and type as this project, that have continuously operated for a minimum of three years.
2. Government reserves the right to require a list of installations where products have been in operation before approval.
3. Authorized representative of OEM shall be responsible for design, satisfactory operation of installed system, and certification.
C. Trade Contractor Qualifications: Trade contractor shall have completed three or more installations of similar systems of comparable size and complexity with regards to coordinating, engineering, testing, certifying, supervising, training, and documentation. Identify these installations as a part of submittal.
D. System Supplier Qualifications: System supplier shall be authorized by OEM to warranty installed equipment.

E. Telecommunications technicians assigned to system shall be trained, and certified by OEM on installation and testing of system; provide written evidence of current OEM certifications for installers.

F. Manufactured Products:

1. Comply with FAR clause 52.236-5 for material and workmanship.
2. When more than one unit of same class of equipment is required, units shall be product of a single manufacturer.
3. Equipment Assemblies and Components:
   a. Components of an assembled unit need not be products of same manufacturer.
   b. Manufacturers of equipment assemblies, which include components made by others, to assume complete responsibility for final assembled unit.
   c. Provide compatible components for assembly and intended service.
   d. Constituent parts which are similar shall be product of a single manufacturer.
4. Identify factory wiring on equipment being furnished and on wiring diagrams.

G. Testing Agencies: Government reserves the option of witnessing factory tests. Notify COR minimum 15 working days prior to manufacturer performing the factory tests.

1. When equipment fails to meet factory test and re-inspection is required, contractor is liable for additional expenses, including expenses of Government.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:

1. Government's approval of submittals shall be obtained for equipment and material before delivery to job site.
2. Deliver and store materials to job site in OEM's original unopened containers, clearly labeled with OEM's name and equipment catalog numbers, model and serial identification numbers for COR to inventory cable, patch panels, and related equipment.

B. Storage and Handling Requirements:

1. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, moisture, cold and rain:
   a. Store and protect equipment in a manner that precludes damage or loss, including theft.

b. Protect painted surfaces with factory installed removable heavy kraft paper, sheet vinyl or equivalent.

c. Protect enclosures, equipment, controls, controllers, circuit protective devices, and other like items, against entry of foreign matter during installation; vacuum clean both inside and outside before testing and operating.

C. Coordinate storage.

1.11 FIELD CONDITIONS

A. Where variations from documents are requested in accordance with GENERAL CONDITIONS and Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, connecting work and related components shall include additions or changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels and installation methods.

B. A contract adjustment or additional time shall not be granted because of field conditions pursuant to FAR 52.236-2 and FAR 52.236-3; a contract adjustment or additional time shall not be granted for additional work required for complete and usable construction and systems pursuant to FAR 52.246-12.

1.12 WARRANTY

A. Comply with FAR clause 52.246-21.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Provide interior communications spaces and pathways conforming to TIA 569, at a minimum. Provide exterior Outside Plant (OSP) communications pathways conforming to BICSI OSP Design Reference Manual, latest edition.

2.2 EQUIPMENT IDENTIFICATION

A. Provide laminated black phenolic resin with a white core nameplates with minimum 6 mm (1/4 inch) high engraved lettering.

B. Nameplates furnished by manufacturer as standard catalog items, unless other method of identification is indicated.

2.3 UNDERGROUND WARNING TAPE

A. Underground Warning: Standard 4-Mil polyethylene 76 mm (3 inch) wide tape detectable type; red with black letters imprinted with “CAUTION BURIED ELECTRIC LINE BELOW”, orange with black letters imprinted with “CAUTION BURIED TELEPHONE LINE BELOW” or orange with black letters imprinted with “CAUTION BURIED FIBER OPTIC LINE BELOW”, as applicable.

2.4 WIRE LUBRICATING COMPOUND

A. Provide non-hardening or forming adhesive coating cable lubricants suitable for cable jacket material and raceway.

2.5 FIREPROOFING TAPE

A. Provide flexible, conformable fabric tape of organic composition and coated one side with flame-retardant elastomer.

B. Tape shall be self-extinguishing and cannot support combustion; arc-proof and fireproof.

C. Tape cannot deteriorate when subjected to water, gases, salt water, sewage, or fungus; and tape shall be resistant to sunlight and ultraviolet light.

D. Application shall withstand a 200-ampere arc for minimum 30 seconds.

E. Securing Tape: Glass cloth electrical tape minimum 0.18 mm (7 mils) thick and 19 mm (3/4 inch) wide.

2.6 UNDERGROUND CABLES

A. Provide buried closure suitable for enclosing a straight, butt, and branch splice in a container into which can be poured an encapsulating compound.

B. Provide closure of adequate strength to protect splice and maintain cable shield electrical continuity in buried environment.

C. Provide re-enterable encapsulating compound maintaining chemical stability of closure.

D. Provide filled splice cases in accordance with RUS Bull 345-72.

E. In Vault or Manhole:

1. Provide underground closure suitable to house a straight, butt, and branch splice in a protective housing into which can be poured an encapsulating compound

2. Closure shall be suitable thermoplastic, thermo-set, or stainless steel material supplying structural strength to pass mechanical and electrical requirements in a vault or maintenance hole (manhole) environment.

F. Re-Enterable Encapsulating Compound: Product maintaining chemical stability of closure.

2.7 AERIAL (ABOVEGROUND) ENCLOSURES

A. Provide aboveground enclosures constructed of minimum 2.108 mm (14 gauge) steel and acceptable for pole mounting in accordance with RUS 1755.

B. Size enclosures and install marker.

C. Secure covers to prevent unauthorized entry.

D. Provide gel filled cable meeting requirements of ICEA S-99-689, and RUS 1755.390; except, Figure 8 distribution wire suitable for aerial installation with:

1. 26,700 N (6,000 pound); or
2. 6,000 pound Class A galvanized steel; or
3. 26,700 N (6,000 pound) aluminum-clad steel strand.

PART 3 - EXECUTION

3.1 PREPARATION

A. Penetrations and Sleeves:

1. Lay out penetration and sleeve openings in advance, to permit provision in work.
2. Set sleeves in forms before concrete is poured.
3. Set sleeves prior to installation of structure for passage of pipes, conduit, ducts.
4. Provide sleeves and packing materials at penetrations of foundations, walls, slabs, partitions, and floors.
5. Make sleeves that penetrate outside walls, basement slabs, footings, and beams waterproof.
6. Fill slots, sleeves and other openings in floors or walls if not used.
   a. Fill spaces in openings after installation of conduit or cable.
   b. Provide fill for floor penetrations to prevent passage of water, smoke, fire, and fumes.
   c. Provide fire resistant fill in rated floors and walls, to prevent passage of air, smoke and fumes.
7. Install sleeves through floors watertight and extend minimum 50.8 mm (2 inches) above floor surface.
8. Match and set sleeves flush with adjoining floor, ceiling, and wall finishes where raceways passing through openings are exposed in finished rooms.
9. Annular space between conduit and sleeve shall be minimum 6 mm (1/4 inch).
10. Do not provide sleeves for slabs-on-grade, unless specified or indicated otherwise.

11. Comply with requirements for firestopping, for sleeves through rated fire walls and smoke partitions.
12. Do not support piping risers or conduit on sleeves.
13. Identify unused sleeves and slots for future installation.
14. Provide core drilling if walls are poured or otherwise constructed without sleeves and wall penetration is required; do not penetrate structural members.

B. Core Drilling:
1. Avoid core drilling whenever possible.
2. Coordinate openings with other trades and utilities, and prevent damage to structural reinforcement.
3. Investigate existing conditions in vicinity of required opening prior to coring, including an x-ray of floor if determined necessary by competent person or COR.
4. Protect areas from damage.

C. Verification of In-Place Conditions:
1. Verify location, use and status of all material, equipment, and utilities that are specified, indicated, or determined necessary for removal.
   a. Verify materials, equipment, and utilities to be removed are inactive, not required, or in use after completion of project.
   b. Replace with equivalent any material, equipment and utilities that were removed by contractor that are required to be left in place.
2. Existing Utilities: Do not interrupt utilities serving facilities occupied by Government or others unless permitted under following conditions and then only after arranging to provide temporary utility services, according to requirements indicated:
   a. Notify COR in writing at least 14 days in advance of proposed utility interruptions.
   b. Do not proceed with utility interruptions without Government’s written permission.

D. Provide suspended platforms, strap hangers, brackets, shelves, stands or legs for floor, wall and ceiling mounting of equipment as required.

E. Provide steel supports and hardware for installation of hangers, anchors, guides, and other support hardware.

F. Obtain and analyze catalog data, weights, and other pertinent data required for coordination of equipment support provisions and installation.

G. Verify site conditions and dimensions of equipment to ensure access for proper installation of equipment without disassembly that would void warranty.

3.2 INSTALLATION - GENERAL

A. Coordinate systems, equipment, and materials installation with other building components.

B. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings.

C. Conform to VAAR 852.236.91 arrangements indicated, recognizing that work shall be shown in diagrammatic form or have been impracticable to detail all items because of variances in manufacturers' methods of achieving specified results.

D. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed in both exposed and un-exposed spaces.

E. Install equipment according to manufacturers' written instructions.

F. Install wiring and cabling between equipment and related devices.

G. Install cabling, wiring, and equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum interference of adjacent other installations.

H. Provide access panel or doors where units are concealed behind finished surfaces.

I. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for wiring, cabling, and equipment installations.

J. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide maximum headroom and access for service and maintenance as possible.

K. Install systems, materials, and equipment giving priority to systems required to be installed at a specified slope.

L. Avoid interference with structure and with work or other trades, preserving adequate headroom and clearing doors and passageways to satisfaction of COR and code requirements.

M. Install equipment and cabling to distribute equipment loads on building structural members provided for equipment support under other sections; install and support roof-mounted equipment on structural steel or roof curbs as appropriate.

N. Provide supplementary or miscellaneous items, appurtenances, devices and materials for a complete installation.

3.3 EQUIPMENT INSTALLATION

A. Locate equipment as close as practical to locations shown on drawings.

B. Note locations of equipment requiring access on record drawings.

C. Access and Access Panels: Verify access panel locations and construction with COR.

D. Inaccessible Equipment:

1. Where Government determines that contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled as directed and without additional cost to Government.

3.4 EQUIPMENT IDENTIFICATION

A. Install an identification sign which clearly indicates information required for use and maintenance of equipment.

B. Secure identification signs with screws.

3.5 CUTTING AND PATCHING

A. Perform cutting and patching according to contract general requirements and as follows:

1. Remove samples of installed work as specified for testing.
2. Perform cutting, fitting, and patching of equipment and materials required to uncover existing infrastructure in order to provide access for correction of improperly installed existing or new work.
3. Remove and replace defective work.
4. Remove and replace non-conforming work.

B. Cut, remove, and legally dispose of selected equipment, components, and materials, including removal of material, equipment, devices, and other items indicated to be removed and items made obsolete by new work.

C. Provide and maintain temporary partitions or dust barriers adequate to prevent spread of dust and dirt to adjacent areas.

D. Protect adjacent installations during cutting and patching operations.

E. Protect structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

F. Patch finished surfaces and building components using new materials specified for original installation and experienced installers.

3.6 FIELD QUALITY CONTROL

A. Provide work according to VAAR 852.236.91 and FAR clause 52.236-5.

B. Provide minimum clearances and work required for compliance with NFPA 70, National Electrical Code (NEC), and manufacturers' instructions; comply with additional requirements indicated for access and clearances.

C. Verify all field conditions and dimensions that affect selection and provision of materials and equipment, and provide any disassembly, reassembly, relocation, demolition, cutting and patching required to provide work specified or indicated, including relocation and reinstallation of existing wiring and equipment.

1. Protect facility, equipment, and wiring from damage.

D. Submit written notice that:

1. Project has been inspected for compliance with documents.
2. Work has been completed in accordance with documents.

E. Non-Conforming Work: Conduct project acceptance inspections, final completion inspections, substantial completion inspections, and acceptance testing and demonstrations after verification of system operation and completeness by Contractor.

F. For project acceptance inspections, final completion inspections, substantial completion inspections, and testing/demonstrations that require more than one site visit by COR or design professional to verify project compliance for same material or equipment, Government reserves right to obtain compensation from contractor to defray cost of additional site visits that result from project construction or testing deficiencies and incompleteness, incorrect information, or non-compliance with project provisions.

1. COR shall notify contractor, of hourly rates and travel expenses for additional site visits, and shall issue an invoice to Contractor for additional site visits.
2. Contractor is not be eligible for extensions of project schedule or additional charges resulting from additional site visits that result from project construction or testing deficiencies/incompleteness, incorrect information, or non-compliance with Project provisions.

G. Tests:

1. Interim inspection is required at approximately 50 percent of installation.
2. Request inspection ten working days prior to interim inspection start date by notifying COR in writing; this inspection shall verify equipment and system being provided adheres to installation, mechanical and technical requirements of construction documents.
3. Inspection to be conducted by OEM and factory-certified contractor representative, and witnessed by COR, facility and SMCS 0050P2H3 representatives.
4. Check each item of installed equipment to ensure appropriate NRTL listing labels and markings are fixed in place.
5. Review cable tray, conduit and path/wire way installation practice.
6. OEM and contractor to perform:
   a. Fiber optical cable field inspection tests via attenuation measurements on factory reels; provide results along with OEM certification for factory reel tests.
   b. Coaxial cable field inspection tests via attenuation measurements on factory reels; provide results along with OEM certification for factory reel tests.
   c. Baseband cable field inspection tests via attenuation measurements on factory reels and provide results along with OEM certification for factory reel tests.
7. Relocate failed cable reels to a secured location for inventory, as directed by COR, and then remove from project site within two working days; provide COR with written confirmation of defective cable reels removal from project site.
8. Provide results of interim inspections to COR.
9. If major or multiple deficiencies are discovered, additional interim inspections could be required until deficiencies are corrected, before permitting further system installation.
   a. Additional inspections are scheduled at direction of COR.
   b. Re-inspection of deficiencies noted during interim inspections, shall be part of system’s Final Acceptance Proof of Performance Test.
   c. The interim inspection cannot affect the system’s completion date unless directed by COR.

10. Facility COR shall ensure test documents become a part of system's official documentation package.

H. Pretesting: Re-align, re-balance, sweep, re-adjust and clean entire system and leave system working for a "break-in" period, upon completing installation of system and prior to Final Acceptance Proof of Performance Test. System RF transmitting equipment shall not be connected to keying or control lines during "break-in" period.

1. Pretesting Procedure:
   a. Verify systems are fully operational and meet performance requirements, utilizing accepted test equipment and spectrum analyzer.
   b. Pretest and verify system functions and performance requirements conform to construction documents and, that no unwanted physical, aural and electronic effects, such as signal distortion, noise pulses, glitches, audio hum, poling noise are present.
2. Measure and record signal, aural and control carrier levels of each DAS RF, voice and data channel, at each of the following minimum points in system:
   a. Utility provider entrance.
   b. Buried conduit duct locations.
   c. Maintenance Holes (Manholes) and hand holes.
   d. ENTR or DEMARC.
   e. PBX interconnections.
   f. MCR interconnections.
   g. MCOR interconnections.
   h. TER interconnections.
   i. TOR interconnections.
   j. Control room interconnections.
   k. TR interconnections.
   l. System interfaces in locations listed herein.
   m. HE interconnections.
   n. Antenna (outside and inside) interconnections.
   o. System and lightning ground interconnections.
   p. Communications circulating ground system.
   q. UPS areas.
   r. Emergency generator interconnections.
   s. Each general floor areas.

t. Others as required by AHJ (SMCS 005OP2H3).

3. Provide recorded system pretest measurements and certification that the system is ready for formal acceptance test to COR.

I. Acceptance Test:

1. Schedule an acceptance test date after system has been pretested, and pretest results and certification submitted to COR.
2. Give COR fifteen working days written notice prior to date test is expected to begin; include expected duration of time for test in notification.
3. Test in the presence of the following:
   a. COR.
   b. OEM representatives.
   c. VACO:
      1) CFM representative.
      2) AHJ-SMCS 005OP2H3, (202)461-5310.
   d. VISN-CIO, Network Officer and VISN representatives.
   e. Facility:
      1) FMS Service Chief, Bio-Medical Engineering and facility representatives.
      2) OI&T Service Chief and OI&T representatives.
      3) Safety Officer, Police Chief and facility safety representatives.
   f. Local Community Safety Personnel:
      1) Fire Marshal representative.
      2) Disaster Coordinator representative.
      3) EMS Representatives: Police, Sherriff, City, County or State representatives.
4. Test system utilizing accepted test equipment to certify proof of performance and Life and Public Safety compliance, FCC, NRTL, NFPA and OSHA compliance.
   a. Rate system as acceptable or unacceptable at conclusion of test; make only minor adjustments and connections required to show proof of performance.
      1) Demonstrate and verify that system complies with performance requirements under operating conditions.

2) Failure of any part of system that precludes completion of system testing, and which cannot be repaired within four hours, terminates acceptance test of that portion of system.
3) Repeated failures that result in a cumulative time of eight hours to affect repairs is cause for entire system to be declared unacceptable.
4) If system is declared unacceptable, retesting shall be rescheduled at convenience of Government and costs borne by the contractor.

J. Acceptance Test Procedure:
1. Physical and Mechanical Inspection: The test team representatives shall tour major areas to determine system and sub-systems are completely and properly installed and are ready for acceptance testing.
2. A system inventory including available spare parts shall be taken at this time.
3. Each item of installed equipment shall be re-checked to ensure appropriate NRTL (i.e. UL) certification listing labels are affixed.
4. Confirm that deficiencies reported during Interim Inspections and Pretesting are corrected prior to start of Acceptance Test.
5. Inventory system diagrams, record drawings, equipment manuals, pretest results.
6. Failure of system to meet installation requirements of specifications is grounds for terminating testing and to schedule re-testing.

K. Operational Test:
1. Individual Item Test: VACO AHJ representative (SMCS 005OP2H3) shall select individual items of equipment for detailed proof of performance testing until 100 percent of system has been tested and found to meet requirements of the construction documents.
2. Government’s Condition of Acceptance of System Language:
a. Without Acceptance: Until system fully meets conditions of construction documents, system’s ownership, use, operation and warranty commences at Government’s final acceptance date.
b. With Conditional Acceptance: Stating conditions that need to be addressed by contractor or OEM and stating system’s use and

operation to commence immediately while its warranty commences only at Government's agreed final extended acceptance date.

c. With Full Acceptance: Stating system's ownership, use, operation and warranty to immediately commence at Government's agreed to date of final acceptance.

L. Acceptance Test Conclusion: Reschedule testing on deficiencies and shortages with COR, after COR and SMCS AHJ jointly agree to results of the test, using the generated punch list or discrepancy list. Perform retesting to comply with these specifications at contractor's expense.

M. Proof of Performance Certification:

1. If system is declared acceptable, AHJ (SMCS 005OP2H3) provides COR notice stating system processes to required operating standards and functions and is Government accepted for use by facility.
2. Validate items with COR needing to be provided to complete project contract (i.e. charts & diagrams, manuals, spare parts, system warranty documents executed). Once items have been provided, COR contacts FMS service chief to turn over system from CFM oversight for beneficial use by facility.
3. If system is declared unacceptable without conditions, rescheduled testing expenses shall be borne by contractor.

3.7 CLEANING

A. Remove debris, rubbish, waste material, tools, construction equipment, machinery and surplus materials from project site and clean work area, prior to final inspection and acceptance of work.

B. Put building and premises in neat and clean condition.

C. Remove debris on a daily basis.

D. Remove unused material, during progress of work.

E. Perform cleaning and washing required to provide acceptable appearance and operation of equipment to satisfaction of COR.

F. Clean exterior surface of all equipment, including concrete residue, dirt, and paint residue, after completion of project.

G. Perform final cleaning prior to project acceptance by COR.

H. Remove paint splatters and other spots, dirt, and debris; touch up scratches and mars of finish to match original finish.

I. Clean devices internally using methods and materials recommended by manufacturer.

J. Tighten wiring connectors, terminals, bus joints, and mountings, to include lugs, screws and bolts according to equipment manufacturer's published torque tightening values for equipment connectors. In absence of published connection or terminal torque values, comply with torque values specified in UL 486A-486B.

3.8 TRAINING

A. Provide training in accordance with subsection, INSTRUCTIONS, of Section 01 00 00, GENERAL REQUIREMENTS.

B. Provide training for equipment or system as required in each associated specification.

C. Develop and submit training schedule for approval by COR, at least 30 days prior to planned training.

3.9 PROTECTION

A. Protection of Fireproofing:

1. Install clips, hangers, clamps, supports and other attachments to surfaces to be fireproofed, if possible, prior to start of spray fireproofing work.
2. Install conduits and other items that would interfere with proper application of fireproofing after completion of spray fire proofing work.
3. Patch and repair fireproofing damaged due to cutting or course of work shall be performed by installer of fireproofing and paid for by trade responsible for damage.

B. Maintain equipment and systems until final acceptance.

C. Ensure adequate protection of equipment and material during installation and shutdown and during delays pending final test of systems and equipment because of seasonal conditions.

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SECTION 27 15 00
COMMUNICATIONS STRUCTURED CABLING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies a complete and operating voice and digital structured cabling distribution system and associated equipment and hardware to be installed in VA Medical Center here-in-after referred to as the “facility”.

1.2 RELATED WORK

A. General electrical requirements that are common to more than one section in Division 27: Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

1.3 SUBMITTALS

A. In addition to requirements of Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS provide:
   1. List of test equipment as per 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS.

B. Certifications:
   1. Submit written certification from OEM indicating that proposed supervisor of installation and proposed provider of contract maintenance are authorized representatives of OEM. Include individual's legal name and address and OEM warranty credentials in the certification.
   2. Test system cables and certify to COR before proof of performance testing can be conducted. Identify each cable as labeled on as-installed drawings.
   3. Provide current and qualified test equipment OEM training certificates and product OEM installation certification for contractor installation, maintenance, and supervisory personnel.

C. Closeout Submittal: Provide document from OEM certifying that each item of equipment installed conforms to OEM published specifications.

1.4 WARRANTY

A. Work subject to terms of Article "Warranty of Construction," FAR clause 52.246-21.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

A. Provide complete system including associated hardware including fiber optic distribution cables, connectors, "patch" cables, "break out" devices and equipment cabinets, and interface cabinets.

B. Industry Standards:

1. Cable distribution systems provided under this section are connected to systems identified as critical care performing life support functions.
2. Conform to National and Local Life Safety Codes (whichever are more stringent), NFPA, NEC, this section, Joint Commission Life Safety Accreditation requirements, and OEM recommendations, instructions, and guidelines.
3. Provide supplies and materials listed by a nationally recognized testing laboratory where such standards are established for supplies, materials or equipment.
4. Refer to industry standards and minimum requirements of Section 27 05 11, REQUIREMENTS FOR COMMUNICATIONS INSTALLATIONS and guidelines listed.
5. Active and passive equipment required by system design and approved technical submittal; shall conform to each UL standard in effect for equipment, when technical submittal was reviewed and approved by Government or date when COR accepted system equipment to be replaced. Where a UL standard is in existence for equipment to be used in completion of this contract, equipment shall bear approved NRTL label.

C. Provide continuous inter- and/or intra-facility data.

1. Provide fiber cable distribution system based on a physical and logical "loop" topology.
2. Contact SMCS 005OP2H3 (202-462-5310) for specific technical assistance and approvals.

D. Specific Subsystem Requirements: Provide products necessary for a complete and functional data communications cabling system, including backbone cabling system, patch panels and cross-connections, and patch cords.

E. Coordinate size and type of conduit, pathways and firestopping for maximum 40 percent cable fill with subcontractors.

F. Terminate all interconnecting fiber-optic cables on patch panels in fiber termination cabinets. Terminate unused or spare fiber strands. Do not leave unused or spare fiber-optic cable unterminated, unconnected, loose or unsecured.

G. Color code distribution wiring to conform to ANSI/TIA 606-B and construction documents, whichever is more stringent. Label all equipment, conduit, enclosures, jacks, and cables on record drawings, to facilitate installation and maintenance.

2.2 EQUIPMENT AND MATERIALS

A. Cable Systems - Fiber optic:

1. General:

a. Provide cable (i.e. backbone, outside plant) conforming to accepted industry standards with regards to size, color code, and insulation.

b. Some areas can be considered “plenum”. Comply with all codes pertaining to plenum environments. It is contractor’s responsibility to review the VA’s cable requirements with COR and OI&T Service prior to installation to confirm type of environment present at each location.

c. Provide proper test equipment to confirm that cable pairs meet each OEM’s standard transmission requirements, and ensure cable carries data transmissions at required speeds, frequencies, and fully loaded bandwidth.

2. Telecommunications Rooms (TR):

a. Provide fiber optic modular wall mount termination panels with “ST” couplers dedicated for voice, data and FMS applications.

b. Provide connecting cables required to extend backbone cables (i.e. patch cords, twenty-five pair), to ensure complete and operational distribution systems.

3. Fiber Optics Backbone Cable:

a. Provide 62.5/125 multi-mode cable, containing at minimum 12 strands of fiber, unless otherwise specified.

b. Provide 8/125 single-mode cable, containing at minimum 12 strands of fiber, unless otherwise specified.

c. Provide loose tube cable, which separates individual fibers from the environment, or indoor/outdoor cables, for outdoor runs or any area that includes an outdoor run.

d. Provide tight buffered fiber cable or indoor/outdoor cables for indoor runs.
e. Terminate multimode fibers at both ends with ST type female connectors installed in an appropriate patch or breakout panel and secured with a cable management system. Provide minimum 610 mm (2 ft.) cable loop at each end.
f. Provide single mode fiber optic cable 8.3 mm containing at minimum 12 strands of fiber, unless otherwise specified. Terminate single mode fibers at both ends with LC type female connectors installed in an appropriate patch or breakout panel and secured with a cable management system. Provide minimum 610 mm (2 feet) cable loop at each end to allow for future movement.
g. Test all fiber optic strands' cable transmission performance in accordance with TIA standards. Measure attenuation in accordance with fiber optic test procedures TIA-455-C ('-61', or -53). Provide written results to COR for review and approval.

B. Cross-Connect Systems (CCS):
1. Fiber Optic Cables:
a. Provide fiber CCS sized to connect cables at TR and allow for a minimum of 50 percent anticipated growth.
b. Install fiber optic cable slack in protective enclosures.

C. Telecommunication Room (TR):
1. Terminate backbone fiber optic cables on appropriate cross-connection systems (CCS) containing patch panels, punch blocks, and breakout devices provided in enclosures and tested, regardless of installation method, mounting, termination, or cross-connecting used. Provide cable management system as a part of each CCS.
2. Coordinate location in TR with FMS equipment (i.e. fire alarm, nurse call, code blue, video, public address, radio entertainment, intercom, and radio paging equipment).

D. Main Cross-connection Subsystem (MCCS): MCCS is common point of distribution for inter- and intra-building fiber optic backbone system cables, and connections to the data cable systems.

E. Fiber-Optic Cross-Connection Subsystems: Provide wall mounted patch or distribution panels installed inside a lockable cabinet or “breakout enclosure” that accommodate minimum 12 strands multimode fiber and 12

strand single mode fiber - these counts do not include 50 percent spare requirement. Provide cable management system for each panel.

1. Provide panels for female connectors, able to accommodate splices and field mountable connectors and have capacity for additional connectors to be added up to OEM's maximum standard panel size for this type of use. Protect patch panel sides, including front and back, by a cabinet or enclosure.
2. Provide panels that conform to EIA/ECA 310-E dimensions suitable for installation in standard racks, cabinets, and enclosures. Provide panels for system grounding where armored cables are installed.
3. Provide patch panels with highest OEM approved density of fiber termination's, while maintaining a high level of manageability. Provide proper couplers installed for each pair of fiber optic cable connectors.
   a. Provide system inputs from interface equipment or distribution systems on top row of connectors of appropriate patch panel.
   b. Provide backbone cable connections on bottom row of connectors of same patch panel.
   c. Provide patch cords for each pair of fiber optic strands with connector to match couplers.
4. Provide field installable connectors that are pre-polished.
   a. Terminate every fiber cable with appropriate connector, and test to ensure compliance to specifications and industry standards for fiber optic female connector terminated with a fiber optic cable.
   b. Install a terminating cap for each unused connector.

2.3 DISTRIBUTION EQUIPMENT AND SYSTEMS

A. Backbone Distribution Cables:
   1. Provide cable listed for environments where it is installed.
   2. Technical Characteristics:
      a. Length: As required, in minimum 1 kilometer (3,000 ft.) reels.
      b. Size:
         1) Minimum 0.326 mm2 (22 AWG) outside plant installation.
         2) Minimum 0.205 mm2 (24 AWG) interior installations.
      c. Color Coding: American Telephone and Telegraph Company Standard; Bell System Practices Outside Plant Construction and Maintenance Section G50.607.3, Issue 2 February, 1959.
      d. Minimum Bend Radius: 10X cable outside diameter.

3. Fiber Optic:
   a. Multimode Fiber:
      1) Provide OM2 Type general purpose multimode fiber optic cable installed in conduit for system locations with load-bearing support braid surrounding inner tube for strength during cable installation.
      2) Technical Characteristics:
         a) Bend Radius: Minimum 152 mm (6 inches); outer jacket as required.
         b) Fiber Diameter: 62.5 microns.
         c) Cladding: 125 microns.
         d) Attenuation:
            1) 850 nanometer: Maximum 4.0 dB per kilometer.
            2) 1,300 nanometer: Maximum 2.0 dB per kilometer.
         e) Bandwidth:
            1) 850 nanometer: Minimum 160 MHz.
            2) 1,300 nanometer: Minimum 500 MHz.
         f) Connectors: Stainless steel.
   b. Single mode Fiber:
      1) Provide OS1 Type general purpose single mode fiber optic cable installed in conduit for all system locations with load-bearing support braid surrounding inner tube for strength during cable installation.
      2) Technical Characteristics:
         a) Bend Radius: Minimum 100 mm (4 inches).
         b) Outer Jacket: PVC.
         c) Fiber Diameter: 8.7 microns.
         d) Cladding: 125 microns.
         e) Attenuation at 850 nanometer: 1.0 dBm per kilometer.
         f) Connectors: Ceramic.

B. Fiber Optic Terminators:
   1. Pre-polished crimp on type that has proper ferrule to terminate fiber optic cable.
   2. Technical Characteristics:
      a. Frequency: Light wave.
      b. Power Blocking: As required.
      c. Return Loss: 25 dB.

d. Connectors: Multimode (ST), Singlemode (LC).

e. Construction: Ceramic.

C. Conduit and Signal Ducts:

1. Conduit:

a. Provide conduit or sleeves for cables penetrating walls, ceilings, floors, interstitial space, and fire barriers.

b. Minimum Conduit Size: 19 mm (3/4 inch).

c. Provide separate conduit and signal ducts for each cable type installation.

d. Maximum 40 percent new conduit fill for cable installation.

2. Signal Duct, Cable Duct, or Cable Tray: Use existing signal duct, cable duct, and cable tray, when identified and accepted by COR.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install for ease of operation, maintenance, and testing.

B. Install system to comply with NFPA 70 National Electrical Code, NFPA 99 Health Care Facilities, NFPA 101 Life Safety Code, Joint Commission Manual for Health Care Facilities, and original equipment manufacturers' (OEM) installation instructions.

C. Cable Systems Installation:

1. Install system cables in cable duct, cable tray, cable runway, conduit or when specifically approved, flexible NEC Article 800 communications raceway. Confirm drawings show sufficient quantity and size of cable pathways. If flexible communications raceway is used, install in same manner as conduit.

2. Bond to ground metallic cable sheaths (i.e. risers, underground, and horizontal).

D. Labeling:

1. Industry Standard: Provide labeling in accordance with ANSI/TIA-606-B.

2. Print lettering of labels with laser printers; handwritten labels are not acceptable.

3. Label both ends of all cables in accordance with industry standard. Provide permanent Labels in contrasting colors and identify according to system “Record Wiring Diagrams”.

4. Termination Hardware: Label workstation outlets and patch panel connections using color coded labels with identifiers in accordance with industry standard and record on "Record Wiring Diagrams".

3.2 FIELD QUALITY CONTROL

A. Interim Inspection:
1. Verify that equipment provided adheres to installation requirements of this section. Interim inspection shall be conducted by a factory-certified representative and witnessed by COR.
2. Check each item of installed equipment to ensure appropriate NRTL label.
3. Visually confirm marking of cables, patch panel connectors and patch cords.
4. Perform fiber optical field inspection tests via attenuation measurements on factory reels and provide results along with manufacturer certification for factory reel tests. Remove failed cable reels from project site upon attenuation test failure.
5. Notify COR of the estimated date the contractor expects to be ready for interim inspection, at least 20 working days before requested inspection date, so interim inspection does not affect systems' completion date.
6. Provide results of interim inspection to COR. If major or multiple deficiencies are discovered, COR can require a second interim inspection before permitting contractor to continue with system installation.
7. Do not proceed with installation until COR determines if an additional inspection is required. In either case, re-inspection of deficiencies noted during interim inspections shall be part of the proof of performance test.

B. Pretesting:
1. Pretest entire system upon completion of system installation.
2. Verify during system pretest, utilizing the accepted equipment, that system is fully operational and meets system performance requirements of this section.
3. Provide COR four copies of recorded system pretest measurements and the written certification that system is ready for formal acceptance test.

C. Acceptance Test:

1. After system has been pretested and the contractor has submitted pretest results and certification to COR, then schedule an acceptance test date and give COR 30 days' written notice prior to date acceptance test is expected to begin.
2. Test only in presence of a COR.
3. Test utilizing approved test equipment to certify proof of performance.
4. Verify that total system meets the requirements of this section.
5. Include expected duration of test time, with notification of the acceptance test.

D. Verification Tests:
1. Multi-mode Fiber Optic Cable: Perform end-to-end attenuation tests in accordance with TIA-568-B.3 and TIA-526-14A using Method A, Optical Power Meter and Light Source and Method B, OTDR. Perform verification acceptance test.
2. Single mode Fiber Optic Cable: Perform end-to-end attenuation tests in accordance with TIA-568-B.3 and TIA-526-7 using Method A, Optical Power Meter and Light Source and Method B, OTDR. Perform verification acceptance test.

E. Performance Testing:
1. Fiber Optic Links: Perform end-to-end fiber optic cable link tests in accordance with TIA-568-B.3.

F. Total System Acceptance Test: Perform verification tests for multi-mode and single mode fiber optic cabling systems after complete telecommunication distribution system and workstation outlet are installed.

3.3 MAINTENANCE

A. Accomplish the following minimum requirements during one year warranty period:
1. Respond and correct on-site trouble calls, during standard work week:
   a. A routine trouble call within one working day of its report. A routine trouble is considered a trouble which causes a system outlet, station, or patch cord to be inoperable.
   b. Standard work week is considered 8:00 A.M. to 5:00 P.M., Monday through Friday exclusive of Federal holidays.

2. Respond to an emergency trouble call within six hours of its report. An emergency trouble is considered a trouble which causes a subsystem or distribution point to be inoperable at any time.
3. Respond on-site to a catastrophic trouble call within four hours of its report. A catastrophic trouble call is considered total system failure.
   a. If a system failure cannot be corrected within four hours (exclusive of standard work time limits), provide alternate equipment, or cables within four hours after four hour trouble shooting time.
   b. Routine or emergency trouble calls in critical emergency health care facilities (i.e., cardiac arrest, and intensive care units) are also be deemed as a catastrophic trouble.
4. Provide COR written report itemizing each deficiency found and the corrective action performed during each official reported trouble call. Provide COR with sample copies of reports for review and approval at beginning of total system acceptance test.

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SECTION 31 20 11
EARTHWORK (SHORT FORM)

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies the requirements for furnishing all equipment, materials, labor and techniques for earthwork including excavation, fill, backfill and site restoration utilizing fertilizer, seed and/or sod.

1.2 DEFINITIONS:

A. Unsuitable Materials:

1. Fills: Topsoil, frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 75 mm (3 inches); organic materials, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable.
2. Existing Subgrade (except footings): Same materials as above paragraph, that are not capable of direct support of slabs, pavement, and similar items, with the possible exception of improvement by compaction, proofrolling, or similar methods of improvement.
3. Existing Subgrade (footings only): Same as Paragraph 1, but no fill or backfill. If materials differ from design requirements, excavate to acceptable strata subject to COR's approval.

B. Earthwork: Earthwork operations required within the new construction area. It also includes earthwork required for auxiliary structures and buildings and sewer and other trenchwork throughout the job site.

C. Degree of Compaction: Degree of compaction is expressed as a percentage of maximum density obtained by the test procedure presented in AASHTO T99.

D. The term fill means fill or backfill as appropriate.

1.3 RELATED WORK:

A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.

C. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article, PHYSICAL DATA.

1.4 CLASSIFICATION OF EXCAVATION:

A. Unclassified Excavation: Removal and disposal of pavements and other man-made obstructions visible on the surface; utilities, and other items including underground structures indicated to be demolished and removed; together with any type of materials regardless of character of material and obstructions encountered.

B. Rock Excavation:

1. Solid ledge rock (igneous, metamorphic, and sedimentary rock).
2. Bedded or conglomerate deposits so cemented as to present characteristics of solid rock which cannot be excavated without blasting; or the use of a modern power excavator (shovel, backhoe, or similar power excavators) of no less than 0.75 m3 (1 cubic yard) capacity, properly used, having adequate power and in good running condition.
3. Boulders or other detached stones each having a volume of 0.4 m3 (1/2 cubic yard) or more.

1.5 MEASUREMENT AND PAYMENT FOR EXCAVATION:

Measurement: The unit of measurement for excavation and borrow will be the cubic yard, computed by the average end area method from cross sections taken before and after the excavation and borrow operations, including the excavation for ditches, gutters, and channel changes, when the material is acceptably utilized or disposed of as herein specified. Quantities shall be computed by a Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00, GENERAL REQUIREMENTS. The measurement will not include the volume of subgrade material or other material used for purposes other than directed. The volume of overburden stripped from borrow pits and the volume of excavation for ditches to drain borrow its, unless used as borrow material, will not be measured for payment. The measurement will not include the volume of any excavation performed prior to taking of elevations and measurements of the undisturbed grade.

1.6 MEASUREMENT AND PAYMENT FOR ROCK EXCAVATION:

A. Measurement: Cross section and measure the uncovered and separated materials, and compute quantities by the Registered Professional Land Surveyor or Registered Civil Engineer, specified in Section 01 00 00,

GENERAL REQUIREMENTS. Do not measure quantities beyond the following limits:

1. 300 mm (12 inches) outside of the perimeter of formed footings.
2. 600 mm (24 inches) outside the face of concrete work for which forms are required, except for footings.
3. 150 mm (6 inches) below the bottom of pipe and not more than the pipe diameter plus 600 mm (24 inches) in width for pipe trenches.
4. The outside dimensions of concrete work for which no forms are required (trenches, conduits, and similar items not requiring forms).

B. Payment for Differing Site Conditions: When rock excavation, as classified, is encountered, the contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable.

1.7 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Rock Excavation Report:

1. Certification of rock quantities excavated.
2. Excavation method.
3. Labor.
4. Equipment.
5. Land Surveyor's or Civil Engineer's name and official registration stamp.
6. Plot plan showing elevations.

C. Contractor shall submit procedure and location for disposal of unused satisfactory material. Proposed source of borrow material. Notification of encountering rock in the project. Advance notice on the opening of excavation or borrow areas. Advance notice on shoulder construction for rigid pavements.

1.8 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. American Nursery and Landscape Association (ANLA):

2004.....American Standard for Nursery Stock

C. American Association of State Highway and Transportation Officials (AASHTO):

T99-10.....Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 inch) Drop

T180-10.....Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg [10 lb] Rammer and a 457 mm (18 inch) Drop

D. American Society for Testing and Materials (ASTM):

C33-03.....Concrete Aggregate

D698-e1.....Laboratory Compaction Characteristics of Soil Using Standard Effort

D1140-00.....Amount of Material in Soils Finer than the No. 200 (75-micrometer) Sieve

D1556-00.....Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method

D1557-09.....Laboratory Compaction Characteristics of Soil Using Modified Effort

D2167-94 (2001).....Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method

D2487-06.....Standard Classification of Soil for Engineering Purposes (Unified Soil Classification System)

D6938-10.....Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

E. Standard Specifications of Ohio State Department of Transportation, latest revision.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Fills: Materials approved from on site and off site sources having a minimum dry density of 1760 kg/m3 (110 pcf), a maximum Plasticity Index of 6, and a maximum Liquid Limit of 30.

B. Granular Fill:

1. Under concrete slab, granular fill shall consist of clean, poorly graded crushed rock, crushed gravel, or uncrushed gravel placed beneath a building slab with or without a vapor barrier to cut off the capillary flow of pore water to the area immediately below.

Fine aggregate grading shall conform to ASTM C33 with a maximum of 3 percent by weight passing ASTM D1140, 75 micrometers (No. 200) sieve, or 37.5 mm (1-1/2 inches) and no more than 2 percent by weight passing the 4.75 mm (No. 4) size sieve or coarse aggregate Size 57, 67, or 77.

2. Bedding for sanitary and storm sewer pipe, crushed stone or gravel graded from 13 mm (1/2 inch) to 4.75 mm (No. 4).

C. Fertilizer: (5-10-5) delivered to site in unopened containers that clearly display the manufacturer's label, indicating the analysis of the contents.

D. Seed: Grass mixture comparable to existing turf delivered to site in unopened containers that clearly display the manufacturer's label, indicating the analysis of the contents.

E. Sod: Comparable species with existing turf. Use State Certified or State Approved sod when available. Deliver sod to site immediately after cutting and in a moist condition. Thickness of cut shall be 19 mm to 32 mm (3/4 inch to 1 1/4 inches) excluding top growth. There shall be no broken pads and torn or uneven ends.

F. Requirements For Offsite Soils: Offsite soils brought in for use as backfill shall be tested for TPH, BTEX and full TCLP including ignitability, corrosivity and reactivity. Backfill shall contain less than 100 parts per million (ppm) of total hydrocarbons (TPH) and less than 10 ppm of the sum of Benzene, Toleune, Ethyl Benzene, and Xylene (BTEX)and shall not fail the TCLP test. TPH concentrations shall be determined by using EPA 600/4-79/020 Method 418.1. BTEX concentrations shall be determined by using EPA SW-846.3-3a Method5030/8020. TCLP shall be performed in accordance with EPA SW-846.3-3a 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. Material shall not be brought on site until tests have been approved by the COR.

G. Buried Warning and Identification Tape: 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 inch minimum width, color coded as specific 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. Color and printing shall be permanent, 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

H. Warning Tape for Metallic Piping: Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements specified above. Minimum thickness of tape shall be 0.076 mm (0.003 inch). Tape shall have a minimum strength of 10.3 MPa (1500 psi) lengthwise, and 8.6 MPa (1250 psi) crosswise, with a maximum 350 percent elongation.

I. Detectable Warning Tape for Non-Metallic Piping: Polyethylene plastictape conforming to the width, color, and printing requirements specified above. Minimum thickness of the tape shall be 0.102 mm (0.004 inch). Tape shall have a minimum strength of 10.3 MPa (1500 psi) lengthwise and 8.6 MPa (1250 psi) crosswise. Tape shall be manufactured with integral wires, foil backing, or other means of enabling detection by a metal detector when tape is buried up to 0.9 m(3 feet) deep. Encase metallic element of the tape in a protective jacket or provide with other means of corrosion protection.

J. Detection Wire For Non-Metallic Piping: Detection wire shall be Insulated single strand, solid copper with a minimum of 12 AWG.

PART 3 - EXECUTION

3.1 SITE PREPARATION:

A. Clearing: Clearing within the limits of earthwork operations as described or designated by the COR. Work includes removal of trees, shrubs, fences, foundations, incidental structures, paving, debris, trash and any other obstructions. Remove materials from the Medical Center.

B. Grubbing: Remove stumps and roots 75 mm (3 inches) and larger diameter. Undisturbed sound stumps, roots up to 75 mm (3 inches) diameter, and nonperishable solid objects which will be a minimum of 900 mm (3 feet) below subgrade or finished embankment may be left.

C. Trees and Shrubs: Trees and shrubs, not shown for removal, may be removed from the areas within 4500 mm (15 feet) of new construction and 2250 mm (7’-6”) of utility lines if such removal is approved in advance by the COR. Remove materials from the Medical Center. Trees and shrubs, shown to be transplanted, shall be dug with a ball of earth and burlapped in accordance with the latest issue of the, "American Standard for Nursery Stock", of the American Association of Nurserymen, Inc. Transplant trees and shrubs to a permanent or temporary position within two hours after digging. Maintain trees and shrubs held in temporary locations by watering as necessary and feeding semi-annually with liquid fertilizer with a minimum analysis of 5 percent nitrogen, 10 percent phosphorus and 5 percent potash. Maintain plants moved to permanent positions as specified for plants in temporary locations until the conclusion of the contract. Box, and otherwise protect from damage, existing trees and shrubs which are not shown to be removed in the construction area. Repair immediately damage to existing trees and shrubs by trimming, cleaning and painting damaged areas, including the roots, in accordance with standard industry horticultural practice for the geographic area and plant species. Building materials shall not be stored closer to trees and shrubs that are to remain, than the farthest extension of their limbs.

D. Stripping Topsoil: Unless otherwise indicated on the drawings, the limits of earthwork operations shall extend anywhere the existing grade is filled or cut or where construction operations have compacted or otherwise disturbed the existing grade or turf. Strip topsoil as defined herein, or as indicated in the geotechnical report, from within the limits of earthwork operations as specified above unless specifically indicated or specified elsewhere in the specifications or shown on the drawings. Topsoil shall be fertile, friable, natural topsoil of loamy character and characteristic of the locality. Topsoil shall be capable of growing healthy horticultural crops of grasses. Stockpile topsoil and protect as directed by the COR. Eliminate foreign material, such as weeds, roots, stones, subsoil, frozen clods, and

similar foreign materials, larger than 0.014 m3 (1/2 cubic foot) in volume, from soil as it is stockpiled. Retain topsoil on the station. Remove foreign materials larger than 50 mm (2 inches) in any dimension from topsoil used in final grading. Topsoil work, such as stripping, stockpiling, and similar topsoil work, shall not, under any circumstances, be carried out when the soil is wet so that the tilth of the soil will be destroyed.

1. Concrete Slabs and Paving: Score deeply or saw cut to insure a neat, straight cut, sections of existing concrete slabs and paving to be removed where excavation or trenching occurs. Extend pavement section to be removed a minimum of 300 mm (12 inches) on each side of widest part of trench excavation and insure final score lines are approximately parallel unless otherwise indicated. Remove material from the Medical Center.

E. Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.

3.2 EXCAVATION:

A. Shoring, Sheeting and Bracing: Shore, brace, or slope to its angle of repose banks of excavations to protect workmen, banks, adjacent paving, structures, and utilities, in compliance with OSHA requirements.

1. Extend shoring and bracing to the bottom of the excavation. Shore excavations that are carried below the elevations of adjacent existing foundations.
2. If the bearing of any foundation is disturbed by excavating, improper shoring or removal of shoring, placing of backfill, and similar operations, provide a concrete fill support under disturbed foundations, as directed by COR, at no additional cost to the Government. Do not remove shoring until permanent work in excavation has been inspected and approved by COR.

B. Excavation Drainage: Operate pumping equipment , and/or provide other materials, means and equipment as required, to keep excavations free of water and subgrades dry, firm, and undisturbed until approval of permanent work has been received from COR. Approval by the COR is also required before placement of the permanent work on all subgrades. When subgrade for foundations has been disturbed by water, remove the

disturbed material to firm undisturbed material after the water is brought under control. Replace disturbed subgrade in trenches by mechanically tamped sand or gravel. When removed disturbed material is located where it is not possible to install and properly compact disturbed subgrade material with mechanically compacted sand or gravel, the COR shall be contacted to consider the use of flowable fill. Groundwater flowing toward or into excavations shall be controlled to prevent sloughing of excavation slopes and walls, boils, uplift and heave in the excavation and to eliminate interference with orderly progress of construction. French drains, sumps, ditches or trenches will not be permitted within 0.9 m (3 feet) of the foundation of any structure, except with specific written approval, and after specific contractual provisions for restoration of the foundation area have been made. Control measures shall be taken 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, the water level shall be maintained continuously, at least 1 m (3 feet) below the working level. Operate dewatering system continuously until construction work below existing water levels is complete. Submit performance records weekly. Measure and record performance of dewatering system at same time each day by use of observation wells or piezometers installed in conjunction with the dewatering system. Relieve hydrostatic head in pervious zones below subgrade elevation in layered soils to prevent uplift.

C. Blasting: Blasting shall not be permitted.

D. Building Earthwork:

1. Excavation shall be accomplished as required by drawings and specifications.
2. Excavate foundation excavations to solid undisturbed subgrade.
3. Remove loose or soft material to solid bottom.
4. Fill excess cut under footings or foundations with 25 MPa (3000 psi) concrete, poured separately from the footings.
3. Do not tamp earth for backfilling in footing bottoms, except as specified.

E. Trench Earthwork:

1. Utility trenches (except sanitary and storm sewer):
   a. Excavate to a width as necessary for sheeting and bracing and proper performance of the work.

b. Grade bottom of trenches with bell-holes, scooped-out to provide a uniform bearing.

c. Support piping on suitable undisturbed earth unless a mechanical support is shown. Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 150 mm (6 inches) loose thickness.

d. The length of open trench in advance of pipe laying shall not be greater than is authorized by the COR.

e. Provide buried utility lines with utility identification tape. Bury tape 300 mm (12 inches) below finished grade; under pavements and slabs, bury tape 150 mm (6 inches) below top of subgrade

f. Bury detection wire directly above non-metallic piping at a distance not to exceed 300 mm (12 inches) above the top of pipe. The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 0.9 m (3 feet) of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over it's entire length. The wire shall enter 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, the wire shall terminate in the valve pit at the pump station end of the pipe.

g. Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken 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. Backfill to top of pipe shall be compacted to 95 percent of ASTM D 698maximum density. Plastic piping shall have bedding to spring line of pipe. Provide materials as follows:

1) Class I: Angular, 6 to 40 mm (0.25 to 1.5 inches), graded stone, including a number of fill materials that have regional

significance such as coral, slag, cinders, crushed stone, and crushed shells.

2) Class II: Coarse sands and gravels with maximum particle size of 40 mm (1.5 inches), 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 D 2487.

2. Sanitary and storm sewer trenches:

a. Trench width below a point 150 mm (6 inches) above top of the pipe shall be 600 mm (24 inches) for up to and including 300 mm (12 inches) diameter and four-thirds diameter of pipe plus 200 mm (8 inches) for pipe larger than 300 mm (l2 inches). Width of trench above that level shall be as necessary for sheeting and bracing and proper performance of the work.

b. The bottom quadrant of the pipe shall be bedded on suitable undisturbed soil or granular fill. Unstable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 150 mm (6 inches) loose thickness.

1) Undisturbed: Bell holes shall be no larger than necessary for jointing. Backfill up to a point 300 mm (12 inches) above top of pipe shall be clean earth placed and tamped by hand.

2) Granular Fill: Depth of fill shall be a minimum of 75 mm (3 inches) plus one-sixth of pipe diameter below the pipe of 300 mm (12 inches) above top of pipe. Place and tamp fill material by hand.

c. Place and compact as specified the remainder of backfill using acceptable excavated materials. Do not use unsuitable materials.

d. Use granular fill for bedding where rock or rocky materials are excavated.

e. Provide buried utility lines with utility identification tape. Bury tape 300 mm (12 inches) below finished grade; under pavements and slabs, bury tape 150 mm (6 inches) below top of subgrade

f. Bury detection wire directly above non-metallic piping at a distance not to exceed 300 mm (12 inches) above the top of pipe.

The wire shall extend continuously and unbroken, from manhole to manhole. The ends of the wire shall terminate inside the manholes at each end of the pipe, with a minimum of 0.9 m (3 feet) of wire, coiled, remaining accessible in each manhole. The wire shall remain insulated over its entire length. The wire shall enter 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, the wire shall terminate in the valve pit at the pump station end of the pipe.

g. Initial backfill material shall be placed and compacted with approved tampers to a height of at least one foot above the utility pipe or conduit. The backfill shall be brought up evenly on both sides of the pipe for the full length of the pipe. Care shall be taken 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. Backfill to top of pipe shall be compacted to 95 percent of ASTM D698 maximum density. Plastic piping shall have bedding to spring line of pipe. Provide materials as follows:

1) Class I: Angular, 6 to 40 mm (0.25 to 1.5 inches), graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed stone, and crushed shells.

2) Class II: Coarse sands and gravels with maximum particle size of 40 mm (1.5 inches), 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.

F. Site Earthwork: Excavation shall be accomplished as required by drawings and specifications. Remove subgrade materials that are determined by the COR as unsuitable, and replace with acceptable material. If there is a question as to whether material is unsuitable or not, the Contractor shall obtain samples of the material, under the direction of the COR, and the materials shall be examined by an independent testing laboratory for soil classification to determine

whether it is unsuitable or not. When unsuitable material is encountered and removed, the contract price and time will be adjusted in accordance with Articles, DIFFERING SITE CONDITIONS, CHANGES and CHANGES-SUPPLEMENT of the GENERAL CONDITIONS as applicable. Adjustments shall be based on meters (yardage) in cut section only.

G. Finished elevation of subgrade shall be as follows:
   1. Pavement Areas - bottom of the pavement or base course as applicable.
   2. Planting and Lawn Areas - 100 mm (4 inches) below the finished grade, unless otherwise specified or indicated on the drawings.

3.3 FILLING AND BACKFILLING:

A. General: Do not fill or backfill until all debris, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from the excavation. Proof-roll exposed subgrades with a fully loaded dump truck. Use excavated materials or borrow for fill and backfill, as applicable. Do not use unsuitable excavated materials. Do not backfill until foundation walls have been completed above grade and adequately braced, waterproofing or dampproofing applied, and pipes coming in contact with backfill have been installed, and inspected and approved by COR.

B. Proof-rolling Existing Subgrade: - Proof rolling shall be done on an exposed subgrade free of surface water (wet conditions resulting from rainfall) which would promote degradation of an otherwise acceptable subgrade. Notify the COR a minimum of 3 days prior to proof rolling. Proof rolling shall be performed in the presence of the COR. Rutting or pumping of material shall be undercut as directed by the COR.

C. Placing: Place material in horizontal layers not exceeding 200 mm (8 inches) in loose depth and then compacted. Do not place material on surfaces that are muddy, frozen, or contain frost.

D. Compaction: Use approved equipment (hand or mechanical) well suited to the type of material being compacted. Do not operate mechanized vibratory compaction equipment within 3000 mm (10 feet) of new or existing building walls without the prior approval of the COR. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Compact each layer to not less than 95 percent of the maximum density determined in accordance with the following test method

AASHTO T99. Backfill adjacent to any and all types of structures shall be placed and compacted to at least 90 percent laboratory maximum density for cohesive materials or 95 percent laboratory maximum density for cohesionless materials to prevent wedging action or eccentric loading upon or against the structure.

E. Borrow Material: Borrow material shall be selected to meet the requirements and conditions of the particular fill or embankment for which it is to be used. Borrow material shall be obtained from the borrow areas from approved private sources. Unless otherwise provided in the contract, the Contractor shall obtain from the owners the right to procure material, pay royalties and other charges involved, and bear the expense of developing the sources, including rights-of-way for hauling. Borrow material from approved sources on Government-controlled land may be obtained without payment of royalties. Unless specifically provided, no borrow shall be obtained within the limits of the project site without prior written approval. Necessary clearing, grubbing, and satisfactory drainage of borrow pits and the disposal of debris thereon shall be considered related operations to the borrow excavation.

F. Opening and Drainage of Excavation and Borrow Pits: The Contractor shall notify the COR sufficiently in advance of the opening of any excavation or borrow pit to permit elevations and measurements of the undisturbed ground surface to be taken. Except as otherwise permitted, borrow pits and other excavation areas shall be excavated providing adequate drainage. Overburden and other spoil material shall be transported to designated spoil areas or otherwise disposed of as directed. Borrow pits shall be neatly trimmed and drained after the excavation is completed. The Contractor shall ensure that excavation of any area, operation of borrow pits, or dumping of spoil material results in minimum detrimental effects on natural environmental conditions.

3.4 GRADING:

A. General: Uniformly grade the areas within the limits of this section, including adjacent transition areas. Smooth the finished surface within specified tolerance. Provide uniform levels or slopes between points where elevations are indicated, or between such points and existing

finished grades. Provide a smooth transition between abrupt changes in slope.

B. Cut rough or sloping rock to level beds for foundations. In unfinished areas fill low spots and level off with coarse sand or fine gravel.

C. Slope backfill outside the building away from the building walls for a minimum distance of 3048 mm (10 feet)at a minimum five percent (5%) slope.

D. The finished grade shall be 150 mm (6 inches) below bottom line of windows or other building wall openings unless greater depth is shown.

E. Place crushed stone or gravel fill under concrete slabs on grade tamped and leveled. The thickness of the fill shall be 150 mm (6 inches), unless otherwise indicated.

F. Finish subgrade in a condition acceptable to the COR at least one day in advance of the paving operations. Maintain finished subgrade in a smooth and compacted condition until the succeeding operation has been accomplished. Scarify, compact, and grade the subgrade prior to further construction when approved compacted subgrade is disturbed by contractor's subsequent operations or adverse weather.

G. Grading for Paved Areas: Provide final grades for both subgrade and base course to +/- 6 mm (0.25 inches) of indicated grades.

3.5 LAWN AREAS:

A. General: Harrow and till to a depth of 100 mm (4 inches), new or existing lawn areas to remain, which are disturbed during construction. Establish existing or design grades by dragging or similar operations. Do not carry out lawn areas earthwork out when the soil is wet so that the tilth of the soil will be destroyed. Plant bed shall be approved by COR before seeding or sodding operation begins.

B. Finished Grading: Begin finish grading after rough grading has had sufficient time for settlement. Scarify subgrade surface in lawn areas to a depth of 100 mm (4 inches). Apply topsoil so that after normal compaction, dragging and raking operations (to bring surface to indicated finish grades) there will be a minimum of 100 mm (4 inches) of topsoil over all lawn areas; make smooth, even surface and true grades, which will not allow water to stand at any point. Shape top and bottom of banks to form reverse curves in section; make junctions with undisturbed areas to conform to existing topography. Solid lines within grading limits indicate finished contours. Existing contours, indicated

by broken lines are believed approximately correct but are not guaranteed.

C. Fertilizing: Incorporate fertilizer into the soil to a depth of 100 mm (4 inches) at a rate of 12 kg/100 m2 (25 pounds per 1000 square feet).

D. Seeding: Seed at a rate of 2 kg/100 m2 (4 pounds per 1000 square feet) and accomplished only during periods when uniform distribution may be assured. Lightly rake seed into bed immediately after seeding. Roll seeded area immediately with a roller not to exceed 225 kg/m (150 pounds per foot) of roller width.

E. Sodding: Topsoil shall be firmed by rolling and during periods of high temperature the topsoil shall be watered lightly immediately prior to laying sod. Sod strips shall be tightly butted at the ends and staggered in a running bond fashion. Placement on slopes shall be from the bottom to top of slope with sod strips running across slope. Secure sodded slopes by pegging or other approved methods. Roll sodded area with a roller not to exceed 225 kg/m (150 pounds per foot) of the roller width to improve contact of sod with the soil.

F. Watering: The COR is responsible for having adequate water available at the site. As sodding is completed in any one section, the entire sodded area shall be thoroughly irrigated by the contractor, to a sufficient depth, that the underside of the new sod pad and soil, immediately below sod, is thoroughly wet. COR will be responsible for sod after installation and acceptance.

3.6 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL:

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Medical Center property.

B. Place excess excavated materials suitable for fill and/or backfill on site where directed.

C. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.

D. Segregate all excavated contaminated soil designated by the COR from all other excavated soils, and stockpile on site on two 0.15 mm (6 mil) polyethylene sheets with a polyethylene cover. A designated area shall be selected for this purpose. Dispose of excavated contaminated material in accordance with State and Local requirements.

3.7 CLEAN-UP:

Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove debris, rubbish, and excess material from the Medical Center.

- - - E N D - - -

SECTION 31 23 19
DEWATERING

PART 1 - GENERAL

1.1 DESCRIPTION:

This section specifies performance of dewatering required to lower and control ground water table levels and hydrostatic pressures to permit excavation, backfill, and construction to be performed in the dry. Control of surface water shall be considered as part of the work under this specification.

1.2 SUMMARY:

A. The work to be completed by the Contractor includes, but is not necessarily limited to the following:
   1. Implementation of the Erosion and Sedimentation Control Plan.
   2. Dewater excavations, including seepage and precipitation.

B. The Contractor shall be responsible for providing all materials, equipment, labor, and services necessary for care of water and erosion control. Excavation work shall not begin before the Erosion and Sedimentation Control Plan is in place.

1.3 REQUIREMENT:

A. Dewatering system shall be of sufficient size and capacity necessary to lower and maintain ground water table to an elevation at least 300 mm (1 foot) below bottom of pipe trench and to allow material to be excavated in a reasonably dry condition. Materials to be removed shall be sufficiently dry to permit excavation to grades shown and to stabilize excavation slopes where sheeting is not required. Operate dewatering system continuously until backfill work has been completed.

B. Reduce hydrostatic head below any excavation to the extent that water level in the construction area is a minimum of 300 mm (1 foot) below prevailing excavation surface.

C. Prevent loss of fines, seepage, boils, quick conditions or softening of foundation strata.

D. Maintain stability of sides and bottom of excavation.

E. Construction operations are performed in the dry.

F. Control of surface and subsurface water is part of dewatering requirements. Maintain adequate control so that:
   1. The stability of excavated and constructed slopes are not adversely affected by saturated soil, including water entering prepared

subbase and subgrades where underlying materials are not free draining or are subject to swelling or freeze-thaw action.

2. Erosion is controlled.
3. Flooding of excavations or damage to structures does not occur.
4. Surface water drains away from excavations.
5. Excavations are protected from becoming wet from surface water, or insure excavations are dry before additional work is undertaken.

G. Permitting Requirements: The contractor shall comply with and obtain the required State and County permits where the work is performed.

1.4 RELATED WORK:

A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Submittal requirements as specified in Section 01 33 23 SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.

D. Subsurface Investigation: Section 01 00 00, GENERAL REQUIREMENTS, Article 1.11, PHYSICAL DATA.

E. Excavation, backfilling, site grade and utilities: Section 31 20 11, EARTHWORK.

1.5 SUBMITTALS:

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Drawings and Design Data:

1. Submit drawings and data showing the method to be employed in dewatering excavated areas 30 days before commencement of excavation.
2. Material shall include: location, depth and size of wellpoints, headers, sumps, ditches, size and location of discharge lines, capacities of pumps and standby units, and detailed description of dewatering methods to be employed to convey the water from site to adequate disposal.
3. Include a written report outlining control procedures to be adopted if dewatering problem arises.
4. Capacities of pumps, prime movers, and standby equipment.

5. Design calculations proving adequacy of system and selected equipment. The dewatering system shall be designed using accepted and professional methods of design and engineering consistent with the best modern practice. The dewatering system shall include the deep wells, wellpoints, and other equipment, appurtenances, and related earthwork necessary to perform the function.
6. Detailed description of dewatering procedure and maintenance method.
7. Materials submitted shall be in a format acceptable for inclusion in required permit applications to any and all regulatory agencies for which permits for discharge water from the dewatering system are required due to the discharge reaching regulated bodies of water.

C. Inspection Reports.

D. All required permits.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install a dewatering system to lower and control ground surface water in order to permit excavation, construction of structure, and placement of backfill materials to be performed under dry conditions. Make the dewatering system adequate to pre-drain the water-bearing strata above and below the bottom of structure foundations, utilities and other excavations.

B. In addition, reduce hydrostatic pressure head in water-bearing strata below structure foundations, utility lines, and other excavations, to extent that water levels in construction area are a minimum of 300 mm (1 foot) below prevailing excavation surface at all times.

3.2 OPERATION:

A. Prior to any excavation below the ground water table, place system into operation to lower water table as required and operate it continuously 24 hours a day, 7 days a week until utilities and structures have been satisfactorily constructed, which includes the placement of backfill materials and dewatering is no longer required.

B. Place an adequate weight of backfill material to prevent buoyancy prior to discontinuing operation of the system.

3.3 WATER DISPOSAL:

A. Dispose of water removed from the excavations in such a manner as:

1. Will not endanger portions of work under construction or completed.

2. Will cause no inconvenience to Government or to others working near site.
3. Will comply with the stipulations of required permits for disposal of water.
4. Will Control Runoff: The Contractor shall be responsible for control of runoff in all work areas including but not limited to: excavations, access roads, parking areas, laydown, and staging areas. The Contractor shall provide, operate, and maintain all ditches, basins, sumps, culverts, site grading, and pumping facilities to divert, collect, and remove all water from the work areas. All water shall be removed from the immediate work areas and shall be disposed of in accordance with applicable permits.

B. Excavation Dewatering:
1. The Contractor shall be responsible for providing all facilities required to divert, collect, control, and remove water from all construction work areas and excavations.
2. Drainage features shall have sufficient capacity to avoid flooding of work areas.
3. Drainage features shall be so arranged and altered as required to avoid degradation of the final excavated surface(s).
4. The Contractor shall utilize all necessary erosion and sediment control measures as described herein to avoid construction related degradation of the natural water quality.

C. Dewatering equipment shall be provided to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the work during construction. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

3.4 STANDBY EQUIPMENT:

Provide complete standby equipment, installed and available for immediate operation, as may be required to adequately maintain de-watering on a continuous basis and in the event that all or any part of the system may become inadequate or fail.

3.5 CORRECTIVE ACTION:

If dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system (loosening of the foundation strata, or instability of slopes, or damage to foundations or structures), perform work necessary for reinstatement of foundation soil and damaged structure or damages to work in place resulting from such inadequacy or failure by Contractor, at no additional cost to Government.

3.6 DAMAGES:

Immediately repair damages to adjacent facilities caused by dewatering operations.

3.7 REMOVAL:

Insure compliance with all conditions of regulating permits and provide such information to the COR. Obtain written approval from COR before discontinuing operation of dewatering system.

----- E N D -----

SECTION 32 05 23
CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Subbase for concrete pavements.
   2. Curbs.
   3. Pedestrian Pavement: Walks, grade slabs, wheelchair curb ramps, and steps.

1.2 RELATED REQUIREMENTS

A. Subgrade Preparation and Subbase Compaction: Section 31 20 11, EARTHWORK.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.
B. American Association of State Highway and Transportation Officials (AASHTO):
   1. M147-65-UL-04 - Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
   2. M233-86 - Boiled Linseed Oil Mixture for Treatment of Portland Cement Concrete.
C. American Concrete Institute (ACI):
   1. 305R-10 - Guide to Hot Weather Concreting.
   2. 306R-10 - Guide to Cold Weather Concreting.
D. American National Standards Institute (ANSI):
   1. B101.3 - Wet DOCF of Common Hard Surface Floor Materials (Including Action and Limit Thresholds for the Suitable Assessment of the Measured Values).
E. ASTM International (ASTM):
   1. A615/A615M-16 - Deformed and Plain Carbon Steel Bars for Concrete Reinforcement.
   2. A996/A996M-15 - Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
   3. A1064/A1064M-16 - Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
   4. C33/C33M-16 - Concrete Aggregates.
   5. C94/C94M-16 - Ready Mixed Concrete.

6. C143/C143M-15a - Slump of Hydraulic Cement Concrete.
7. C150/C150M-16 - Portland Cement.
8. C171-16 - Sheet Materials for Curing Concrete.
9. C260/C260M-10a - Air Entraining Admixtures for Concrete.
10. C309-11 - Liquid Membrane Forming Compounds for Curing Concrete.
11. C494/C494M-15a - Chemical Admixtures for Concrete.
12. C618-15 - Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
13. C979/C979M-16 - Pigments for Integrally Colored Concrete.
14. C989/C989M-14 - Slag Cement for Use in Concrete and Mortars.
15. C1240-15 - Silica Fume Used in Cementitious Mixtures.
16. D1751-04(2013)e1 - Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
17. D5893/D5893M-10 - Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements.
18. D6690-15 - Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

1.4 PREINSTALLATION MEETINGS

A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.
   1. Required Participants:
      a. Contracting Officer's Representative.
      b. Architect/Engineer.
      c. Contractor.
      d. Installer.
   2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
      a. Installation schedule.
      b. Installation sequence.
      c. Preparatory work.
      d. Protection before, during, and after installation.
      e. Installation.
      f. Terminations.
      g. Transitions and connections to other work.
      h. Inspecting and testing.
      i. Other items affecting successful completion.

3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.5 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:
   1. Show size, configuration, and fabrication and installation details.
   2. Show reinforcing.
   3. Include jointing plan for concrete pavements, curbs and gutters.

C. Manufacturer's Literature and Data:
   1. Description of each product.
   2. Installation instructions.

D. Test reports: Certify products comply with specifications.
   1. Concrete materials.
   2. Select subbase materials.
   3. Field test reports.

E. Certificates: Certify products comply with specifications.
   1. Expansion joint filler.
   2. Reinforcement.
   3. Curing materials.
   4. Concrete protective coating.

F. Qualifications: Substantiate qualifications comply with specifications.
   1. Installer .
   2. Land surveyor.

G. Concrete mix design.

H. Select subbase job-mix design.

I. Proposed hot and cold weather concreting methods.

J. Land surveyor's construction staking notes, before placing concrete.
   1. Identify discrepancies between field conditions and Drawings.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Regularly installs specified products.
   2. Installed specified products with satisfactory service on five similar installations.
      a. Project Experience List: Provide contact names and addresses for completed projects.

B. Land Surveyor: Professional land surveyor or engineer registered to provide land surveys in jurisdiction where project is located.

C. Preconstruction Testing:

1. Engage independent testing laboratory to perform tests and submit reports.
   a. Deliver samples to laboratory in number and quantity required for testing.
2. Concrete mix design.
3. Select subbase job-mix design. Report the following:
   a. Material sources.
   b. Gradation.
   c. Plasticity index.
   d. Liquid limit.
   e. Laboratory compaction curves indicating maximum density at optimum moisture content.

1.7 DELIVERY

A. Deliver steel reinforcement to prevent damage.

B. Before installation, return or dispose of distorted or damaged steel reinforcement.

C. Bulk Products: Deliver bulk products away from buildings, utilities, pavement, and existing turf and planted areas. Maintain dry bulk product storage away from contaminants.

1.8 STORAGE AND HANDLING

A. Store products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

1.9 FIELD CONDITIONS

A. Hot Weather Concreting Procedures: ACI 305R.

B. Cold Weather Concreting Procedures: ACI 306R.

1. Use non-corrosive, non-chloride accelerator admixture.
2. Do not use calcium chloride, thiocyanates or admixtures containing more than 0.05 percent chloride ions.

1.10 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or II.

B. Pozzolans:

1. Fly Ash: ASTM C618, Class C or F including supplementary optional physical requirements.
2. Slag: ASTM C989/C989M; Grade 80, Grade 100 or Grade 120 .
3. Silica Fume: ASTM C1240.

C. Coarse Aggregate: ASTM C33/C33M; size to suit application.

D. Fine Aggregate: ASTM C33/C33M.

E. Mixing Water: Fresh, clean, and potable.

F. Air-Entraining Admixture: ASTM C260/C260M.

G. Chemical Admixtures: ASTM C494/C494M.

H. Expansion Joint Filler: ASTM D1751.

I. Sheet Materials for Curing Concrete: ASTM C171.

2.2 SELECT SUBBASE

A. Subbase: AASHTO M147; Grade A.

1. Select granular material composed of sand, sand-gravel, crushed stone, crushed or granulated slag, with or without soil binder, or combinations of these materials.

SUBBASE GRADING REQUIREMENTS							
Sieve Size		Percentage Passing by Mass					
		Grades					
(mm)	(in)	A	B	C	D	E	F
50	2	100	100				
25	1		75-95	100	100	100	100
9.5	3/8	30-65	40-75	50-85	60-100		
4.47	No. 4	25-55	30-60	35-65	50-85	55-100	70-100
2.00	No. 10	15-40	20-45	25-50	40-70	40-100	55-100
0.425	No. 40	8-20	15-30	15-30	25-45	20-50	30-70
0.075	No. 200	2-8	5-20	5-15	5-20	6-20	8-25

B. Other Acceptable Gradations: Materials within three to five percent, plus or minus, of specified gradation, or as recommended by the geotechnical engineer and approved by the Contracting Officer's Representative.

2.3 FORMS

A. Forms: Wood, plywood, metal, or other materials, approved by Contracting Officer's Representative, of grade or type suitable to obtain type of finish specified.
   1. Plywood: Exterior grade, free of defects and patches on contact surface.
   2. Lumber: Sound, grade-marked, S4S stress graded softwood, minimum 50 mm (2 inches) thick, free from warp, twist, loose knots, splits, or other defects.
   3. Form Coating: As recommended by Architect/Engineer.

B. Provide forms suitable in cross-section, depth, and strength to resist springing during depositing and consolidating concrete.
   1. Do not use forms varying from straight line more than 3 mm in 3000 mm (1/8 inch in 10 feet), horizontally and vertically.

C. Provide flexible or curved forms for forming radii.

2.4 CONCRETE CURING MATERIALS

A. Concrete curing materials, conform to one of the following:
   1. Burlap: Minimum 233 g/sq. m (7 ounces/sq. yd.) dry.
   2. Sheet Materials for Curing Concrete: ASTM C171.
   3. Curing Compound: ASTM C309, Type 1 clear; liquid membrane forming type, without paraffin or petroleum.

2.5 CONCRETE MIXES

A. Design concrete mixes according to ASTM C94/C94M, Option C.

B. Concrete Type: Air-entrained . See Table I.

TABLE I - CONCRETE TYPES					
Concrete Type	Minimum 28 Day Compressive Strength f'c MPa (psi)	Non-Air-Entrained		Air-Entrained	
		Min. Cement kg/cu. m (lbs./cu. yd.)	Max. Water Cement Ratio	Min. Cement kg/cu. m (lbs./cu. yd.)	Max. Water Cement Ratio
A	35 (5000)1,3	375 (630)	0.45	385 (650)	0.40
B	30 (4000)1,3	325 (550)	0.55	340 (570)	0.50
C	25 (3000)1,3	280 (470)	0.65	290 (490)	0.55
D	25 (3000)1,2	300 (500)	*	310 (520)	*

Footnotes:
1. If trial mixes are used, achieve compressive strength 8.3 MPa (1,200 psi) in excess of f'c. For concrete strengths greater than 35 MPa (5,000 psi), achieve compressive strength 9.7 MPa (1,400 psi) in excess of f’c.
2. For Concrete Exposed to High Sulfate Content Soils: Maximum water cement ratio is 0.44.
3. Laboratory Determined according to ACI 211.1 for normal weight concrete.

C. Maximum Slump: ASTM C143/C143M. See Table II.

TABLE II - MAXIMUM SLUMP	
APPLICATION	MAXIMUM SLUMP
Curb & Gutter	75 mm (3 inches)
Pedestrian Pavement	75 mm (3 inches)
Vehicular Pavement	50 mm (2 inches) Machine Finished 100 mm (4 inches) Hand Finished
Equipment Pad	75 to 100 mm (3 to 4 inches)

2.6 ACCESSORIES

A. Equipment and Tools: Obtain Contracting Officer's Representative's, approval of equipment and tools needed for handling materials and performing work before work begins.

B. Maintain equipment and tools in satisfactory working condition.

C. Sealants:

1. Concrete Paving Expansion Joints: ASTM D5893/D5893M, Type SL, single component, self-leveling, silicone joint sealant.

2. Concrete Paving Joints: ASTM D6690, Type IV, hot-applied, single component joint sealant.

D. Concrete Protective Coating: AASHTO M233 linseed oil mixture.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Prepare, construct, and finish subgrade. See Section 31 20 00, EARTHWORK.

D. Maintain subgrade in smooth, compacted condition, in conformance with the required section and established grade until the succeeding operation has been accomplished.

3.2 SELECT SUBBASE

A. Placing:

1. Place subbase material on prepared subgrade in uniform layer to required contour and grades, and to maximum 200 mm (8 inches) loose depth.
2. When required compacted thickness exceeds 150 mm (6 inches), place subbase material in equal thickness layers.
3. When subbase elevation is 13 mm (1/2 inch) or more below required grade, excavate subbase minimum 75 mm (3 inches) deep. Place and compact subbase to required grade.

B. Compaction:

1. Perform compaction with approved hand or mechanical equipment well suited to the material being compacted.
2. Maintain subbase at optimum moisture content for compaction.
3. Compact each subbase layer to minimum 95 percent or 100 percent of maximum density as specified in Section 31 20 00, EARTHWORK.

C. Subbase Tolerances:

1. Variation from Indicated Grade: Maximum 9 mm (3/8 inch).
2. Variation from Indicated Thickness: Maximum 13 mm (1/2 inch).

D. Protection:

1. Protect subbase from damage until concrete is placed.
2. Reconstruct damaged subbase before placing concrete.

3.3 SETTING FORMS

A. Form Substrate:
   1. Compact form substrate to uniformly support forms along entire length.
   2. Correct substrate imperfections and variations by cutting, filling, and compacting.

B. Form Setting:
   1. Set forms to indicated line and grade with tight joints. Rigidly brace forms preventing movement.
   2. Remove forms when removal will not damage concrete and when required for finishing.
   3. Clean and oil forms before each use.
   4. Correct forms, when required, immediately before placing concrete.

C. Land Surveyor: Establish control, alignment, and grade for forms.
   1. Notify Contracting Officer's Representative immediately when discrepancies exist between field conditions and drawings.
   2. Correct discrepancies greater than 25 mm (1 inch) before placing concrete.

D. Form Tolerances:
   1. Variation from Indicated Line: Maximum 6 mm (1/4 inch).
   2. Variation from Indicated Grade: Maximum 3 mm in 3000 mm (1/8 inch in 10 feet).

3.4 PLACING REINFORCEMENT

A. Keep reinforcement clean from contamination preventing concrete bond.

B. Install reinforcement shown on drawings.

C. Support and securely tie reinforcing steel to prevent displacement during concrete placement.

D. Obtain Contracting Officer's Representative's reinforcement placement approval before placing concrete.

3.5 JOINTS - GENERAL

A. Place joints, where shown on approved submittal Drawings.
   1. Conform to details shown.
   2. Install joints perpendicular to finished concrete surface.

B. Make joints straight and continuous from edge to edge of pavement.

3.6 CONSTRUCTION JOINTS

A. Place transverse construction joints of type shown, where indicated, and whenever concrete placement is suspended for more than 30 minutes.

3.7 CONTRACTION JOINTS

A. Tool or cut joints to width, depth, and radius edge shown on drawings using grooving tool, jointer, or saw.

B. Construct joints in curbs and gutters by inserting 3 mm (1/8 inch) steel plates conforming to curb and gutter cross sections.

1. Keep plates in place until concrete can hold its shape.

C. Finish joint edges with edging tool.

D. Score pedestrian pavement with grooving tool or jointer.

3.8 EXPANSION JOINTS

A. Form expansion joints with expansion joint filler of thickness shown on drawings.

1. Locate joints around perimeter of structures and features abutting site work concrete.
2. Create complete, uniform separation between structure and site work concrete.

B. Extend expansion joint material full depth of concrete with top edge of joint filler below finished concrete surface where sealant is indicated on Drawings.

C. Cut and shape material matching cross section.

D. Anchor with approved devices to prevent displacing during placing and finishing operations.

E. Round joint edges with edging tool.

3.9 PLACING CONCRETE - GENERAL

A. Preparation before Placing Concrete:

1. Obtain Contracting Officer's Representative approval.
2. Remove debris and other foreign material.
3. Uniformly moisten substrate, without standing water.

B. Convey concrete from mixer to final location without segregation or loss of ingredients. Deposit concrete to minimize handling.

C. During placement, consolidate concrete by spading or vibrating to minimize voids, honeycomb, and rock pockets.

1. Vibrate concrete against forms and along joints.
2. Avoid excess vibration and handling causing segregation.

D. Place concrete continuously between joints without bulkheads.

E. Install construction joint in concrete placement suspended for more than 30 minutes.

F. Replace concrete with cracks, chips, bird baths, and other defects to nearest joints, approved by Contracting Officer's Representative.

3.10 PLACING CONCRETE FOR CURB AND GUTTER, PEDESTRIAN PAVEMENT, AND EQUIPMENT PADS

A. Place concrete in one layer conforming to cross section shown on Drawings after consolidating and finishing.

B. Deposit concrete near joints without disturbing joints. Do not place concrete directly onto joint assemblies.

C. Strike concrete surface to proper section ready for consolidation.

D. Consolidate concrete by tamping and spading or with approved mechanical finishing equipment.

E. Finish concrete surface with wood or metal float.

F. Construct concrete pads and pavements with sufficient slope to drain, preventing standing water.

3.11 PLACING CONCRETE FOR VEHICULAR PAVEMENT

A. Deposit concrete as close as possible to its final position.

B. Place concrete continuously between construction joints without cold joints.

C. Strike and consolidate concrete with finishing machine, vibrating screed, or by hand-finishing.

D. Finish concrete surface to elevation and crown shown on drawings.

E. Deposit concrete near joints without disturbing joints. Do not place concrete directly onto joint assemblies.

F. Obtain Contracting Officer's Representative's approval before placing adjacent lanes.

3.12 FORM REMOVAL

A. Keep forms in place minimum 12 hours after concrete placement. Remove forms without damaging concrete.

B. Do not use bars or heavy tools against concrete to remove forms. Repair damage concrete found after form removal.

3.13 CONCRETE FINISHING - GENERAL

A. Follow operation sequence below, unless otherwise indicated on Drawings:

1. Consolidating, floating, striking, troweling, texturing, and joint edging.

B. Use edging tool with 6 mm (1/4 inch) radius, unless otherwise shown on Drawings.

C. Keep finishing equipment and tools clean and suitable for use.

3.14 CONCRETE FINISHING - PEDESTRIAN PAVEMENT

A. Walks, Grade Slabs, Wheelchair Curb Ramps:

1. Finish concrete surfaces with metal float, troweled smooth, and finished with a broom moistened with clear water.
2. Finish slab edges and formed transverse joints with edger.
3. Broom surfaces transverse to traffic direction.
   a. Use brooming to eliminate flat surface produced by edger.
   b. Produce uniform corrugations, maximum 1.5 mm (1/16 inch) deep profile.
4. Provide surface uniform in color and free of surface blemishes, form marks, and tool marks.
5. Paving Tolerances:
   a. Variation from Indicated Plane: Maximum 5 mm in 3000 mm (3/16 inch in 10 feet).
   b. Variation from Indicated Thickness: Maximum 6 mm (1/4 inch).
6. Replace paving within joint boundary when paving exceeds specified tolerances.

B. Step Treads, Risers and Sidewalls: Finish as specified for pedestrian pavement, except as follows:

1. Remove riser forms sequentially, starting with top riser.
2. Rub riser face with wood or concrete rubbing block and water. Remove blemishes, form marks, and tool marks. Use outside edger to round nosing; use inside edger to finish bottom of riser.
3. Apply uniform brush finish to treads, risers, and sidewall.
   a. Apply stiff brush finish to treads to provide slip resistant surface complying with ANSI B101.3.
4. Step Tolerance:
   a. Variation from Indicated Plane: Maximum 5 mm in 3000 mm (3/16 inch in 10 feet).

3.15 CONCRETE FINISHING - CURBS AND GUTTERS

A. Round edges of gutter and top of curb with edging tool.

B. Gutter and Curb Top:
   1. Float surfaces and finish with smooth wood or metal float until true to grade and section and uniform color.
   2. Finish surfaces, while still plastic, longitudinally with bristle brush.
C. Curb Face:
   1. Remove curb form and immediately rub curb face with wood or concrete rubbing block removing blemishes, form marks, and tool marks and providing uniform color.
   2. Brush curb face, while still plastic, matching gutter and curb top.
D. Curb and Gutter Tolerances:
   1. Variation from Indicated Plane and Grade:
      a. Gutter: Maximum 3 mm in 3000 mm (1/8 inch in 10 feet).
      b. Curb Top and Face: Maximum 6 mm in 3000 mm (1/4 inch in 10 feet).
E. Replace curbs and gutters within joint boundary when curbs and gutters exceed specified tolerances.
F. Correct depressions causing standing water.

3.16 CONCRETE CURING

A. Concrete Protection:
   1. Protect unhardened concrete from rain and flowing water.
   2. Provide sufficient curing and protection materials available and ready for use before concrete placement begins.
   3. Protect concrete to prevent pavement cracking from ambient temperature changes during curing period.
      a. Replace pavement damaged by curing method allowing concrete cracking.
      b. Employ another curing method as directed by Contracting Officer's Representative.
B. Cure concrete for minimum 7 days by one of the following methods appropriate to weather conditions preventing moisture loss and rapid temperature change:
   1. Burlap Mat: Provide minimum two layers kept saturated with water during curing period. Overlap Mats at least 150 mm (6 inches).
   2. Sheet Materials:
      a. Wet exposed concrete surface with fine water spray and cover with sheet materials.

b. Overlap sheets minimum 300 mm (12 inches).

c. Securely anchor sheet materials preventing displacement.

3. Curing Compound:

a. Protect joints indicated to receive sealants preventing contamination from curing compound.

b. Insert moistened paper or fiber rope into joint or cover joint with waterproof paper.

c. Apply curing compound before concrete dries.

d. Apply curing compound in two coats at right angles to each other.

e. Application Rate: Maximum 5 sq. m/L (200 sq. ft./gallon), both coats.

f. Immediately reapply curing compound to surfaces damaged during curing period.

3.17 FIELD QUALITY CONTROL

A. Field Tests: Performed by testing laboratory specified in Section 01 45 29, TESTING LABORATORY SERVICES.

1. Compaction.

a. Pavement subgrade.

b. Curb and sidewalk.

2. Concrete:

a. Delivery samples.

b. Field samples.

3. Slip Resistance: Steps and pedestrian paving.

3.18 CLEANING

A. After completing curing:

1. Remove burlap and sheet curing materials.

2. Sweep concrete clean, removing foreign matter from the joints.

3. Seal joints as specified.

3.19 PROTECTION

A. Protect exterior improvements from traffic and construction operations.

1. Prohibit traffic on paving for minimum seven days after placement, or longer as directed by Contracting Officer's Representative.

B. Remove protective materials immediately before acceptance.

C. Repair damage.

1. Replace concrete containing excessive cracking, fractures, spalling, and other defects within joint boundary, when directed by Contracting Officer's Representative, and at no additional cost to the Government.

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SECTION 32 12 16
ASPHALT PAVING

PART 1 - GENERAL

1.1 DESCRIPTION

This work shall cover the composition, mixing, construction upon the prepared subgrade, and the protection of hot asphalt concrete pavement. The hot asphalt concrete pavement shall consist of an aggregate or asphalt base course and asphalt surface course constructed in conformity with the lines, grades, thickness, and cross sections as shown. Each course shall be constructed to the depth, section, or elevation required by the drawings and shall be rolled, finished, and approved before the placement of the next course.

1.2 RELATED WORK

A. Laboratory and field testing requirements: Section 01 45 29, TESTING LABORATORY SERVICES.

B. Subgrade Preparation: Paragraph 3.3 and Section 31 20 11, EARTHWORK.

1.3 INSPECTION OF PLANT AND EQUIPMENT

The COR shall have access at all times to all parts of the material producing plants for checking the mixing operations and materials and the adequacy of the equipment in use.

1.4 ALIGNMENT AND GRADE CONTROL

The Contractor’s Registered Professional Land Surveyor shall establish and control the pavement (aggregate or asphalt base course and asphalt surface course) alignments, grades, elevations, and cross sections as shown on the Drawings.

1.5 SUBMITTALS

A. In accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES, furnish the following:

B. Data and Test Reports:

1. Aggregate Base Course: Sources, gradation, liquid limit, plasticity index, percentage of wear, and other tests required by State Highway Department.
2. Asphalt Base/Surface Course: Aggregate source, gradation, soundness loss, percentage of wear, and other tests required by State Highway Department.
3. Job-mix formula.

C. Certifications:

1. Asphalt prime and tack coat material certificate of conformance to State Highway Department requirements.
2. Asphalt cement certificate of conformance to State Highway Department requirements.
3. Job-mix certification - Submit plant mix certification that mix equals or exceeds the State Highway Specification for Ohio Department of Transportation (ODOT) 441 Surface Course.

D. One copy of State Highway Department Specifications.

E. Provide MSDS (Material Safety Data Sheets) for all chemicals used on ground.

PART 2 - PRODUCTS

2.1 GENERAL

A. Aggregate base (ODOT 304) and asphalt concrete materials (ODOT 441) shall conform to the requirements of the following and other appropriate sections of the latest version of the State Highway Material Specifications, including amendments, addenda and errata. Where the term "Engineer" or "Commission" is referenced in the State Highway Specifications, it shall mean the VA Resident Engineer or VA Contracting Officer.

2.2 AGGREGATES

A. Provide aggregates consisting of crushed stone, gravel, sand, or other sound, durable mineral materials processed and blended, and naturally combined.

B. Subbase aggregate (where required) maximum size: 38mm(1-1/2").

C. Base aggregate maximum size:
   1. Base course over 152mm(6") thick: 38mm(1-1/2");
   2. Other base courses: 19mm(3/4").

D. Asphaltic base course:
   1. Maximum particle size not to exceed 25.4mm(1”).
   2. Where conflicts arise between this specification and the requirements in the latest version of the State Highway Specifications, the State Specifications shall control.

E. Aggregates for asphaltic concrete paving: Provide a mixture of sand, mineral aggregate, and liquid asphalt mixed in such proportions that the percentage by weight will be within:

Sieve Sizes	Percentage Passing

19mm(3/4")	100
9.5mm(3/8")	67 to 85
6.4mm(1/4")	50 to 65
2.4mm(No. 8 mesh)	37 to 50
600µm(No. 30 mesh)	15 to 25
75µm(No. 200 mesh)	3 to 8

plus 50/60 penetration liquid asphalt at 5 percent to 6-1/2 percent of the combined dry aggregates.

2.3 ASPHALTS

A. Comply with provisions of Asphalt Institute Specification SS2:
   1. Asphalt cement: Penetration grade 50/60
   2. Prime coat: Cut-back type, grade MC-250
   3. Tack coat: Uniformly emulsified, grade SS-1H

2.4 SEALER

A. Provide a sealer consisting of suitable fibrated chemical type asphalt base binders and fillers having a container consistency suitable for troweling after thorough stirring, and containing no clay or other deleterious substance.

B. Where conflicts arise between this specification and the requirements in the latest version of the State Highway Specifications, the State Specifications shall control.

PART 3 - EXECUTION

3.1 GENERAL

The Asphalt Concrete Paving equipment, weather limitations, job-mix formula, mixing, construction methods, compaction, finishing, tolerance, and protection shall conform to the requirements of the appropriate sections of the State Highway Specifications for the type of material specified.

3.2 MIXING ASPHALTIC CONCRETE MATERIALS

A. Provide hot plant-mixed asphaltic concrete paving materials.
   1. Temperature leaving the plant: 143 degrees C(290 degrees F) minimum, 160 degrees C(320 degrees F) maximum.
   2. Temperature at time of placing: 138 degrees C(280 degrees F) minimum.

3.3 SUBGRADE

A. Shape to line and grade and compact with self-propelled rollers.

B. All depressions that develop under rolling shall be filled with acceptable material and the area re-rolled.

C. Soft areas shall be removed and filled with acceptable materials and the area re-rolled.

D. Should the subgrade become rutted or displaced prior to the placing of the subbase, it shall be reworked to bring to line and grade.

E. Proof-roll the subgrade with maximum 45 tonne (50 ton) gross weight dump truck as directed by VA Resident Engineer or VA Contracting Officer. If pumping, pushing, or other movement is observed, rework the area to provide a stable and compacted subgrade.

3.4 BASE COURSES

A. Subbase (when required)

1. Spread and compact to the thickness shown on the drawings.
2. Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller.
3. After completion of the subbase rolling there shall be no hauling over the subbase other than the delivery of material for the top course.

B. Base

1. Spread and compact to the thickness shown on the drawings.
2. Rolling shall begin at the sides and continue toward the center and shall continue until there is no movement ahead of the roller.
3. After completion of the base rolling there shall be no hauling over the base other than the delivery of material for the top course.

C. Thickness tolerance: Provide the compacted thicknesses shown on the Drawings within a tolerance of minus 0.0mm (0.0") to plus 12.7mm (0.5").

D. Smoothness tolerance: Provide the lines and grades shown on the Drawings within a tolerance of 5mm in 3m (3/16 inch in ten feet).

E. Moisture content: Use only the amount of moisture needed to achieve the specified compaction.

3.5 PLACEMENT OF ASPHALTIC CONCRETE PAVING

A. Remove all loose materials from the compacted base.

B. Apply the specified prime coat, and tack coat where required, and allow to dry in accordance with the manufacturer’s recommendations as approved by the Architect or Engineer.

C. Receipt of asphaltic concrete materials:

1. Do not accept material unless it is covered with a tarpaulin until unloaded, and unless the material has a temperature of not less than 130 degrees C(280 degrees F).
2. Do not commence placement of asphaltic concrete materials when the atmospheric temperature is below 10 degrees C (50 degrees F), not during fog, rain, or other unsuitable conditions.

D. Spreading:
1. Spread material in a manner that requires the least handling.
2. Where thickness of finished paving will be 76mm (3") or less, spread in one layer.

E. Rolling:
1. After the material has been spread to the proper depth, roll until the surface is hard, smooth, unyielding, and true to the thickness and elevations shown own the drawings.
2. Roll in at least two directions until no roller marks are visible.
3. Finished paving smoothness tolerance:
   a. No depressions which will retain standing water.
   b. No deviation greater than 3mm in 1.8m (1/8" in six feet).

3.6 APPLICATION OF SEAL COAT

A. Prepare the surfaces, mix the seal coat material, and apply in accordance with the manufacturer’s recommendations as approved by the Architect or Engineer.

B. Achieve a finished surface seal which, when dry and thoroughly set, is smooth, tough, resilient, of uniform black color, and free from coarse textured areas, lap marks, ridges, and other surface irregularities.

C. When sealing new asphalt paving wait an entire year to allow for the expansion and contraction of a year’s cycle of both warm and cool temperatures. This allows for the asphalt’s oils to properly cure and begin oxidation before applying a seal coat.

D. When seal coating in less than a year apply two coats, spray applied. This application method is preferred for less than a year application when there is still plenty of asphalt cement present for the seal coat to bond to.

E. When seal coating existing paving that has new asphalt patches, apply two coats sprayed to the existing asphalt and a single lighter coat on new patch work, just enough to make the color of the new patches match the rest of the reseal coated paving.

F. When resealing existing paving 5, 10, 15 years and older, that is oxidized and is very light in color, squeegee apply the first coat of seal coat and spray on a second coat. Two coats are preferred in older paving when the asphalt cement has oxidized leaving the seal coat with nothing to bond to other than the aggregate that in many cases has polished over time leaving less than a desirable surface to bond to.

3.7 PROTECTION

Protect the asphaltic concrete paved areas from traffic until the sealer is set and cured and does not pick up under foot or wheeled traffic.

3.8 FINAL CLEAN-UP

Remove all debris, rubbish, and excess material from the work area.

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SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Chain link fence, gates and accessories.

1.2 RELATED REQUIREMENTS

A. Temporary Construction Fence: Section 01 00 00, GENERAL REQUIREMENTS.

B. Grounding: Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

1.3 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. ASTM International (ASTM):

1. A121-13 - Metallic Coated Carbon Steel Barbed Wire.
2. A392-11a - Zinc-Coated Steel Chain-Link Fence Fabric.
3. A491-11 - Aluminum Coated Steel Chain Link Fence Fabric.
4. A817-12 - Metal-Coated Steel Wire for Chain-Link Fence Fabric and Marcelled Tension Wire.
5. B429 - Aluminum-Alloy Extruded Structural Pipe and Tube.
6. F567-14a - Installation of Chain-Link Fence.
7. F626-14 - Fence Fittings.
8. F900-11 - Industrial and Commercial Swing Gates.
9. F1043-16 - Strength and Protective Coatings on Steel Industrial Fence Framework.
10. F1083-16 - Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.

C. Chain Link Fence Manufacturing Institute (CLFMI):

1. Product Manual.

1.4 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Submittal Drawings:

1. Show size, configuration, and fabrication and installation details.

C. Manufacturer's Literature and Data:

1. Description of each product.
2. Installation instructions.

D. Certificates: Certify products comply with specifications.
   1. Zinc-coating.
E. Qualifications: Substantiate qualifications comply with specifications.
   1. Manufacturer with project experience list.
   2. Installer with project experience list.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Regularly manufactures specified products.
   2. Manufactured specified products with satisfactory service on five similar installations for minimum five years.
      a. Project Experience List: Provide contact names and addresses for completed projects.
B. Installer Qualifications:
   1. Regularly installs specified products.
   2. Installed specified products with satisfactory service on five similar installations for minimum five years.
      a. Project Experience List: Provide contact names and addresses for completed projects.
C. Welders and Welding Procedures Qualifications: AWS D1.1/D1.1M. or AWS D1.3/D1.3M.

1.6 DELIVERY

A. Deliver products in manufacturer's original sealed packaging.
B. Mark packaging, legibly. Indicate manufacturer's name or brand, type, production run number, and manufacture date.
C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.7 STORAGE AND HANDLING

A. Protect products from damage during handling and construction operations.

1.8 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

PART 2 - PRODUCTS

2.1 PRODUCTS - GENERAL

A. Provide fences and gates from one manufacturer.

2.2 CHAIN-LINK FENCING AND GATES

A. General: Conform to CLFMI Product Manual.

B. Chain Link Fabric: 50 mm (2 inch) mesh, , 1.8 m (72 inches) high, top selvage and bottom selvage.

1. Zinc-Coated Steel Fabric: ASTM A392, hot dipped galvanized before or after weaving.
   a. Class 2 - 610 g/sq. m (2.0 oz/sq. ft.).
2. Aluminum-Coated Steel Fabric (Aluminized): ASTM A491.
3. Fabric Selvage: K&T, Knuckle finish at one end, twist at other.
   a. Fabric less than 1.8 m (72 inches) width, knuckle finish top and bottom.

C. Fence Framework:

1. Round Steel Pipe and Rail: ASTM F1043, Group IA Heavy Industrial Fence Framework, ASTM F1083 schedule 40 galvanized pipe.
   a. Line post: 60 mm (2.375 inch) diameter.
   b. End, Corner, Pull post: 60 mm (2.375 inch) diameter.
   c. Brace rails, top, bottom, and intermediate rails, 42 mm (1.660 inch) diameter, 3.38 kg/m (2.27 lb./ft.).

2.3 TENSION WIRE

A. Metallic Coated Steel Marcelled Tension Wire: ASTM A817, Type II 4.5 mm (0.177 inches) marcelled wire.

2.4 BARBED WIRE

A. Metallic Coated Steel Barbed Wire: ASTM A121, Type Z, zinc-coated double 2.5 mm (0.10 inches) twisted strand wire, with 4 point 2.0 mm (0.080 inches) round barbs spaced 125 mm (5 inches) on center.

2.5 FITTINGS

A. General: ASTM F626.

B. Tension and Brace Bands: Galvanized pressed steel.

C. Terminal Post Caps, Line Post Loop Tops, Rail and Brace Ends, Boulevard Clamps, Rail Sleeves: Pressed steel galvanized.

D. Truss Rod Assembly: Steel truss rod with a pressed steel tightener.

E. Tension Bars: Galvanized steel one-piece length 50 mm (2 inches) less than the fabric height.

F. Barbed Wire Arms: Pressed steel galvanized after fabrication Type I - three strand 45 degree arm.

2.6 TIE WIRE and HOG RINGS

A. Galvanized: Minimum zinc coating 366 g/sq. m (1.20 oz./sq. ft.); 3.76 mm (0.148 inch) diameter steel wire.

2.7 CONCRETE

A. Concrete: As specified in Section 03 30 53, Cast-in-Place Concrete.

2.8 ACCESSORIES

A. Barrier Coating: ASTM D1187/D1187M.

B. Welding Materials: AWS D1.1/D1.1M, type to suit application.

C. Galvanizing Repair Paint: MPI No. 18.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine and verify substrate suitability for product installation.

B. Protect existing construction and completed work from damage.

C. Remove existing fences to permit new installation.

1. Retain existing fences for reuse.
2. Dispose of other removed materials.

D. Apply barrier coating to steel and aluminum surfaces in contact with and cementitious materials to minimum 0.7 mm (30 mils) dry film thickness.

3.2 INSTALLATION

A. Layout fence and locate position of post.

B. Installation:

1. General: Comply with ASTM F567.
2. Framework:
   a. Posts: Set plumb in concrete footings with 600 mm (24 inches) minimum depth.
      1) Minimum Footing Diameter: Four times largest cross section of post, up to 100 mm (4 inches) O.D. and three times largest cross section of post greater than 100 mm (4 inches). O.D.
      2) Provide larger footings for gate posts. Top of post concrete footing, at grade crowned to shed water away from the post.
      3) Space line posts not exceeding 3 m (10 ft.) on center.
   b. Top rail: Install 6.4 m (21 ft.) lengths of rail continuous thru line post or barb arm loop top. Splice rail using top rail sleeves minimum 150 mm (6 inches) long.

1) Secure rail to terminal post by brace band and rail end.
2) Field cut and secure bottom rail or intermediate rail to line posts with boulevard bands or rail ends and brace bands.
3) Provide mid rail for fences 3.7 m (12 feet) high or higher.

c. Terminal posts: Brace and truss end, corner, pull and gate posts for fence 1.8 m (6 ft.) and higher and for fences 1.5 m (5 ft.) in height without top rail.

d. Tension wire: Install tension wire 100 mm (4 inches) up from bottom of fabric. Fences without top rail, install tension wire 100 mm (4 inches) down from the top of the fabric.
1) Stretched taut tension wire independently, between terminal posts and secure with brace band.
2) Secure tension wire to chain link fabric with 3.76 mm (0.15 inch) hog rings 450 mm (18 inches) on center and to each line post with tie wire.
3) Install top tension wire through barb arm loop for fences with barbed wire and no top rail.

C. Chain Link Fabric:
1. Install fabric outside of the framework with ground clearance of 50 mm (2 inches) maximum.
2. Stretch fabric between terminal posts and secure with tension bar.
3. Wrap tie wire around the post or rail. Attached to fabric wire picket on both sides. Cut off and bend excess wire to prevent injury.

D. Barbed Wire: Stretched taut between terminal posts. Secure in slots provided on the line post barb arms. Attach each strand to the terminal post with a brace band. Indicate type of barb arm, Type I outward for installation of Type I arm.

E. Nuts and Bolts:
1. Bolts: Install carriage bolts with head on the secure side of the fence. Peened over all bolts shall be to prevent removal of the nut.

F. Electrical Grounding:
1. Grounding: Grounding, when required, as specified in Section 26 05 26, GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS.

G. Touch up damaged factory finishes.
1. Repair galvanized surfaces with galvanized repair paint.
2. Repair painted surfaces with touch up primer.

3.3 CLEANING

A. Clean exposed fence surfaces. Remove contaminants and stains.

3.4 PROTECTION

A. Protect fence from construction operations.

B. Repair damage.

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SECTION 32 90 00
PLANTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plants, soils, edging, turf, and landscape materials.

1.2 RELATED REQUIREMENTS - NOT USED

1.3 DEFINITIONS

A. Pesticide: Any substance or mixture of substances, including biological control agents, that may prevent, destroy, repel, or mitigate pests and is specifically labeled for use by U.S. Environmental Protection Agency (EPA). Also, any substance used as plant regulator, defoliant, disinfectant, or biocide.

B. Planter Bed: An area containing one or combination of following plant types: shrubs, vines, wildflowers, annuals, perennials, ground cover, excluding turf. Trees may also be found in planter beds.

C. Stand of Turf: 95 percent of established species.

1.4 APPLICABLE PUBLICATIONS

A. Comply with references to extent specified in this section.

B. American Society for Testing and Materials (ASTM):

1. C136/C136M-14 - Sieve Analysis of Fine and Coarse Aggregates.
2. C602-13a - Agricultural Liming Materials.
3. D977-13e1 - Emulsified Asphalt.
4. D5268-13 - Topsoil Used for Landscaping Purposes.

C. Turfgrass Producers International (TPI):

1. 2006 Guideline Specifications to Turfgrass Sodding.

D. United States Department of Agriculture (USDA):

1. DOA SSIR 42-2014 - Soil Survey Laboratory Methods Manual.
2. Handbook No. 60 - Diagnosis and Improvement of Saline and Alkali Soils.

1.5 PREINSTALLATION MEETINGS

A. Conduct preinstallation meeting at project site minimum 30 days before beginning Work of this section.

1. Required Participants:

a. Contracting Officer's Representative.

b. Contractor.

c. Installer.

2. Meeting Agenda: Distribute agenda to participants minimum 3 days before meeting.
   a. Inspection of planting materials.
   b. Installation schedule.
   c. Installation sequence.
   d. Preparatory work.
   e. Protection before, during, and after installation.
   f. Installation.
   g. Inspecting.
   h. Environmental procedures.
3. Document and distribute meeting minutes to participants to record decisions affecting installation.

1.6 SUBMITTALS

A. Submittal Procedures: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Manufacturer's Literature and Data:
   1. Description of each product.
   2. Photographs: Color photographs of each plant species showing actual size and condition of plants to be provided with measuring device included for scale. Where more than 20 plants are required of any species, submit minimum three photographs of average, best, and worst quality plant to be provided. Include on each photograph, plant full scientific name, size, and source nursery.
   3. Installation instructions.
   4. Warranty.

C. Samples:
   1. Organic and Compost Mulch: 0.5 L. (1 pint) sealed plastic bag of each required mulch, including label with percentage weight of each material and source representing material to be provided. Samples to match color, texture, and composition of installed material.
   2. Mineral Mulch: 1.0 kg (2 lb.) sealed plastic bag of mulch, including label with source. Samples to match color, texture, and composition of installed material.
   3. Filter Fabric: 300 by 300 mm (12 by 12 inches).

D. Test reports: Certify products comply with specifications.

E. Certificates: Certify products comply with specifications.
   1. Plant Materials: Department of Agriculture certification by State Nursery Inspector declaring material to be free from insects and disease.
   2. Seed and Turf Materials: Notarized certificate of product analysis.
F. Qualifications: Substantiate qualifications comply with specifications.
   1. Installer, including supervisor with project experience list.
G. Operation and Maintenance Data:
   1. Care instructions for each plant material.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Regularly installs specified products.
   2. Installed specified products with satisfactory service on five similar installations for minimum five years.
      a. Project Experience List: Provide contact names and addresses for completed projects.
   3. Member in good standing of either Professional Landcare Network or American Nursery and Landscape Association.
   4. Personnel assigned to Work certified in one of following categories from Professional Landcare Network and submit one copy of certificate to Contracting Officer’s Representative:
      a. Certified Landscape Technician (CLT) - Exterior, with installation specialty areas, designated CLT-Exterior.
      b. Certified Landscape Technician (CLT) - Interior, designated CLT-Interior.
      c. Certified Ornamental Landscape Professional, designated COLP.
B. Contracting Officer’s Representative may review plant materials either at place of growth or project site before planting for compliance with requirements. Contracting Officer’s Representative retains right to inspect trees and shrubs to determine if any unacceptable conditions exist and to reject any trees or shrubs at any time during Project. All rejected trees and shrubs must be immediately removed from Project site.
   1. Submit plant material source information to Contracting Officer’s Representative seven days in advance of delivery to Project site.
C. Material Test Reports: For imported or manufactured topsoil.

1. For each unamended soil type, provide soil analysis and written report by qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; pH; and mineral and plant-nutrient content of soil.
2. Comply with USDA's Handbook No. 60 testing methods and written recommendations.
3. Soil-testing laboratory to oversee soil sampling; with depth, location, and number of samples to be taken per instructions from Contracting Officer’s Representative. Take minimum one representative samples from varied locations for each soil to be used or amended for planting purposes.
4. Report suitability of tested soil for plant growth.
5. Based on test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 92.9 sq. m (1000 sq. ft.) or volume per 0.76 cu. m (1 cu. yd.) for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
6. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

1.8 DELIVERY

A. Deliver packaged products in manufacturer's original sealed packaging.

B. Bulk Products:

1. Deliver bulk products away from buildings, utilities, pavement, and existing turf and planted areas. Maintain dry bulk product storage away from contaminants.
2. Install erosion control materials to prevent erosion or displacement of bulk products.

1.9 STORAGE AND HANDLING

A. Store seeds and other packaged materials in dry locations away from contaminants.

B. Topsoil: Before stockpiling topsoil, eradicate on site undesirable growing vegetation. Clear and grub existing vegetation three to four weeks before stockpiling existing topsoil.

1.10 FIELD CONDITIONS

A. Environment:

1. Coordinate installation of planting materials during optimal planting seasons for each type of plant material required.
2. Planting Dates:
3. Restrictions: Do not plant when ground is frozen, snow covered, muddy, or when air temperature exceed 32 degrees C (90 degrees F).

B. Weather Limitations: Install plantings only during current and forecasted weather conditions that are comply with plant requirements. Apply associated products in compliance with manufacturers' instructions.

1.11 WARRANTY

A. Construction Warranty: FAR clause 52.246-21, "Warranty of Construction."

B. Manufacturer's Warranty: Warrant plantings and against material defects.

1. Warranty Period: Two years.
2. Plant and Turf Warranty Periods will begin from date of Government acceptance of project or phase for beneficial use and occupancy.
3. Contracting Officer's Representative will reinspect plants and turf at end of Warranty Period. Replace any dead, missing, or defective plant material and turf immediately. Warranty Period will end on date of this inspection provided Contractor has complied with warranty work required by this specification. Comply with following requirements:
   a. Replace any plants more than 25 percent dead, missing or defective plant material before final inspection.
   b. Only one replacement of each plant will be required except when losses or replacements are due to failure to comply with these requirements.
   c. Complete remedial measures directed by Contracting Officer’s Representative to ensure plant and turf survival.
   d. Repair damage caused while making plant or turf replacements.

PART 2 - PRODUCTS

2.1 PRODUCTS - GENERAL

A. Provide each product from one source or manufacturer.

B. Sustainable Construction Requirements:

1. Select products with recycled content to achieve overall Project recycled content requirement.

a. Fertilizer.

2.2 SEED

A. Grass Seed: Ohio-approved seed of latest season's crop delivered in original sealed packages, bearing producer's guaranteed analysis for percentages of mixtures, purity, germination, weed seed content, and inert material. Label in conformance with AMS Seed Act and applicable state seed laws. Wet, moldy, or otherwise damaged seed will not be acceptable. Field mixes will be acceptable when field mix is performed on site in presence of Contracting Officer's Representative.

B. Seed Mixtures: Proportion seed mixtures by weight.

1. Sun and Partial Shade: Proportioned grass species as follows:

a. 30 percent Kentucky Bluegrass.

b. 30 percent Creeping Red Fescue.

c. 20 percent Annual Ryegrass.

d. 20 percent Perennial Ryegrass.

2.3 PLANTING SOILS

A. Planting Soil: Evaluate soil for use as topsoil according to ASTM D5268. From 5 to 10 percent organic matter as determined by topsoil composition tests of Organic Carbon, 6A, Chemical Analysis Method described in USDA DOA SSIR 42. Maximum particle size, 19 mm (3/4 inch), with maximum 3 percent retained on 6 mm (1/4 inch) screen. Mix topsoil with following soil amendments and fertilizers as recommended by soils analysis.

B. Existing Planting Soil: Existing, native surface topsoil formed under natural conditions retained during excavation process and stockpiled on-site. Verify suitability of native surface topsoil to produce viable planting soil. Clean soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

1. Supplement with planting soil when quantities are insufficient.

2. Mix existing, native surface topsoil with soil amendments and fertilizers as recommended by soils analysis.

C. Imported Planting Soil: Imported topsoil or manufactured topsoil from off-site sources are acceptable if sufficient topsoil is not available on site to meet specified depth. At least 10 days before topsoil delivery, notify Contracting Officer's Representative of topsoil sources. Obtain imported topsoil displaced from naturally well-drained construction or mining sites where topsoil is at least 100 mm (4 inches) deep. Topsoil from agricultural land, bogs, or marshes will be rejected.

2.4 INORGANIC SOIL AMENDMENTS

A. Lime: Commercial grade hydrated or burnt limestone containing calcium carbonate equivalent (CCE) specified in ASTM C602 of minimum 80 percent.

B. Sulfur: 100 percent elemental.

C. Iron Sulfate: 100 percent elemental.

D. Aluminum Sulfate: Commercial grade.

E. Perlite: Horticultural grade.

F. Agricultural Gypsum: Coarsely ground from recycled scrap gypsum board comprised of calcium sulfate dehydrate 91 percent, calcium 22 percent, sulfur 17 percent, minimum 96 percent passing through 850 micrometers 20 mesh screen, 100 percent passing through 970 micrometers 16 mesh screen.

G. Coarse Sand: ASTM C33/C33M, clean and free of materials harmful to plants.

H. Vermiculite: Horticultural grade for planters.

I. Diatomaceous Earth: Calcined, 90 percent silica, with approximately 140 percent water absorption capacity by weight.

J. Zeolites: Mineral clinoptilolite with at least 60 percent water absorption by weight.

2.5 EROSION CONTROL

A. Erosion Control Blankets: 100 percent agricultural straw in flat areas (less than 5:1 slopes) and 70 percent agricultural straw and 30 percent coconut fiber matrix stitched with degradable nettings, designed to degrade within 12 months on slopes greater than 5:1.

B. Erosion Control Fabric: Knitted construction of polypropylene yarn with uniform mesh openings 19 to 25 mm (3/4 to 1 inch) square with strips of biodegradable paper. Minimum filler paper strip life of six months.

C. Erosion Control Net: Heavy, twisted jute mesh weighing approximately 605 grams per meter (1.22 pounds per linear yard) and 1200 mm (4 feet) wide with mesh openings approximately 25 mm (1 inch) square.

D. Erosion Control Material Anchors: As recommended by erosion control material manufacturer.

2.6 TACKIFIERS AND ADHESIVES

A. Nonasphalt Tackifier: Colloidal liquid fixative recommended by fiber mulch manufacturer for hydroseeding.

B. Asphalt emulsion: ASTM D977, Grade SS-1.

2.7 WATER

A. Water: Source approved by Contracting Officer's Representative and suitable quality for irrigation, containing no elements toxic to plant life, including acids, alkalis, salts, chemical pollutants, and organic matter. Use collected storm water or graywater when available.

2.8 PESTICIDES

A. Consider IPM (Integrated Pest Management) practices to minimize use of all pesticides and chemical products. Obtain Contracting Officer's Representative's approval for allowable products, product alternatives, scheduling and application procedures. Evaluate existing weather and site conditions before application. Apply products during favorable weather and site conditions according to manufacturer's instructions and warranty requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.

1. Verify that no materials that would inhibit plant growth are present in planting area. If such materials are present, remove soil and contaminants ad directed by Contracting Officer's Representative and provide new planting soil.
2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.

3. Suspend soil spreading, grading, and tilling operations if soil moisture becomes excessive. Resume soil preparations when moisture content returns to acceptable level.
4. If soil is excessively dry, not workable, and too dusty, moisten uniformly.
5. Special conditions may exist that warrant variance in specified planting dates or conditions. Submit written request to Contracting Officer’s Representative stating special conditions and proposed variance.

B. Proceed with planting operations only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect existing and proposed landscape features, elements, and site construction and completed work from damage. Protect trees, vegetation, and other designated features by erecting high-visibility, reusable construction fencing. Locate fence no closer to trees than drip line. Plan equipment and vehicle access to minimize and confine soil disturbance and compaction to areas indicated on drawings.

B. Install erosion control materials at all areas inside or outside limits of construction that are disturbed by planting operations. Provide erosion control and seeding with native plant species to protect slopes.

3.3 PLANT BED PREPARATION

A. Verify location of underground utilities before excavation. Protect existing adjacent turf before excavations are made. Do not disturb topsoil and vegetation in areas outside those indicated on Drawings.

B. For newly graded subgrades, loosen subgrade to minimum 100 mm (4 inches) deep. Remove stones larger than 25 mm (1 inch) in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Government's property.

1. Apply fertilizer lime and soil amendments directly to subgrade before loosening, at rates recommended by soils analysis.
2. Spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil.
3. Spread planting soil 100 mm (4 inches) deep but minimum required to meet finish grades after light rolling and natural settlement. Do

not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

a. Spread approximately 1/2 thickness of planting soil over loosened subgrade. Mix thoroughly into top 50 mm (2 inches) of subgrade. Spread remainder of planting soil.

b. Reduce elevation of planting soil to allow for soil thickness of sod.

C. Finish grade planting areas to smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 13 mm (1/2 inch) of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in immediate future.

3.4 MULCH INSTALLATION

A. Provide specified mulch over entire planting bed surfaces and individual plant surfaces, including earth mount watering basin around plants, to 75 mm (3 inches) depth after plant installation and before watering. Do not place mulch in crowns of shrubs. Place mulch minimum 50 to 75 mm (2 to 3 inches) away from tree or shrub trunks. Place mulch on all weed control fabric.

3.5 SEEDING

A. Broadcast and Drop Seeding: Uniformly broadcast seed at rate of 3 pounds per 1000 square feet. Use broadcast or drop seeders. Sow one-half seed in one direction and sow remainder at right angles to first sowing. Cover seed uniformly to maximum 6 mm (1/4 inch) deep in clay soils and 13 mm (1/2 inch) deep in sandy soils by means of spike-tooth harrow, cultipacker, raking, or other approved device.

B. Rolling: Immediately after seeding, firm entire area, except for slopes in excess of 3 to 1, with roller not exceeding 130 kg/m (90 lb./ft.) of roller width.

3.6 HYDROSEEDING

A. Mix water with wood cellulose fiber, paper fiber, or recycled paper at rate of 11.2 kg per 100 square meters (1,000 lb. per acre) dry weight. Add seed and fertilizer to fiber and water and mix to produce homogeneous slurry.

1. Broadcast seed mixture at rate of 3 pounds per 1000 square feet.

2. Hydraulically spray slurry to form uniformly impregnated grass seed cover. Spread with one application with no second application of mulch.

3.7 TURF RENOVATION

A. General: Restore to original condition existing turf areas damaged during turf installation and construction operations. Keep at least one paved pedestrian access route and one paved vehicular access route to each building clean at all times. Clean other paving when work in adjacent areas is complete.

B. Overseeding: Apply seed according to applicable portions of "Seed Application Method" at rates specified in "Seed Composition."

3.8 PLANT MAINTENANCE

A. Frequency: Begin maintenance immediately after plants have been installed. Inspect plants at least once week and perform required maintenance promptly.

B. Promotion of Plant Growth and Vigor: Water, prune, fertilize, mulch, eradicate weeds, and perform other operations necessary to promote plant growth and vigor.

3.9 SLOPE EROSION CONTROL MAINTENANCE

A. Provide slope erosion control maintenance to prevent undermining of all slopes in newly landscaped areas. Maintenance tasks include immediate repairs to weak spots in sloped areas and maintaining clean, clear culverts and graded berms and terraces to intercept and direct water flow to prevent development of large gullies and slope erosion.

1. Fill eroded areas with amended topsoil and replant with same plant species.
2. Reinstall erosion control materials damaged due to slope erosion.

3.10 TURF MAINTENANCE

A. Mow turf to uniform finished height measured from soil. Perform mowing in manner that prevents scalping, rutting, bruising, uneven and rough cutting. Before mowing, remove and dispose of all rubbish, debris, trash, leaves, rocks, paper, and limbs or branches on turf areas. Sweep or vacuum clean adjacent paved areas.

B. Apply fertilizer in manner that promotes health, growth, vigor, color and appearance of cultivated turf areas. Determine method of application, fertilizer type and frequencies by results of laboratory

soil analysis. Apply fertilizer by approved methods and according to manufacturer's instructions.

C. Watering: Perform irrigation in manner that promotes health, growth, color, and appearance of cultivated vegetation, complying with Federal, State, and local water agency and authority directives. Prevent overwatering, water run-off, erosion, and ponding due to excessive quantities or rate of application.

3.11 CLEANING

A. Remove and legally dispose of all excess soil and planting debris.

3.12 PROTECTION

A. Protect plants from traffic and construction operations.

B. Provide temporary fences or enclosures and signage, at planted areas. Maintain fences and enclosures during maintenance period.

C. Remove protective materials immediately before acceptance.

D. Repair damage.

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SECTION 33 10 00

WATER UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section specifies materials and procedures for construction of underground water distribution for domestic and/or fire supply systems outside the building (and interior where noted) that are complete and ready for operation. This includes piping, structures, appurtenances and all other incidentals.

1.2 RELATED WORK

A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 11, EARTHWORK.

B. Concrete: Section 03 30 53, CAST IN-PLACE CONCRETE.

C. Fire Protection System connection: Section 21 12 00, FIRE-SUPPRESSION STANDPIPES.

D. General plumbing: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

E. Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

F. Erosion and Sediment Control: Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.

1.3 DEFINITIONS

A. Water distribution system: Pipelines and appurtenances which are part of the distribution system outside the building for potable water and fire supply.

B. Water service line: Pipeline from main line to flange above the slab of building.

1.4 ABBREVIATIONS

A. PVC: Polyvinyl chloride plastic.

B. DI: Ductile iron pipe.

C. WOG: Water, Oil and Gas.

1.5 DELIVERY, STORAGE AND HANDLING

A. Ensure that valves are dry and internally protected against rust and corrosion. Protect valves against damage to threaded ends and flange faces.

B. Use a sling to handle valves and fire hydrants if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

C. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

D. Protect stored piping from moisture and dirt by elevating above grade. Protect flanges, fittings, and specialties from moisture and dirt.

E. Store plastic piping protected from direct sunlight and support to prevent sagging and bending.

F. Cleanliness of Piping and Equipment Systems:

1. Care shall be exercised in the storage and handling of equipment and piping material to be incorporated in the work. Debris arising from cutting, threading and welding of piping shall be removed.
2. Piping systems shall be flushed, blown or pigged as necessary to deliver clean systems.

1.6 COORDINATION

A. Coordinate connection to water main with Public Utility company.

B. Coordinate water service lines with building contractor.

1.7 QUALITY ASSURANCE:

A. Products Criteria:

1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.
2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

B. Materials and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least three years. Digital electronic devices, software and systems such as controls, instruments or computer work stations shall be the current generation of technology and basic design that has a proven satisfactory service record of at least three years.

C. Regulatory requirements:

1. Comply with the rules and regulations of the public utility company having jurisdiction over the connection to public water lines and the extension and/or modifications to public utility systems.
2. Comply with the rules and regulations of the Federal, State, and/or Local Health Department having jurisdiction for potable water-service.
3. Comply with rules and regulations of Federal, State, and/or Local authorities having jurisdiction for fire-suppression water-service piping including materials, hose threads, installation and testing.

D. Provide of not less than 500 psi (3.5 MPa) in accordance with certification of factory hydrostatic testing AWWA C151. Piping materials shall bear the label, stamp or other markings of the specified testing agency.

E. Before any welding is performed, contractor shall submit a certificate certifying that welders comply with the following requirements:
1. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code", Section IX, "Welding and Brazing Qualifications".
2. Comply with provisions of ASME B31 series "Code for Pressure Piping".
3. Certify that each welder has passed American Welding Society (AWS) qualification tests for the welding processes involved, and that certification is current.
4. All welds shall be stamped according to the provisions of the American Welding Society.

F. Where installation procedures or any part thereof are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the COR prior to installation.

G. Applicable codes:
1. Plumbing Systems: IPC, International Plumbing Code.
2. Electrical components, devices and accessories shall be listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended use.
3. Fire-service main products shall be listed in the FM Global “Approval Guide” or Underwriters Laboratories (UL) “Fire Protection Equipment Directory”.

1.8 APPLICABLE PUBLICATIONS

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

B. American National Standards Institute (ANSI):

MSS SP-60-2004 .....Connecting Flange Joint Between Tapping Sleeves and Tapping Valves

MSS SP-108-2002.....Resilient-Seated Cast Iron, Eccentric Plug Valves

C. American Society of Mechanical Engineers (ASME):

A112.1.2-2004.....Air Gaps in Plumbing Systems (for Plumbing Fixtures and Water-Connected Receptors))

B16.1-2010.....Gray Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250

B31.....Code for Pressure Piping Standards

D. American Society for Testing and Materials (ASTM):

A36/A36M-08.....Carbon Structural Steel

A48/A48M-08(2008).....Gray Iron Castings

A536-84(2009).....Ductile Iron Castings

A674-10.....Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids

B61-08.....Steam or Valve Bronze Castings

B62-09.....Composition Bronze or Ounce Metal Castings

C651-05.....Disinfecting Water Mains

C858-10e1.....Underground Precast Utility Structures

F1267-07.....Metal, Expanded, Steel

E. American Water Works Association (AWWA):

B300-10.....Hypochlorites

B301-10.....Liquid Chlorine

C104-08.....Cement-Mortar Lining for Ductile Iron Pipe and Fittings

C105/A21.5-10.....Polyethylene Encasement for Ductile Iron Pipe Systems

C110-08.....Ductile Iron and Gray-Iron Fittings

C111/A21.11-07.....Rubber-Gasket Joints for Ductile Iron Pressure Pipe and Fittings

C115/A21.11-11.....Flanged Ductile Iron Pipe with Ductile Iron or Gray-Iron Threaded Flanges

C151/A21.51-09.....Ductile Iron Pipe, Centrifugally Cast

C153/A21.53-11.....Ductile Iron Compact Fittings for Water Service

C504-10.....Rubber-Seated Butterfly Valves

C508-09.....Swing-Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS

C509-09.....Resilient-Seated Gate Valves for Water Supply Service

C510-07.....Double Check Valve Backflow Prevention Assembly

C511-07.....Reduced-Pressure Principle Backflow Prevention Assembly

C512-07.....Air Release, Air/Vacuum and Combination Air Valves

C550-05.....Protective Interior Coatings for Valves and Hydrants

C600-10.....Installation of Ductile Iron Mains and Their Appurtenances

C606-11.....Grooved and Shouldered Joints

C651-05.....Disinfecting Water Mains

C700-09.....Cold-Water Meters, “Displacement Type,” Bronze Main Case

C800-05.....Underground Service Line Valves and Fittings

M44-2nd Ed.....Distribution Valves: Selection, Installation, Field Testing and Maintenance

F. National Fire Protection Association (NFPA):

NFPA 24-2010 Ed.....Installation of Private Fire Service Mains and Their Appurtenances

G. NSF International (NSF):

NSF/ANSI 61-2012.....Drinking Water System Components - Health Effects

NSF/ANSI 372-2011.....Drinking Water System Components – Lead Content

H. American Welding Society (AWS):

A5.8/A5.8M-2004 .....Filler Metals for Brazing and Braze Welding

I. American Society of Safety Engineers (ASSE):

1003-2009 .....Water Pressure Reducing Valves

1015-2009.....Double Check Backflow Prevention Assemblies and Double Check Fire Protection Backflow Prevention Assemblies

1047-2009.....Performance Requirements for Reduced Pressure Detector Fire Protection Backflow Prevention Assemblies

1048-2009.....Performance Requirements for Double Check Detector Fire Protection Backflow Prevention Assemblies

1060-2006.....Performance Requirements for Outdoor Enclosures for Fluid Conveying Components

J. Underwriters' Laboratories (UL):

262.....Gate Valves for Fire-Protection Service

312.....Check Valves for Fire-Protection Service

753.....Alarm Accessories for Automatic Water-Supply Control Valves for Fire Protection Service

789.....Indicator Posts for Fire-Protection Service

1091.....Butterfly Valves for Fire-Protection Service

1.9 WARRANTY

A. The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of one year from final acceptance. Further, the Contractor will furnish all manufacturers' and supplier's written guarantees and warranties covering materials and equipment furnished under this Contract.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Material or equipment containing a weighted average of greater than 0.25 percent lead shall not be used in any potable water system intended for human consumption, and shall be certified in accordance with NSF/ANSI 61.

B. Plastic pipe, fittings, and solvent cement shall meet NSF/ANSI 14 and shall be NSF listed for the service intended.

2.2 FACTORY-ASSEMBLED PRODUCTS

A. Standardization of components shall be maximized to reduce spare part requirements. The contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

2.3 SAFETY GUARDS

A. All equipment shall have moving parts protected to prevent personal injury. Pump shafts and couplings shall be fully guarded by a sheet steel guard, covering coupling and shaft but not bearings. Material shall be minimum 16-gauge sheet steel; ends shall be braked and drilled and attached to pump base with minimum of four 1/4 inch (6 mm) bolts. Reinforce guard as necessary to prevent side play forcing guard onto couplings.

2.4 LIFTING ATTACHMENTS

A. Equipment shall be provided with suitable lifting attachments to enable equipment to be lifted in its normal position. Lifting attachments shall withstand any handling conditions that might be encountered, without bending or distortion of shape, such as rapid lowering and braking of load.

2.5 DUCTILE IRON PIPE AND FITTINGS

A. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end unless grooved or flanged ends are indicated, 350 psi (2400 kPa).
   1. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   2. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.

B. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end unless grooved or flanged ends are indicated, 350 psi (2400 kPa).
   1. Push-on-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
   2. Gaskets: AWWA C111, rubber.

C. Cement Mortar Internal Lining: Cement mortar lining and bituminous seal coat as per AWWA C104.

D. Exterior Pipe Coating: The exterior of pipe shall have the standard asphaltic coating.

2.6 POLYVINYL CHLORIDE PIPE AND FITTINGS – NOT USED

2.7 PE PIPE AND FITTINGS - NOT USED

2.8 COPPER TUBE AND FITTINGS – NOT USED

2.9 VALVES

A. Gate Valves: AWWA C509, Non-rising Stem, Resilient Seat, 200 psi (1380 kPa).
   1. Valves 3 inches (75 mm) and larger: Resilient seat valve with gray- or ductile iron body and bonnet; cast iron or bronze double-disc gate; bronze gate rings; non-rising bronze stem and stem nut.
   2. Interior and exterior coating: AWWA C550, thermo-setting or fusion epoxy.
   3. Underground valve nut: Furnish valves with 2 inch (50 mm) nut for socket wrench operation.
   4. Aboveground and pit operation: Furnish valves with hand wheels.
   5. End connections shall be mechanical joint for exterior installation and flanged for interior valve vault locations.

B. Gate Valve Accessories and Specialties
   1. Tapping-Sleeve Assembly: ANSI MSS SP-60; sleeve and valve to be compatible with the drilling matching.

a. Tapping Sleeve: Ductile Iron or Stainless-Steel, two-piece bolted sleeve. Sleeve to match the size and type of pipe material being tapped.
b. Valve shall include one raised face flange mating tapping-sleeve flange.

2. Valve Boxes: AWWA M44 with top section, adjustable extension of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over valve and with a barrel.
3. Operating Wrenches: Steel, tee-handle with one pointed end, stem of length to operate deepest buried valve, and socket matching valve operating nut. (Provide two wrenches for Project.)
4. Indicator Posts: UL 789, FMG approved, vertical-type, cast iron body with operating wrench, extension rod, and adjustable cast iron barrel of length required for depth of burial of valve.

C. Flow Control Valve

1. The Rate-of-Flow Control Valve with pressure reducing feature shall be a pilot operated diaphragm valve designed to automatically limit flow rate to a constant, adjustable maximum, and reduce a fluctuating higher upstream pressure to a constant lower downstream pressure. The flow control action of the valve shall be controlled by an externally mounted modulating flow control pilot, which senses differential pressure across a remote mounted orifice plate (field installed). The pressure reducing action of the valve shall be controlled by a separate Pressure Reducing Control Pilot which internally senses downstream pressure.
   a. Size: 4 inch NPS
   b. Design flow rate: 260 gpm
   c. Design inlet pressure: 160 psi
   d. Design outlet pressure setting: 75 psi
2. Body: Ductile iron ASTM A536. Internal components are ductile iron or 316 Stainless Steel. All ductile iron components shall be lined and coated with NSF 61 Certified Epoxy Coating.
3. End connections: Flanged.
4. Pilot control system shall contain an external Y-Strainer, Adjustable Closing Speed Control, Adjustable opening speed control, pressure Reducing Pilot, rate-of-flow pilot and isolation ball valves on all

body connections. All pilot control systems shall utilize copper tubing and brass fittings regardless of valve size. The adjustment range of the pressure reducing pilot shall be 30-300 psi. The Orifice Plate Assembly shall be included with the valve and field installed 3-5 pipe diameters downstream of the Flow Control Valve. The Orifice Plate Assembly shall be (field) connected to the Rate-of-Flow Control Pilot in accordance with factory piping schematic with minimum 3/8” diameter copper tubing.

D. Relief Valves (interior to building)
   1. Combination Air Valve: AWWA C512, Float-operated, hydromechanical device to automatically release accumulated air or to admit air during filling of piping.
      a. Pressure Rating: 150 psi
      b. Body material: Cast iron
      c. Trim material: Stainless steel
      d. Water inlet size: 1” NPS (6 inch water main size)
      e. Air outlet size: (By Manufacturer)
      f. Orifice size: (By Manufacturer)
      g. Design air-release capacity: Minimum 2 cfm (L/s) at 75 psi

E. Backflow Preventer
   1. Backflow Preventer shall not be located in any area containing fumes that are toxic, poisonous or corrosive.
   2. Direct connections between potable water piping and sewer connected wastes shall not exist under any condition with or without backflow protection.
   3. Backflow Preventer shall be accessed and have clearances for the required testing, maintenance and repair. Access and clearances shall maintain a minimum of 1 foot (305 mm) between the lowest portion of the assembly and grace, floor or platform. Installations elevated more than 5 feet (1524 mm) above the floor or grade shall be provided with a permanent platform capable of supporting a tester or maintenance person.

F. Reduced-Pressure-Principle Backflow Preventer: AWWA C511 for continuous-pressure applications. (Interior to building)
   1. Size: 6” NPS
   2. Design flow rate: 600 gpm
   3. Pressure loss at design flow rate: 8 psi

4. Body: Stainless steel
5. End connections: Grooved
6. Configuration: Designed for horizontal, straight through flow.
7. Valves: Resilient seated gate OS&Y type with grooved or flanged ends on inlet and outlet.
8. Air-gap fitting: ASME A112.1.2, matching backflow Preventer connection.
9. Provide with flood detection alarm. Field installed on relief drain pipe in accordance with manufacturers installation guidelines and connected to Building Automation System.

G. Backflow Preventer Test Kits
1. Provide factory calibrated test kit with gauges, fittings, hoses and carrying case with test-procedure instructions.

2.10 WATER METER BOXES – NOT USED

2.11 CONCRETE VAULTS

A. Precast or poured in place, reinforced-concrete vault: ASTM C858, designed for AASHTO H20-44 load designation. See Project Drawings.
1. Ladder: ASTM A36, aluminum or polyethylene-encased steel steps.
2. Drain: ASME A112.6.3, cast iron floor drain with outlet. Include body anchor flange, light-duty cast iron grate, bottom outlet, and integral or field-installed bronze ball or clapper-type backwater valve.
3. Vault Frame and Cover: See Project Drawings.

2.12 PROTECTIVE ENCLOSURES – NOT USED

2.13 FLUSHING HYDRANTS – NOT USED

2.14 FIRE HYDRANTS – NOT USED

2.15 FIRE DEPARTMENT CONNECTIONS – NOT USED

2.16 ALARM DEVICES NOT USED

2.17 DISINFECTION CHLORINE

A. Liquid chlorine: AWWA B301.
B. Sodium Hypochlorite: AWWA B300 with 5 percent to 15 percent available chlorine.
C. Calcium hypochlorite: AWWA B300 supplied in granular form of 5 g. tablets, and shall contain 65 percent chlorine by weight.

2.18 WARNING TAPE

A. Warning tape shall be standard, 4 mil. Polyethylene, 3 inch (76 mm) wide tape, detectable type, blue with black letters and imprinted with "CAUTION BURIED WATER LINE BELOW".

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Use pipe, fittings, and joining methods for piping systems according to the following applications.
   1. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
   2. Do not use flanges or unions for underground piping.
   3. Flanges, unions, grooved-end-pipe couplings, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.

B. Underground Combined Water-Service and Fire-Service-Main Piping NPS 6 to NPS 12 (DN 150 to DN 300) shall be the following:
   1. Ductile iron, gasketed mechanical-joint pipe; Ductile Iron, mechanical-joint fittings;

3.2 VALVE APPLICATIONS

A. Use mechanical-joint-end valves for NPS 3 (DN 80) and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, non-rising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 (DN 50) and smaller installation.

B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   1. Underground Valves, NPS 3 (DN 80) and Larger: AWWA, cast iron, non-rising-stem, resilient seated gate valves with valve box.
   2. Underground Valves, NPS 4 (DN 100) and Larger, for Indicator Posts: UL/FMG, cast iron, non-rising-stem gate valves with indicator post.
   3. Use the following for valves in vaults and aboveground:
      a. Gate Valves, NPS 3 (DN 80) and Larger: AWWA, cast iron, OS&Y rising stem, resilient seated.
      b. Check Valves: AWWA C508, swing type.

3.3 DUCTILE IRON PIPE

A. Install Ductile Iron, water-service piping according to AWWA C600 and AWWA M41-3rd Edition.
   1. Install PE corrosion-protection encasement according to ASTM A674 or AWWA C105/A21.5.

B. Pipe shall be sound and clean before laying. When laying is not in progress, the open ends of the pipe shall be closed by watertight plug or other approved means.

C. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Bevel cut ends of pipe to be used with push-on bell to conform to the manufactured spigot end. Cement lining shall be undamaged.

D. Push on joints shall be made in strict accordance with the manufacturer’s instruction. Pipe shall be laid with bell ends looking ahead.

3.4 PVC PIPE – NOT USED

3.5 COPPER PIPE – NOT USED

3.6 ANCHORAGE INSTALLATION

A. Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include: concrete thrust blocks, locking mechanical joints, bolted flanged joints, pipe clamps and tie rods.

B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
   1. Gasketed-Joint, Ductile Iron, Water-Service Piping: According to AWWA C600.
   2. Fire-Service-Main Piping: According to NFPA 24.

C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.7 VALVE INSTALLATION

A. AWWA Valves: Install each underground valve with stem pointing up and with valve box.

B. UL/FMG, Valves: Install each underground valve and valves in vaults with stem pointing up and with vertical cast iron indicator post.

C. MSS Valves: Install as component of connected piping system.

D. Pressure-Reducing Valves: Install in vault or aboveground between shutoff valves.

E. Relief Valves: Install aboveground with shutoff valve on inlet.

F. Raise or lower existing valve and curb stop boxes and fire hydrants to finish grade in areas being graded.

3.8 WATER METER INSTALLATION – NOT USED

3.9 ROUGHING-IN FOR WATER METERS – NOT USED

3.10 WATER METER BOX INSTALLATION – NOT USED

3.11 VACUUM BREAKER ASSEMBLY INSTALLATION – NOT USED

3.12 BACKFLOW PREVENTER INSTALLATION

A. Install backflow Preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.

B. Do not install backflow Preventers that have relief drain in vault or in other spaces subject to flooding.

C. Do not install bypass piping around backflow Preventers.

D. Support NPS 2-1/2 (DN 65) and larger backflow Preventers, valves, and piping near floor and on brick or concrete piers.

3.13 CONCRETE VAULT INSTALLATION – NOT USED

A. Install precast concrete vaults according to ASTM C891.

3.14 PROTECTIVE ENCLOSURE INSTALLATION – NOT USED

3.15 FLUSHING HYDRANT INSTALLATION – NOT USED

3.16 FIRE DEPARTMENT CONNECTION INSTALLATION – NOT USED

3.17 FIRE HYDRANT INSTALLATION – NOT USED

3.18 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties. Install water service lines to a point of connection 12 inches above slab to which service is to be connected and make connections thereto. If building services have not been installed provide temporary caps and mark for future connection.

3.19 FIELD QUALITY CONTROL

A. Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water. Tests shall occur no more than 14 days before pipe is placed in service.

B. Prior to final acceptance, provide a video record of all piping from the building to the municipal connection to show the lines are free from obstructions, properly sloped and joined.

C. Perform hydrostatic tests at not less than one-and-one-half times working pressure for two hours.

1. Increase pressure in 50-psi (350-kPa) increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psi (0 kPa). Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.

D. Prepare reports of testing activities.

3.20 IDENTIFICATION

A. Install continuous underground warning tape 12 inches (300 mm) directly over piping.

3.21 CLEANING

A. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.

B. Use purging and disinfecting procedure prescribed by local utility provider or other authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:

1. Fill the water system with a water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
2. Drain the system of the previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow system to stand for 3 hours.
3. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
4. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

C. Prepare reports of purging and disinfecting activities.

--- E N D ---

SECTION 33 40 00

STORM SEWER UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies materials and procedures for construction of outside, underground storm sewer systems that are complete and ready for operation. This includes piping, structures and all other incidentals.

1.2 RELATED WORK

A. Excavation, Trench Widths, Pipe Bedding, Backfill, Shoring, Sheeting, Bracing: Section 31 20 11, EARTH MOVING.

B. Concrete Work, Reinforcing, Placement and Finishing: Section 03 30 53, CAST-IN-PLACE CONCRETE.

C. General plumbing, protection of Materials and Equipment, and quality assurance: Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

D. Fabrication of Steel Ladders: Section 05 50 00, METAL FABRICATIONS.

E. Materials and Testing Report Submittals: Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.

1.3 DEFINITIONS

1.4 ABBREVIATIONS

A. HDPE: High-density polyethylene

B. PE: Polyethylene

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic manholes, pipe, and fittings in direct sunlight.

B. Handle according to manufacturer's written rigging instructions.

1.6 COORDINATION

A. Coordinate connection to storm sewer main with the Public Agency providing storm sewer off-site drainage.

B. Coordinate exterior utility lines and connections to building services up to the actual extent of building wall.

1.7 QUALITY ASSURANCE:

A. Products Criteria:

1. When two or more units of the same type or class of materials or equipment are required, these units shall be products of one manufacturer.

2. A nameplate bearing manufacturer's name or trademark, including model number, shall be securely affixed in a conspicuous place on equipment. In addition, the model number shall be either cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

1.8 SUBMITTALS

A. Manufacturers' Literature and Data shall be submitted, as one package, for pipes, fittings and appurtenances, including jointing materials, hydrants, valves and other miscellaneous items.

1.9 APPLICABLE PUBLICATIONS

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

B. American Society for Testing and Materials (ASTM):

C14-07.....Non-reinforced Concrete Sewer, Storm Drain, and Culvert Pipe

C76-11.....Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

C443-10.....Joints for Concrete Pipe and Manholes, Using Rubber Gaskets

C924-02(2009).....Testing Concrete Pipe Sewer Lines by Low-Pressure Air Test Method

C1103-03(2009).....Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines

C1479-10.....Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations

D1785-06.....Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120

D2321-11.....Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications

D2751-05.....Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings

D3034-08.....Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

D3350-10.....Polyethylene Plastics Pipe and Fittings Materials

D4101-11.....Polypropylene Injection and Extrusion Materials

D5926-09.....Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems

F477-10.....Elastomeric Seals (Gaskets) for Joining Plastic Pipe

F679-08.....Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings

F714-10.....Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter

F794-03(2009).....Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter

F894-07.....Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe

F949-10.....Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings

F1417-11.....Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air

F1668-08.....Construction Procedures for Buried Plastic Pipe

C. American Association of State Highway and Transportation Officials (AASHTO):

M252-09.....Corrugated Polyethylene Drainage Pipe

M294-10.....Corrugated Polyethylene Pipe, 12 to 60 In. (300 to 1500 mm) Diameter

D. American Society of Mechanical Engineers (ASME):

A112.6.3-2001.....Floor and Trench Drains

A112.14.1-2003.....Backwater Valves

A112.36.2M-1991.....Cleanouts

E. American Concrete Institute (ACI):

318-05.....Structural Commentary and Commentary

350/350M-06.....Environmental Engineering Concrete Structures and Commentary

F. National Stone, Sand and Gravel Association (NSSGA): Quarried Stone for Erosion and Sediment Control

1.10 WARRANTY

The Contractor shall remedy any defect due to faulty material or workmanship and pay for any damage to other work resulting therefrom within a period of one year from final acceptance. Further, the Contractor will furnish all manufacturers' and suppliers' written guarantees and warranties covering materials and equipment furnished under this Contract.

PART 2 - PRODUCTS

2.1 FACTORY-ASSEMBLED PRODUCTS

A. Standardization of components shall be maximized to reduce spare part requirements. The Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

2.2 STEEL PIPE AND FITTINGS - NOT USED

2.3 ALUMINUM PIPE AND FITTINGS - NOT USED

2.4 ABS PIPE AND FITTINGS

A. ABS Sewer Pipe and Fittings: Pipe and fittings shall conform to ASTM D2751, with bell-and-spigot ends for gasketed joints.
   1. NPS 3 to NPS 6 (DN 80 to DN 150): SDR 35.
   2. NPS 8 to NPS 12 (DN 200 to DN 300): SDR 42.

B. Gaskets: ASTM F477, elastomeric seals.

2.5 PE PIPE AND FITTINGS

A. Corrugated PE drainage pipe and fittings, NPS 3 to NPS 10 (DN 80 to DN 250); ASTM F714, SDR 21 with smooth waterway for coupling joints.
   1. Silt-tight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.

B. Corrugated PE pipe and fittings, NPS 12 to NPS 60 (DN 300 to DN 1500); ASTM F714, SDR 21 for pipes 3 to 24 inches (300 to 600 mm) with smooth waterway for coupling joints. Pipe shall be produced from PE certified by the resin producer as meeting the requirements of ASTM D3350, minimum cell class 335434C.
   1. Silt-tight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.

C. PVC Pipe And Fittings
   1. PVC Cellular-Core Pipe And Fittings: ASTM F891, Sewer and Drain Series, PS 50 minimum stiffness, PVC cellular-core pipe with plain ends for solvent-cemented joints.
   2. Fittings: ASTM D3034, SDR 35, PVC socket-type fittings.

D. PVC Corrugated Sewer Piping
   1. Pipe: ASTM F949, PVC, corrugated pipe with bell-and-spigot ends for gasketed joints.
   2. Fittings: ASTM F949, PVC molded or fabricated, socket type.
   3. Gaskets: ASTM F477, elastomeric seals.

E. PVC Profile Sewer Piping
   1. Pipe: ASTM F794, PVC profile, gravity sewer pipe with bell-and-spigot ends.
   2. Fittings: ASTM D3034, PVC with bell ends.
   3. Gaskets: ASTM F477, elastomeric seals.

F. PVC Type PSM Sewer Piping
   1. Pipe: ASTM D3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends.
   2. Fittings: ASTM D3034, PVC with bell ends.
   3. Gaskets: ASTM F477, elastomeric seals.

G. PVC Gravity Sewer Piping
   1. Pipe and fittings shall be ASTM F679, T-1 wall thickness, PVC gravity sewer pipe with bell-and-spigot ends.
   2. Gaskets: ASTM F477, elastomeric seals for gasketed joints.

2.6 CONCRETE PIPE AND FITTINGS

A. Non-Reinforced-Concrete sewer pipe and fittings shall be ASTM C14, Class 3, with bell-and-spigot ends and gasketed joints with ASTM C443, rubber gaskets.

B. Reinforced-Concrete sewer pipe and fittings shall be ASTM C76 or ASTM C655.

1. Bell-and-spigot ends and gasketed joints with ASTM C443, rubber gaskets.
2. Class III: Wall A

2.7 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials
   1. For concrete pipes: ASTM C443, rubber.
   2. For plastic pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
   3. For dissimilar pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings: Couplings shall be an elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Shielded, flexible couplings shall be elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Ring-Type, flexible couplings shall be elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.8 PRESSURE PIPE COUPLINGS – NOT USED

2.9 EXPANSION JOINTS AND DEFLECTION FITTINGS – NOT USED

2.10 BACKWATER VALVES – NOT USED

2.11 CLEANOUTS – NOT USED

2.12 DRAINS

A. Cast-Iron Area Drains: ASME A112.6.3, gray-iron round body with anchor flange and round grate. Include bottom outlet with inside calk or spigot connection, of sizes indicated.
   1. Top-Loading Classification(s): Medium Duty

2.13 ENCASEMENT FOR PIPING – NOT USED

2.14 MANHOLES AND CATCH BASINS – NOT USED

2.15 CONCRETE FOR MANHOLES AND CATCH BASINS – NOT USED

2.16 POLYMER-CONCRETE, CHANNEL DRAINAGE SYSTEMS – NOT USED

2.17 PLASTIC, CHANNEL DRAINAGE SYSTEMS – NOT USED

2.18 PIPE OUTLETS – NOT USED

2.19 DRY WELLS – NOT USED

2.20 STORMWATER DISPOSAL SYSTEMS – NOT USED

2.21 HEADWALLS – NOT USED

2.22 FLARED END SECTIONS – NOT USED

2.23 PRECAST REINFORCED CONCRETE BOX CULVERT – NOT USED

2.24 RESILIENT CONNECTORS AND DOWNSPOUT BOOTS FOR BUILDING ROOF DRAINS

A. Resilient connectors and downspout boots: Flexible, watertight connectors used for connecting pipe to manholes and inlets, and shall conform to ASTM C923.

2.25 WARNING TAPE

A. Standard, 4-Mil polyethylene 3 inch (76 mm) wide tape detectable type, green with black letters, and imprinted with "CAUTION BURIED STORM DRAIN LINE BELOW".

PART 3 - EXECUTION

3.1 PIPE BEDDING

A. The bedding surface of the pipe shall provide a firm foundation of uniform density throughout the entire length of pipe. Concrete pipe requirements are such that when no bedding class is specified, concrete pipe shall be bedded in a soil foundation accurately shaped and rounded to conform with the lowest one-fourth of the outside portion of circular pipe. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall not be more than the length, depth, and width required for properly making the particular type of joint. Plastic pipe bedding requirements shall meet the requirements of ASTM D2321. Bedding, haunching and initial backfill shall be either Class IB or Class II material. Corrugated metal pipe bedding requirements shall conform to ASTM A798.

3.2 PIPING INSTALLATION

A. Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Install piping as indicated, to

extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.

B. Install piping with 24 inch minimum cover as shown on the Drawings.

C. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.

1. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.
2. Support pipe on compacted bedding material. Excavate bell holes only large enough to properly make the joint.
3. Inspect pipes and fittings, for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.
4. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely to prevent entrance of storm water, dirt or other substances.
5. Lower pipe into trench carefully and bring to proper line, grade, and joint. After jointing, interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.
6. Do not walk on pipe in trenches until covered by layers of shading to a depth of 12 inches (300 mm) over the crown of the pipe.
7. Warning tape shall be continuously placed 12 inches (300 mm) above storm sewer piping.

D. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.

E. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.

F. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.

G. Install gravity-flow, nonpressure drainage piping according to the following:

1. Install piping pitched down in direction of flow.
2. Install piping NPS 6 (DN 150) and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fittings; or cast in-place concrete supports or anchors.
3. Install hub-and-spigot, cast iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook."
4. Install ductile iron piping and special fittings according to AWWA C600.
5. Install corrugated steel piping according to ASTM A798.
6. Install corrugated aluminum piping according to ASTM B788.
7. Install ABS sewer piping according to ASTM D2321 and ASTM F1668.
8. Install PE corrugated sewer piping according to ASTM D2321 with gasketed joints.
9. Install PVC cellular-core piping, PVC sewer piping, and PVC profile gravity sewer piping, according to ASTM D2321 and ASTM F1668.
10. Install reinforced concrete sewer piping according to ASTM C1479.

3.3 REGRADING

A. Raise or lower existing manholes and structures frames and covers in regraded areas to finish grade. Carefully remove, clean and salvage cast iron frames and covers. Adjust the elevation of the top of the manhole or structure as detailed on the drawings. Reset cast iron frame and cover, grouting below and around the frame. Install concrete collar around reset frame and cover as specified for new construction.

B. During periods when work is progressing on adjusting manholes or structures cover elevations, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure, and shall prevent debris from entering the wastewater stream.

3.4 CONNECTIONS TO EXISTING VA-OWNED MANHOLES – NOT USED

3.5 CONNECTIONS TO EXISTING PUBLIC UTILITY MANHOLES – NOT USED

3.6 DRAIN INSTALLATION

A. Install type of drains in locations indicated.
   1. Use Medium-Duty, top-loading classification cleanouts in paved foot-traffic areas.

B. Embed drains in 4 inch (102 mm) minimum concrete around bottom and sides.

C. Set drain frames and covers with tops flush with pavement surface.

D. Assemble trench sections with flanged joints and embed trench sections in 4 inch (102 mm) minimum concrete around bottom and sides.

3.7 MANHOLE INSTALLATION – NOT USED

3.8 CATCH BASIN INSTALLATION – NOT USED

3.9 STORMWATER INLET AND OUTLET INSTALLATION – NOT USED

3.10 DRY WELL INSTALLATION – NOT USED

3.11 CHANNEL DRAINAGE SYSTEM INSTALLATION – NOT USED

3.12 STORMWATER DISPOSAL SYSTEM INSTALLATION – NOT USED

3.13 CONNECTIONS

A. Connect nonpressure, gravity-flow drainage piping in building's storm building drains specified in Division 22 Section FACILITY STORM DRAINAGE PIPING.

B. Encase entire connection fitting, plus 6 inch (150 mm) overlap, with not less than 6 inches (150 mm) of concrete with 28-day compressive strength of 3000 psi (20.7 MPa).

C. Make connections to existing piping and underground manholes.

1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe; install wye fitting into existing piping.
2. Make branch connections from side into existing piping, NPS 4 to NPS 20 (DN 100 to DN 500). Remove section of existing pipe, install wye fitting into existing piping.
3. Make branch connections from side into existing piping, NPS 21 (DN 525) or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches (76 mm) of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, use epoxy-bonding compound as interface between new and existing concrete and piping materials.
4. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

D. Pipe couplings, expansion joints, and deflection fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
   1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
      a. Unshielded flexible couplings for same or minor difference OD pipes.
      b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
      c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.14 CLOSING ABANDONED STORM DRAINAGE SYSTEMS – NOT USED

3.15 IDENTIFICATION

A. Install green warning tape directly over piping and at outside edge of underground structures.

3.16 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Prior to final acceptance, provide a video record of all piping from the building to the municipal connection to show the lines are free from obstructions, properly sloped and joined.
   1. Submit separate reports for each system inspection.
   2. Defects requiring correction include the following:
      a. Alignment: Less than full diameter of inside of pipe is visible between structures.
      b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
      c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
      d. Infiltration: Water leakage into piping.
      e. Exfiltration: Water leakage from or around piping.
   3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
   4. Reinspect and repeat procedure until results are satisfactory.

3.17 TESTING OF STORM SEWERS:

A. Submit separate report for each test.

B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
   1. Do not enclose, cover, or put into service before inspection and approval.
   2. Test completed piping systems according to requirements of authorities having jurisdiction.
   3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours advance notice.
   4. Submit separate report for each test.
   5. Air test gravity sewers. Concrete Pipes conform to ASTM C924, Plastic Pipes conform to ASTM F1417, all other pipe material conform to ASTM C828 or C924, after consulting with pipe manufacturer. Testing of individual joints shall conform to ASTM C1103.
C. Leaks and loss in test pressure constitute defects that must be repaired. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.18 CLEANING

A. Clean interior of piping of dirt and superfluous materials. Flush with water.

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SECTION 46 66 00
ULTRAVIOLET EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. This section describes the requirements for domestic water building point-of-entry (POE) ultraviolet water treatment, including all necessary accessories, connections, and equipment.

B. Application is for secondary treatment of municipal water supply.

C. A complete listing of all acronyms and abbreviations are included in Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.2 RELATED WORK

A. Section 01 00 00, GENERAL REQUIREMENTS.

B. Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

C. Section 03 30 53, CAST-IN-PLACE CONCRETE: Concrete and Grout.

D. Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

E. Section 22 05 19, METERS AND GAGES FOR PLUMBING PIPING.

F. Section 22 05 23, GENERAL-DUTY VALVES FOR PLUMBING PIPING.

G. Section 22 07 11, PLUMBING INSULATION.

H. Section 22 11 00, FACILITY WATER DISTRIBUTION: Piping, Fittings, Valves and Gages.

1.3 APPLICABLE PUBLICATIONS

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

B. NSF International (NSF):

55-2016.....Ultraviolet Microbiological Water Treatment Systems

1.4 SUBMITTALS

A. Submittals, including number of required copies, shall be submitted in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, and SAMPLES.

B. Information and material submitted under this section shall be marked “SUBMITTED UNDER SECTION 46 66 00, ULTRAVIOLET EQUIPMENT”, with applicable paragraph identification.

C. Manufacturer's Literature and Data including: Full item description and optional features and accessories. Include dimensions, weights,

materials, applications, standard compliance, model numbers, size, and capacity.

1. Ultraviolet System (UV chamber, lamp, housing, sensors, etc.)
2. Temperature Relief Valves.
3. Regulating valves.
4. Gauges.
5. Controller

D. Documentation stating compliance with NSF 55 Class A.

E. Shop drawings shall include wiring diagrams for power, signal and control functions.

F. Complete operating and maintenance manuals including wiring diagrams, technical data sheets and information for ordering replaceable parts:

1. Include complete list indicating all components of the systems.
2. Include complete diagrams of the internal wiring for each item of equipment.
3. Diagrams shall have their terminals identified to facilitate installation, operation and maintenance.

1.5 QUALITY ASSURANCE

A. Equipment components in contact with potable water shall meet compliance requirements in documents NSF 61.

B. The Ultraviolet Treatment Unit shall be certified by NSF.

1.6 AS-BUILT DOCUMENTATION

A. Submit operation and maintenance data updated to include submittal review comments, substitutions and construction revisions shall be in electronic PDF version via Electronic Transmittal and Hard Copy inserted into a three ring binder. All aspects of system operation and maintenance procedures, including piping isometrics, wiring diagrams of all circuits, a written description of system design, control logic, and sequence of operation shall be included in the operation and maintenance manual. The operations and maintenance manual shall include troubleshooting techniques and procedures for emergency situations. Notes on all special systems or devices such as damper and door closure interlocks shall be included. A List of recommended spare parts (manufacturer, model number, and quantity) shall be furnished. Information explaining any special knowledge or tools the owner will be required to employ shall be inserted into the As-Built documentation.

B. The installing contractor shall maintain as-built drawings of each completed phase for verification; and, shall provide the complete set at the time of final systems certification testing. As-built drawings shall be provided in electronic PDF version via Electronic Transmittal and Hard Copy inserted into a three ring binder. Should the installing contractor engage the testing company to provide as-built or any portion thereof, it shall not be deemed a conflict of interest or breach of the 'third party testing company' requirement.

PART 2 - PRODUCTS

2.1 ULTRAVOILET TREATMENT SYSTEM

A. The Ultraviolet Treatment System shall be certified NSF 55 Class A for disinfection of domestic water at building point of entry.

B. The stand or skid shall be factory fabricated for floor mounting. Provide with access for maintenance.

C. General:

1. 120V/60Hz
2. Service Life of UV lamps: 12,000 hours (minimum)
3. Maximum Operating Feed Water Temperature: 110 degrees F
4. Minimum Operating Temperature: 35 degrees F
5. Rated Service Flow: 110 gpm
6. Maximum Working Pressure: 100 psi

D. The lamp shell shall be constructed from stainless steel.

E. System is permitted to consist of multiple headered units to meet rated service flow.

1. Units to be installed in headered arrangement shall be approved by manufacturer for headered installation. Contractor shall follow all installation recommendations by manufacturer.
2. Headered installations shall also take into consideration additional space required. Contractor is responsible for field verification that adequate space is available for equipment, piping connections, and maintenance activity.

F. The controls shall include at minimum:

1. System status
2. Alarm status
3. The system shall utilize controls for thermal management to protect equipment during extended low and no flow periods. Thermal

management may consist of lamp power reduction and/or thermal relief.

4. UV sensor as required by NSF 55 Class A certification.
5. Alarms and equipment status shall be integrated into the Building Automation System from system controller.
6. Alarms conditions shall not restrict or stop flow through unit.

G. Device safety controls shall be automatic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. The Ultraviolet Treatment System shall be installed on concrete bases. Refer to Specification Section 03 30 00, CAST-IN-PLACE CONCRETE and Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

B. The Ultraviolet Treatment System shall be installed level and plumb and securely anchored.

C. Equipment shall be installed and connected in accordance with manufacturer’s written instructions with manufacturer’s recommended clearances.

D. Temperature relief valves discharge shall be piped to nearby floor drains with air gap or break.

E. Isolation valves shall be installed on the unit inlet and outlet piping and shall be positioned such that they can be observed and operated by an operator or staff standing on floor or walkway.

F. All manufacturer’s required clearances shall be maintained.

G. Maintenance drain piping shall be installed as indirect waste to spill by positive air gap into open drains or over floor drains.

H. Dielectric unions shall be provided if there are dissimilar metals between the unit connections and the attached piping.

I. If an installation is unsatisfactory to the COR, the Contractor shall correct the installation at no cost to the Government.

3.2 LEAKAGE TEST

A. All modifications to domestic water system and piping connections to Ultraviolet Treatment System equipment shall be leak tested as recommended by manufacturer and/or specifications. Any failed test shall be reported to the COR and corrected at no additional cost to the VA.

3.3 STARTUP AND TESTING

A. As recommended by product manufacturer and under actual or simulated operating conditions, tests shall be conducted to prove full compliance with design and specified requirements.

B. The tests shall include system capacity, control function, and alarm functions.

C. When any defects are detected, correct defects and repeat test at no additional costs to the Government.

D. The COR will observe startup and testing of equipment. Coordinate the startup and testing schedules with the COR. Provide a minimum of 7 days prior to notice.

3.4 DEMONSTRATION AND TRAINING

A. Provide services of manufacturer’s technical representative for up to eight hours to instruct VA Personnel in operation and maintenance of the system.

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