September 3, 2024

United States Department of the Interior
National Park Service
Denver Service Center
12795 W. Alameda Parkway
P.O. Box 25287
Denver, CO 80225-0287

ATTENTION: Susan Lehmann

Dear Susan,

REFERENCE: NPS Arc Flash Evaluation - LACL
Trip Report

On 4/22/22 through 4/24/22 Billy Comer with Consolidated Contracting, Connor Zietlow with RSA Engineering, and I travelled to Lake Clark National Park and Preserve to investigate the electrical distribution systems. The intent of the site visit was to gather enough information on the equipment to provide an accurate arc flash calculation, to provide warning labels for the equipment and determine any code deficiencies. Since all the equipment was single phase and 240V, or less, an arc flash calculation is not required. See one-line diagrams for further information on site electrical systems. The following report will address any code issues we discovered as part of our investigation.

2024 Update: I, Patrick Collins, travelled to Lake Clark National Park again on 5/15/24 through 5/16/24 to verify and evaluate other code issues with the facilities at the park.

General:

1. ***In existing installations where receptacles are being replaced, per NEC 406.4(D), new receptacles are required to conform with the most recent adoption of the NEC. Example: All housing unit receptacles replaced are required to be UL tamper-resistant type and have AFCI protection, and all receptacles replaced in areas of assembly, per NEC 518, are required to be UL tamper-resistant type.***
2. ***Although breakers were not code required to have AFCI protection when installed, any dwelling unit 120V, 15 and 20A branch circuit supplying outlets or devices would now require AFCI protection per NEC 210.12. As panels or circuits are modified and replaced, we would recommend upgrading these breakers.***

Hangar

The hangar consists of a 300A, 120/240V, 1Ø, 3-position meterbase with (3) 100A, 2-pole breakers with meterbases. Two of the breakers are spare. The final breaker feeds the hangar to a service disconnect just within the hangar. The disconnect then feeds to a surface-mounted 125A, 120/240V, 1Ø with main lugs load center, Siemens type EQ, Panel 'A'. A feeder from Panel 'A' feeds a rectifier panel, on the other side of the building, for a Solar Panel Array. The rectifier has connections to a battery bank and the solar array and then sub-feeds to an exterior mounted manual transfer switch. The Manual Transfer Switch (MTS) can transfer between the rectifier (AC system) and a generator plug. The load side of the MTS feeds Panel 'B' located in the boiler room. Panel 'B' is a recessed-mounted 100A, 120/240V, 1Ø with main lugs, Siemens type EQ. The following are issues we noted with the distribution system:

1. Service disconnect is unfused disconnect switch and needs to be an overcurrent protective device such as a breaker or a fused disconnect in accordance with NEC 230.90.

2. Need a main bonding jumper within the service disconnect for the hangar per NEC 250.24.
3. The MTS and adjacent electrical equipment are under an eave and covered in ice during the winter months, see Image #1. Recommend providing an awning to protect the equipment.

2024 Update: The facility is in the middle of adding a fueling facility to the hangar in order to abandon/demolish the existing fueling facility. Based on discussion on-site the 3-position meterbase is to be demolished at the end of the project.

Code Deficiencies

1. ***Item #3 has been completed. No update to the other items on the list.***

Electrical Recommendations

1. ***The high-bay T5HO light fixtures in the hangar are in excellent condition but are no longer manufactured. When lamps or ballasts fail to 70%, or lower, of the current lighting levels we would recommend replacement of the fixtures with new LED type.***

Maintenance Shop

Maintenance Shop service is a combination meterbase/disconnect with (2) breakers. One breaker feeds Panel 'A' which is in the middle shop office area. Panel 'A' is a surface-mounted Siemens load center with main lugs. The label was torn so we are assuming it is 100A, 120/240V, 1Ø type EQ load center. The second service breaker feeds a distribution panel adjacent to the service we will designate Panel 'B'. This panel is a surface-mounted, 200A, 120/240V, 1Ø with main lugs Siemens type EQ load center. This panel sub-feeds (4) additional panels within the Maintenance Shop and the Battery Shed, discussed later in this document. A panel in the East Shop designated Panel 'C', a panel in the West Shop designated Panel 'D' and a panel in the boiler room designated Panel 'M'. Panel 'C' is a surface-mounted, 125A, 120/240V, 1Ø with main lugs load center, Thomas & Betts type TBL. Panel 'D' is a surface-mounted, 125A, 120/240V, 1Ø with main lugs, Siemens type EQ load center. A 30A, 2-pole breaker within Panel 'D' feeds to the Fuel Storage Facility next to the Maintenance Shop. The distribution system for that system will be discussed below. Panel 'M' is a surface-mounted, 125A, 120/240V, 1Ø with main lugs, Siemens type EQ load center. The following are issues we noted with the distribution system:

1. All panels have the neutral ground bonded together. The only place that a neutral-ground bond is acceptable is at the service disconnect per NEC 250.24. This can cause issues with ground fault receptacles and could allow imbalanced load to be on the equipment grounding system. A dedicated ground bar needs to be installed and all ground wires moved on to this dedicated bar.
2. The Thomas & Betts panel 'C' is no longer manufactured, and the breakers installed are not listed for this panel. If any upgrades are required, the entire panel will need to be replaced.

2024 Update: No updates to the above report including issues noted with the distribution system.

Code Deficiencies

1. ***Exterior receptacle on the west side needs a while-in-use receptacle cover.***
2. ***Receptacles in the break room do not have GFCI protection.***
3. ***Receptacles in the garage 6' from the sink do not have GFCI protection.***
4. ***Single 20A, 120V circuit fed to Grounds Shed for a receptacle which is not GFCI protected and requires a while-in-use cover.***
5. ***Ground shed circuit liquid tight conduit is broken and needs replacement/repair.***

Electrical Recommendations

1. ***Assembly on one of the east side exterior receptacles is not fastened in place.***

2. ***Receptacle on the East wall of the break room is not working. Troubleshoot and replace/repair as required.***

Tank Farm/Fueling Facility

As noted above the fueling system is fed from the Maintenance Shop. The fueling system consists of the feeder which the phase conductors are fed through a contactor then to Panel 'F'. Panel 'F' is surface-mounted, 125A, 120/240V, 1Ø with main lugs, Thomas & Betts Type TBL load center. The contactor is activated via a local emergency pushbutton. All the electrical distribution system equipment is mounted to a backboard with plywood siding/door and a metal corrugated roof. This backboard is installed on (2) 4"x4" which are directly buried into the ground.

The following are issues we noted with the distribution system:

1. At some point recently the backboard was hit by a vehicle which damaged the supports and electrical installations. The wiring is still intact, but the support system needs to be replaced along with all the raceway systems.
2. The Equipment Grounding Conductors (EGC) need to be moved to a new ground bar but since this panel is no longer manufactured and its supports are damaged it would be better to replace it with a similar Siemens or Square D product.

2024 Update: Per on-site discussion this facility is to be demolished or abandoned once the fueling system at the hangar is complete. The above issues would only need to be addressed as the facility is repurposed.

Battery and Evidence Shed

The battery shed is fed from Panel 'B' in the Maintenance Shop with a 50A, 2-pole breaker directly to Panel 'BA'. Panel 'BA' is a Square D type QO load center with main lugs. No ratings were stamped on the panel, so we are assuming 125A, 120/240V, 1Ø. This panel sub-feeds the Evidence Shed with a 60A, 2-pole breaker. The feeder terminates at Panel 'E' within the evidence shed. Panel 'E' is a 125A, 120/240V, 1Ø Siemens type EQ load center. The following are issues we noted with the distribution system:

1. Both structures require a grounding electrode (ground rod) installed per NEC 250.32.
2. Both structures require a 60A disconnect per NEC 225.31. This may be installed in place of the feeder LB just on exterior of the building. This will require that the existing panels be installed with a ground bar and ground wires moved off the neutral bar. The main bonding jumper will then be installed at the disconnect.

2024 Update: It appears that the equipment inside the battery storage is explosion rated being fed with non-hazardous electrical branch circuits. Hazardous equipment may have been required but it does not appear to have enough storage to require rated equipment. We did not have access to the Evidence Shed while on site to verify any code deficiencies. Above issues with the distribution system are still applicable. Recently they added a feed from the Evidence Shed to the Yurt with a #4AL SE cable direct buried to a loadcenter within the Yurt, Panel 'Y'. Panel 'Y' is 125A, 120/240V, 1Ø, Cutler-Hammer with main lugs only. The panel has been properly grounded with its own electrode and no neutral-ground bond but with only a main lug panel the building needs a disconnect. Assuming that the breaker used in Evidence is 50A or less than the SE cable is appropriately sized. However, it is not a listed product for direct burial.

Code Deficiencies

1. ***Add investigation into the Maximum Allowed Quantities for storage of battery systems to determine if hazardous equipment is required.***
2. ***New work recessed boxes are used as surface-mounted.***
3. ***Panel 'Y' requires a disconnect.***
4. ***Re-bury SE cable in conduit or replace with direct burial rated cable.***
5. ***Feeder and branch circuits out of Panel 'Y' do not have proper wire clamps installed.***

Electrical Recommendations

1. ***Replace broken device plates.***

Visitor Center

The Visitor Center service consists of a combination meterbase/disconnect with (2) breakers. A 30A, 2-pole breaker that feeds the adjacent weight room building, see below for details. The other breaker is a 125A, 2-pole breaker that feeds a load center we are designating as Panel 'A'. that is adjacent to the service entrance equipment. Panel 'A' is a surface-mounted, 125A, 120/240V, 1Ø, Square D type QO load center. We could not access the interior due to lock out padlock on one of the breakers. Panel 'A sub-feeds a Visitor Center panel (Panel 'B'), out house panel, see below section on the outhouse, and has breakers labeled "Paint Shed", and "Boat House". Breaker "Paint Shed is turned off and we traced all the powered buildings from other sources and assume this breaker is now a spare. The breaker "Boat House" has a conductor to the boat house but there is no electrical equipment currently within the building and the breaker is locked out. Panel 'B' is a recess-mounted load center in the restroom fed from a 125A breaker in Panel 'A' with #2 copper (CU). We could not find any nameplate data on the panel so we assume, based on the type QP breakers, that it is 125A, 120/240V, 1Ø Siemens type EQ load center. The following are issues we noted with the distribution system:

1. Panel 'B' has the EGC terminated at the neutral bus. See item 1 under the Maintenance Shop for issues associated with this neutral-ground bond. We assume Panel 'A' has a similar issue. A dedicated ground bar is required and the EGC need to be moved off the neutral bars.
2. #2 CU conductors are only rated for 95A per NEC table 310.16 and so the 125A breakers are too large to protect the conductors. The breakers need to be replaced with a new 100A breaker.

2024 Update: No update to the report above.

Code Deficiencies

1. ***No additional code deficiencies to report.***

Electrical Recommendations

1. ***Provide tamper resistant receptacles per NEC 518 in the main visiting area as receptacles are replaced.***

Weight Room and Outhouse

The weight room is fed from a 30A, 2-pole breaker on the Visitor Center service entrance with #10 conductors. These feed directly to Panel 'W' main lugs which is a recess-mounted 125A, 120/240V, 1Ø Square D type QO load center. The Outhouse is fed from a 60A, 2-pole breaker in the Visitor Center Panel 'A'. The feeder conductors terminate in Panel 'O' 100A main breaker. Panel 'O' is a 125A, 120/240V, 1Ø Square D type QO. The following are issues we noted with the distribution system:

1. Feeder conductors to Panel 'W' are identified incorrectly. The neutral wire needs to be moved off the phase lug and to the neutral bar.
2. Weight Room requires a disconnect per NEC 225.31.
3. Weight Room EGC need to be removed from the neutral bars.

2024 Update: No update to the report above.

Code Deficiencies

1. ***30A, 2-pole service entrance breaker for weight room is feeding underground with Romex which is not listed for exterior use.***
2. ***Weight room south exterior receptacle GFCI protection is not working, and while-in-use cover needs to be replaced.***
3. ***Receptacle in outhouse needs to be GFCI.***
4. ***Outhouse fillers required for loadcenter.***

Electrical Recommendations

1. ***Troubleshoot weight room west interior receptacle and repair/replace as required.***
2. ***Weight room exterior light is not working.***
3. ***Outhouse loadcenter is rusting and we would recommend replacement.***

Headquarters and Uniform Cache

The Headquarters service is a combination meterbase/disconnect with (2) breakers. One breaker feeds Panel 'A' in the telecommunication room. Panel 'A' is a recess-mounted, 125A, 120/240V, 1Ø with main lugs Siemens type EQ load center. The other service breaker feeds Panel 'B' located in the Common Area. Panel 'B' is a recess-mounted 225A, 120/240V, 1Ø with main lugs Siemens type EQ load center. (2)20A, 1-pole breakers feed to Panel 'C' located in the crawl space. Panel 'C' does not have any nameplate data but based on the mix of type QP and TB breakers we assume it is a Thomas & Betts load center. Panel 'C' is surface-mounted, 125A, 120/240V, 1Ø with main lugs. From the main lugs on Panel 'B' #4 copper conductors are run out to the Uniform Cache. Equipment is disconnected and not in use but consists of a 30A, 2-pole breaker which then feeds Panel 'U'. Panel 'U' is surface-mounted on the outside of the Uniform Cache and is a 125A, 120/240V, 1Ø with main lugs, Square D type QO load center. There is also a fused disconnect which is no longer connected to anything. The following are issues we noted with the distribution system:

1. #4 CU feeders to Uniform Cache are run in the basement exposed without protection.
2. PVC LB conduit body needs a cover plate.
3. Panel 'A' has several Thomas & Betts type TB breakers. If work is done on these circuits the breakers will need to be replaced with breakers listed with the Siemens type load center.
4. Panel 'C' is of unknown manufacturer type, and we would recommend replacing it with something more readily available. It is also missing several knockouts (KO) and wire clamps.

2024 Update: Panel 'C' also feeds a Panel 'D' with a 20A, 2-pole breaker and #12 wire. Panel 'D' is a 125A, 120/240V, 1Ø with main lugs, Siemens type EQ loadcenter. It appears the utilization equipment at the Uniform Cache and distribution panel has been demolished. The existing fused disconnect on the Uniform Cache is still on the building but appears to be abandoned in place.

Code Deficiencies

1. ***Demolish the Uniform Cache completely.***
2. ***Various PVC pipes run in the crawl space are unsecured. There is a mix of mechanical and electrical run in the PVC which needs to be investigated and labeled.***
3. ***Upgrade feeder for Panel 'D' to minimum 60A per NEC 225.39(D).***

4. ***Panel 'C' neutral bar is unsecured.***
5. ***Feeder for Panel 'C' is unprotected.***
6. ***Receptacle adjacent to Panel 'D' is not GFIC protected.***

Electrical Recommendations

1. ***Provide labels for Panel 'D' circuits.***
2. ***Broken light switch in hall.***

PA-7, Sauna, VIP and Mini

The PA-7 service is a combination meterbase/disconnect with (2) 100A breakers. One breaker feeds Panel 'A'. Panel 'A' is recess-mounted inside the home and is 200A, 120/240V, 1Ø, with main lugs Siemens type EQ load center. The other service breaker feeds through the house to Panel 'S' at the Sauna. The Sauna recently burned down, and the panel is left unsupported. Panel 'S' does not have a nameplate rating, so we are assuming it is 200A, 120/240V, 1Ø. The visible portion of the panel sticker confirms it as a Square D type QO and it has a 125A main breaker. A 30A, 2-pole breaker in Panel 'S' feeds an extension cord to a plug on the mini. The mini is a portable bedroom. The receptacle on the mini is a 30A, 3-pole, 4-wire twist-lock NEMA #L14-30R type. The #10 CU then feed up to Panel 'M'. Panel 'M' is a 100A, 120/240V, 1Ø, Square D type QO load center with main lugs only. It appears that they only ran 3-wires from the plug to the panel as the A and B phases are tied together within the panel. This means that only 1-pole of the feeding 30A, 2-pole breaker is loaded. Panel 'S' also feeds Panel 'V' on the exterior of the VIP building. Panel 'V' does not have any nameplate information. It uses type QP breakers and therefore we assume it is a 100A, 120/240V, 1Ø with main lugs, Siemens type EQ load center. Panel 'V' has a 60A, 2-pole breaker which feeds Panel 'V1' inside and a 50A, 2-pole breaker which feeds Panel 'V2'. Panel 'V1' is a recess-mounted, 100A, 120/240V, 1Ø with main lugs, Square D type QO load center. Panel 'V2' is a recess-mounted, 100A, 120/240V, 1Ø with main lugs, Square D type QO load center. The following are issues we noted with the distribution system:

1. Panels 'A' and 'S' need the ground wires removed from the neutral bars and a dedicated ground bar provided.
2. Panel 'S' is only provided with a NEMA 1 enclosure and needs to be a NEMA 3R enclosure. It also needs to be properly mounted to a structure. The panel missing fillers for blank spaces and KOs.
3. The extension cord used is not rated for direct bury and should not be used as a permanent installation. Recommend replacing it with a more permanent feed to a twist-lock receptacle mounted on a pedestal and replacing the existing receptacle with a 10'-15' section of extension cord with a plug. The cord can be coiled on a building-mounted hook when not in use. At this time the proper 4-wire connection can be installed to Panel 'M' and the A-B phase connection removed.
4. Panel 'V' is missing several KOs and a deadfront. Recommend replacing with a new panel with the ratings and model information available.
5. Panels 'A' and 'S' are fed with #4 AWG Cu not rated for the overcurrent protection device upstream. Replace upstream breakers with 70A 2-Pole breakers or smaller.

2024 Update: Panel 'S' has been demolished completely and the feeder has been extended underground to the VIP cabin to a new Panel 'S'. Panel 'S' is now NEMA 3R 200A, 120/240V, 1Ø, Siemens type EQ loadcenter with a 200A main breaker. Panel 'S' feeds the mini cabin with a 40A, 2-pole breaker with #10. The extension has been replaced with a non-metallic cable to the Mini which is not listed for exterior or direct buried use. Panel 'S' has sub-feed lugs on Panel 'S' feed Panel 'V' underground with #2. Panel 'V' has been replaced with a new 100A, 120/240V, 1Ø NEMA 3R panel with 100A main breaker. The conductors to Panel 'V' would be considered unprotected and would need an overcurrent protection at Panel 'S'. Items #1 through #4 have been addressed with replacement of the panels. Based on NEC

table 310.12 #4 feeders for dwelling units may be protected by 100A breaker and so item #5 is not a code deficiency.

Code Deficiencies

1. ***Non-metallic cable is not listed for installation in exposed area run above ground to mini from Panel 'S'.***
2. ***PA-7 kitchen, bathroom, garage/laundry room, and exterior receptacles are not GFCI protected.***
3. ***Panel 'A' spaces missing fillers.***

Electrical Recommendations

1. ***Upgrading the feeder for Panel 'A' and 'S' would give NPS additional capacity.***
2. ***PA-7 upstairs smoke alarm is above the stairs which makes testing and maintenance difficult. Suggest moving to above landing at the top of the stairs.***
3. ***Provide tamper resistant receptacles per NEC 518 as receptacles are replaced.***

PA-2, PA-4, Redoubt, Illiamna, Tanalian

These buildings are all set up similar with a combination meterbase/disconnect with (2) breakers. One breaker feeds Panel 'A' and the other breaker feeds Panel 'B'.

PA-2 has an upstairs and downstairs unit which have dedicated panels, 'A' being downstairs and 'B' being upstairs. Panel 'A' is recess-mounted, 125A, 120/240V, 1Ø with main lugs, Crouse-Hinds Type F. Panel 'B' is recess-mounted load center. No nameplate data is available but based on the configuration and breakers we are assuming it is a 125A, 120/240V, 1Ø Square D type QO load center.

PA-4 is a single-family house and Panel 'A' is in the data room and Panel 'B' is in the laundry room. Panel 'A' is recess-mounted, 125A, 120/240V, 1Ø, Square D type QO load center. Panel 'B' is recess-mounted, 125A, 120/240V, 1Ø Siemens type EQ load center.

All the panels for Redoubt, Illiamna and Tanalian are recess-mounted, 125A, 120/240V, 1Ø with main lugs, Siemens type EQ load centers.

The following are issues we noted with the distribution system:

1. PA-2 Panel 'A' has a washing machine installed within its NEC working clear space. Either device will need to be relocated.
2. PA-2 Panel 'A' needs to have the EGC removed from the neutral bar and a ground bar will need to be provided.
3. PA-4 meterbase is missing a KO.
4. PA-4 Panel 'B' has shelves/table installed within the NEC working clearance.
5. Redoubt has shelving within the NEC working clearance of the panels in both units.

2024 Update: We did not have access to PA-1, the first floor of PA-2, during the site visit. We assume previous comments are still applicable. There is no change to the above report.

Code Deficiencies

1. ***PA-2 boiler room light is not properly fastened and has exposed wire nuts.***
2. ***PA-2 light switch requires blank filler.***
3. ***PA-4 the boiler room lamp circuit is spliced outside a junction box.***
4. ***PA-4 laundry room receptacle is not GFCI protected.***
5. ***Redobut, Illiamna, Tanalian share the following code deficiencies:***
    a. ***No smoke alarm in the bedrooms.***

   b. ***ENT used on exterior of building up to main service disconnect is not listed for direct buried or exterior use.***
   c. ***Shared boiler circuits are fed from a unit panel which is not accessible to the other unit.***

Electrical Recommendations

1. ***Provide tamper resistant receptacles per NEC 518 as receptacles are replaced.***

Birch Hill

The service is a 3-position meterbase with (3) 100A breakers. The top breaker feeds Panel 'A' on the first floor. Panel 'A' sub-feeds Panel 'B' in the entry. The next service breaker feeds Panel 'C' which is recess-mounted adjacent to Panel 'A' but feeds loads on the second floor. The bottombreaker feeds Panel 'S1' located at the shop and Panel 'S1' sub-feeds Panel 'S2' in the shed adjacent to the shop.

Panel 'A' is a recess-mounted, 200A, 120/240V, 1Ø with main lugs, Challenger type SL load center. Panel 'B', fed from a 50A, 2-pole breaker, did not have any nameplate data. Based on breakers and configuration we are assuming it is a 125A, 120/240V, 1Ø Siemens type EQ load center. Panel 'B' is recess-mounted with main lugs.

Panel 'C' is a 125A, 120/240V, 1Ø with main lugs, Siemens type EQ load center.

Panel 'S1' is a recess-mounted, 100A, 120/240V, 1Ø with main lugs, Square D type QO load center. Panel 'S2' is fed from a 50A, 2-pole breaker in Panel 'S1'. Panel 'S2' is recess-mounted in an accessible wall void. Panel 'S2' is a 125A, 120/240V, 1Ø with main lugs, Crouse-Hinds type D load center.

The following are issues we noted with the distribution system:

1. Panel 'A' EGCs need to be moved to the existing ground bar.
2. Panel 'A' is no longer manufactured and recommend replacement when any upgrades are made to the electrical system.
3. Panels 'A' and 'C' are fed with #4 AWG Cu not rated for the overcurrent protection device upstream. Replace upstream breakers with 70A 2-Pole breakers or smaller.
4. Panel 'B' EGCs need to be moved to a new ground bar.
5. Panel 'C' EGCs need to be moved to the existing ground bar.
6. Generally, all conductors are not color identified by phase or are mis-labeled. Recommend only relabeling the feeders with A-phase as black, and B-phase as red.
7. Panel 'S1' EGCs need to be moved to a new ground bar. Did not see evidence of a grounding electrode to a ground rod. Recommend investigating this further and installing as required.
8. Panel 'S2' EGCs need to be moved to a new ground bar. Did not see evidence of a grounding electrode to a ground rod. Recommend investigating this further and installing as required.
9. Feeders to Panels 'S1' and 'S2' require disconnects per NEC 225.31.

2024 Update: Per NEC Table 310.12 in residential construction #4 may be protected by 100A breaker so Item #3 is not a code issue. It appears that items #7 and #8 were addressed for moving the EGC to a dedicated ground bar but did not see evidence of a new ground bar.

Code Deficiencies

1. ***Smoke alarm coverage is deficient in the main building.***
2. ***Feeders to Panels 'A' and 'B' are unprotected.***
3. ***Kitchen and laundry room receptacles are not GFCI protected.***
4. ***Exterior receptacles are not GFCI protected or have while-in-use covers.***
5. ***Shed lights and receptacles junction boxes are missing device plates.***

Electrical Recommendations

1. ***Shed and garage feeder is routed exposed in Schedule 40 PVC. As the area does not appear to be exposed to damage there isn't an issue with the installation but we would recommend replacing with Schedule 80 PVC to protect against becoming brittle in sub-zero temperatures.***
2. ***Romex cabling is exposed in garage and shed which is acceptable per NEC 334.10 however we would recommend locating it within the joists to provide additional protection.***
3. ***Provide tamper resistant receptacles per NEC 518 as receptacles are replaced.***

Homestead and Cafe

The Homestead service is a 200A 120/240V, 1Ø, 2-position meter pack with (2) 100A, 2-pole breakers. One breaker feeds Panel 'A' in the laundry room. The second breaker feeds Panel 'B' on the second floor. Panel 'A' is a recess-mounted 125A, 120/240V, 1Ø with main lugs, Square D type QO load center. Panel 'B' is a recess-mounted 125A, 120/240V, 1Ø with main lugs, Square D type QO load center.

We could not get into the metered side of the meterbase but visibly there are (2) direct-burial non-metalic cable coming out the bottom of the meterbase, which go into the building just below the meterbase. These could be tapped from the load side of the one or both service breakers. We assumed, for simplicity of installation, that they tap off the lower breaker. We tracked one set of cables to a load center in the garage, Panel 'G' and the other to a load center in the Shed, Panel 'S'.

Panel 'G' is recess-mounted in an open stud space, 100A, 120/240V, 1Ø with 100A main breaker, Square D type QO load center. Panel 'S' is recess-mounted 150A, 120/240V, 1Ø with 125A main breaker GE type PowerMark Plus load center.

The Café, next to the Homestead, has a dedicated service which consists of a combination meterbase/disconnect with (2) 100A breaker. One breaker feeds Panel 'A' inside which is installed in the kitchen inside the cabinets with shelves directly in front. Due to this we could not get close to determine further issues or information on the panel. We can see that it has a main breaker and is recess-mounted. It appears to be similar to the other 125A, 120/240V, 1Ø Siemens type load centers install in other locations. The second main disconnect feeds Panel 'B' inside the bedroom. It is a recess-mounted, with main lugs. It did not have any nameplate data but based on breakers we are assuming it is a 125A, 120/240V, 1Ø Siemens type EQ load center.

The following are issues we noted with the distribution system:

1. Homestead Panel 'A' EGC need to be moved to new ground bar.
2. Homestead Panel A feeder conductors are routed unprotected and exposed within the building. The panel also requires bushings/clamps for the occupied KOs.
3. Panel 'S' is missing the panel dead front and feeder breakers does not appropriately protect conductors. Main circuit breaker needs to be replaced with 50A breaker to appropriately protect the conductors.
4. Panel 'G' main circuit breaker need to be replaced with a 50A breaker to appropriately protect the conductors.
5. Café Panel 'A' needs to be relocated or cabinets installed in front of it need to be removed.
6. Café panels EGC need to be moved to new ground bars.

2024 Update: No update to the report.

Code Deficiencies

1. ***Café kitchen, bathroom, and laundry room receptacles are not GFCI protected.***
2. ***Café exterior receptacles are not GFCI protected and require while-in-use covers.***
3. ***Homestead garage, laundry, and bathroom are not GFCI protected.***
4. ***Homestead exterior receptacles are not GFCI protected and need while-in-use covers.***
5. ***Trails shed receptacle is missing device plate.***
6. ***Trails shed exterior junction box is missing cover.***

Electrical Recommendations

1. ***Provide tamper resistant receptacles per NEC 518 as receptacles are replaced.***

Boneyard

The Boneyard service is a combination meterbase/disconnect with (2) breakers. One breaker feeds Panel 'S' located in the sewer building. The other breaker feeds Panel 'B' in the incinerator building. Panel 'S' is a surface-mounted, 125A, 120/240V, 1Ø with main lugs, Square D type QO load center. Panel 'B' is a surface-mounted, 125A, 120/240V, 1Ø with main lugs, Square D type QO load center.

The feeder to Panel 'B' is run through a junction box on the exterior of the incinerator building, right behind Panel 'B'. Within the junction box there is a set of spare feeders which feed over to a panel in a large canvas awning. This panel is no longer in use. In the junction box is also a tap on Panel 'B' feeders which feeds Panel 'E1'. From Panel 'E1' (2) 20A, 1-pole breakers feed to an adjacent Panel 'E2'. Panel 'E1' is a surface-mounted, 125A, 120/240V, 1Ø with main lugs, Siemens type EQ load center. Panel 'E2' is a surface-mounted, 125A, 120/240V, 1Ø with main lugs, Siemens type EQ load center.

The following are issues we noted with the distribution system:

1. The incinerator and electrical buildings need a grounding electrode installed.
2. The awning panel feeders are run underground unprotected. Since the panel is no longer in use, we would recommend abandoning them in place and remove the panel and all associated wiring and devices.

2024 Update: Panel 'B' in the incinerator building is rating is correct but the nameplate is actually a Thomas & Betts type TB load center.

Code Deficiencies

1. ***ENT used to run feeders below grade to/from Panel 'B' in the incinerator.***
2. ***Branch circuits from Panel 'B' use non-metallic cable which is not listed for use exposed in areas such as this.***
3. ***Thomas & Betts panel has breakers which are not listed or use and is no longer manufactured. We would recommend replacement when any work is done on the panel.***

Electrical Recommendations

1. ***No electrical recommendations at this time.***

Wellhouse

The wellhouse service is a combination meterbase/disconnect. The disconnect is a main breaker which feeds Panel 'W' just inside the building from the service equipment. A 30A, 2-pole breaker in Panel 'W' feeds Panel 'S' that is located in the shop. Panel 'W' is a surface-mounted 125A, 120/240V, 1Ø with main lugs, Cutler-Hammer type CH load center. Panel 'S' is a surface-mounted 125A, 120/240V, 1Ø with main lugs, Siemens type EQ load center.

The following are issues we noted with the distribution system:

1. In Panel ‘W’ and ‘S’ the EGCs need to be moved to a new ground bar.
2. Panel ‘W’ is fed with #4 AWG Cu not rated for the overcurrent protection device upstream. Replace upstream breakers with 70A 2-Pole breakers or smaller.

2024 Update: No updates to the report.

Code Deficiencies

1. ***Surface-mounted conduit is not supported properly.***
2. ***New circuits installed to Panel ‘W’ with PVC are not using the Knock-Outs(KOs) provided by the panel enclosure and are therefore voiding the listing of the equipment. The enclosure may be replaced with the existing interior re-installed in a listed enclosure and circuits properly installed.***

Electrical Recommendations

1. ***Use of recessed device plates on switches and receptacles which are surface-mounted. Recommend replacement for with surface-mounted type especially plates which are broken.***

PT

The PT service is surface-mounted on a remote pedestal near the utility transformer. The service is a combination meterbase/disconnect. The main breaker feeds to Panel ‘F’ mounted in an enclosure with fueling controls. Panel ‘F’ is surface-mounted, 125, 120/240V, 1Ø with 50A main circuit breaker, Siemens type EQ load center. There is no other distribution equipment in this location.

The following are issues we noted with the distribution system:

1. Panel ‘F’ EGC need to be moved to a new ground bar.
2. The 20A, 1-pole breakers may be feeding 2-pole motor loads. We did not pull submersible fuel pumps to verify. If they are 2-pole motors then the existing breakers need a handle tie or need to be replaced with appropriate 2-pole breakers.

2024 Update: Panel ‘F’ feeds to a 100A, 120/240V, Cutler-hammer load center, Panel ‘T’, in a tent with #10 non-metallic UF-B type cable. The UF-B cable is listed for direct bury, and exterior. However, it is routed above ground and protected in PVC over trail crossings. This tent panel feeds a single 20A, 1P breaker and is not required to feed this tent. This entire breaker could be demolished and spliced to the feed eliminating equipment which needs maintenance. Item #1 and #2 of our report appear to have been addressed.

Code Deficiencies

1. ***Dispensing area has no conduit support.***
2. ***Dispensing area receptacle in hazardous location and fed with LCMF.***
3. ***Fuel farm IMC is unsupported.***
4. ***Receptacle at Panel ‘F’ needs while-in-use cover.***
5. ***Deadfront for Panel ‘F’ is missing fasteners.***
6. ***Heat trace junction box left with wires exposed.***

Electrical Recommendations

1. ***Recommend burying feeder to Panel ‘T’ and splicing tent circuit directly to feed. Reconnect branch circuit if intending to use.***

2. ***Panel 'F' feeders and circuits are routed exposed in Schedule 40 PVC. As the area does not appear to be exposed to damage there isn't an issue with the installation but we would recommend replacing with Schedule 80 PVC to protect against becoming brittle in sub-zero temperatures.***

ATTACHMENTS
NPS Arc Flash Deficiency Log LACL.xlsx
M1180 ONE-LINES LACL.pdf

Image #1 – *Hangar MTS*

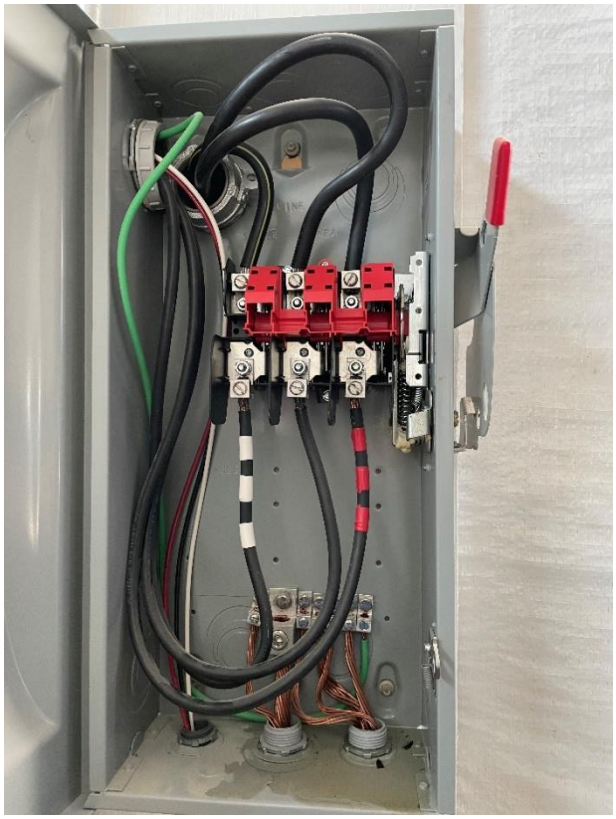

Image #2 - *Hangar Service Disconnect*

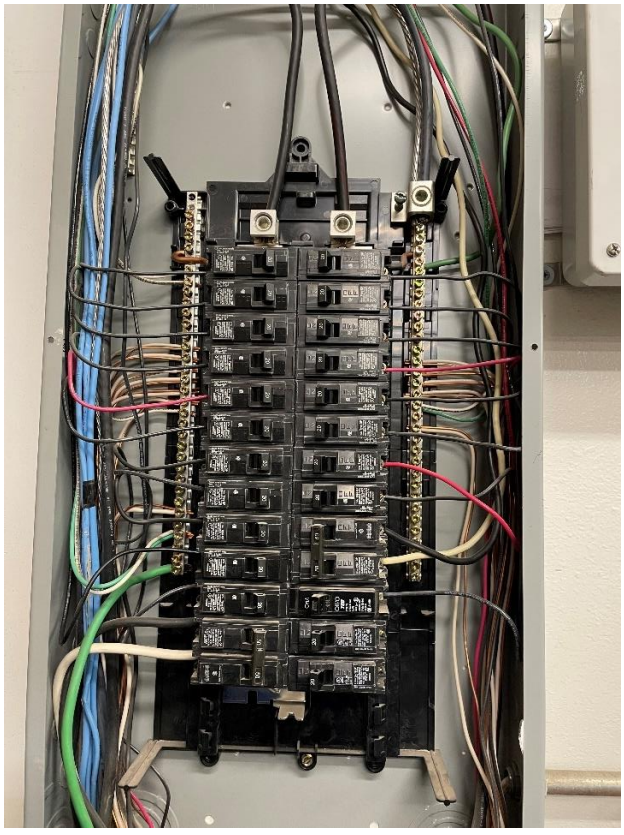

Image #3 – *Maintenance Shop Panel 'A'*

Image #4 – *Maintenance Shop Panel 'C'*

Image #5 – Tank Farm Backboard

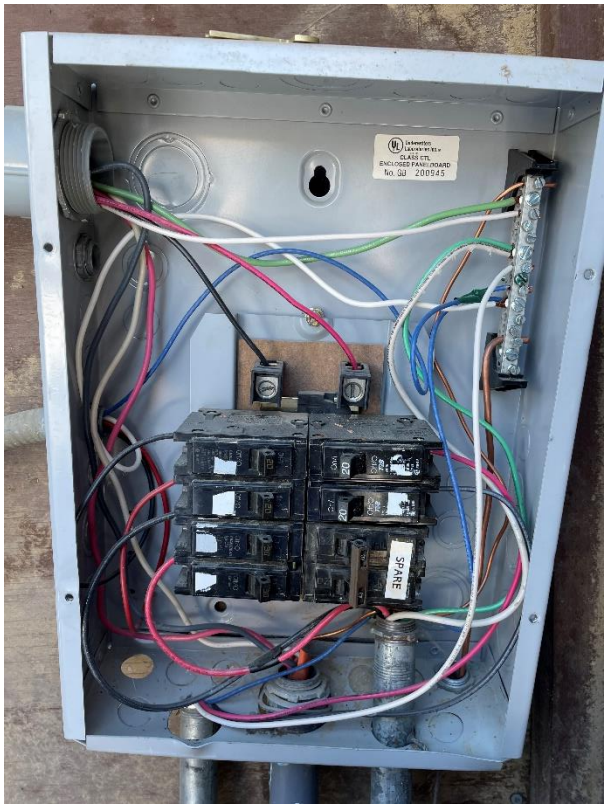

Image #6 – Tank Farm Panel 'F'

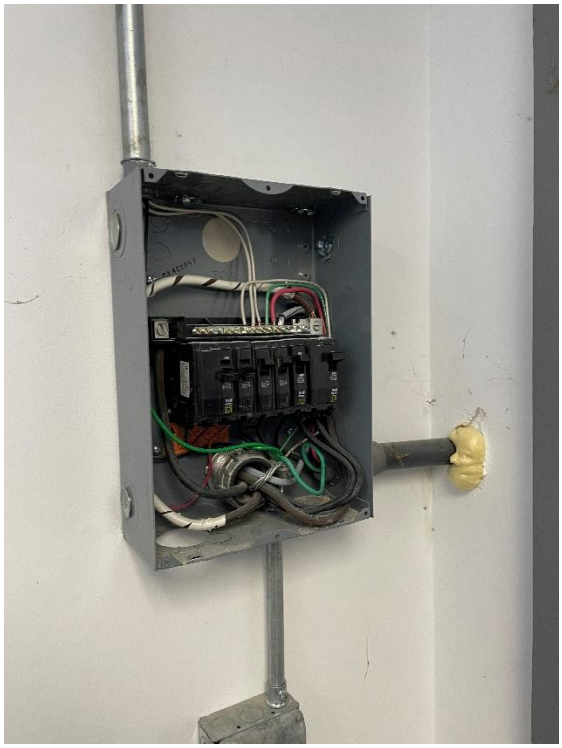

Image #7 – Battery Shed Panel 'BA'

Image #8 – Visitor Center Service Disconnects

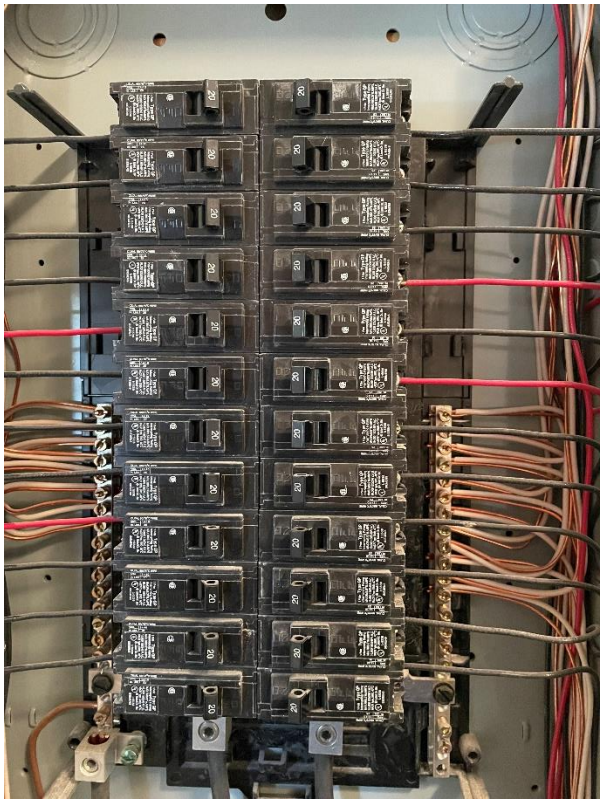

Image #9 – Visitor Center Panel 'B'

Image #10 – Weight Room Panel 'W'

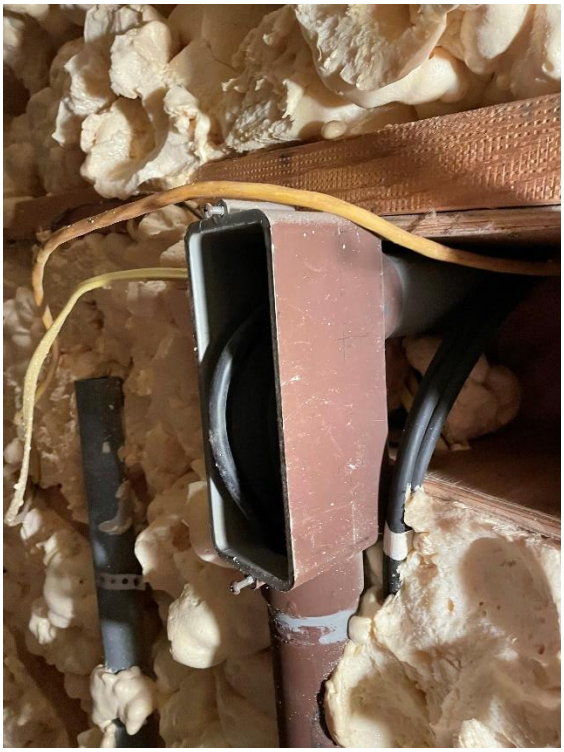

Image #11 – Headquarters Panel 'B' and Uniform Cache Feeders

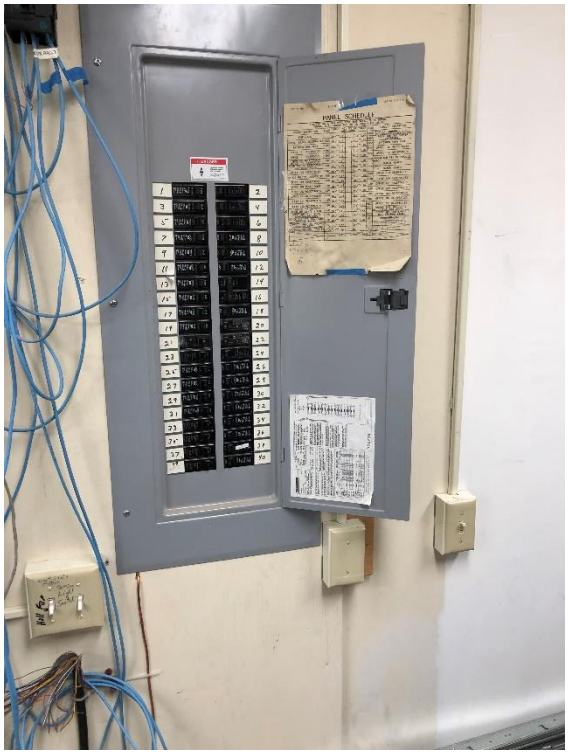

Image #12 – Headquarters Panel 'A'

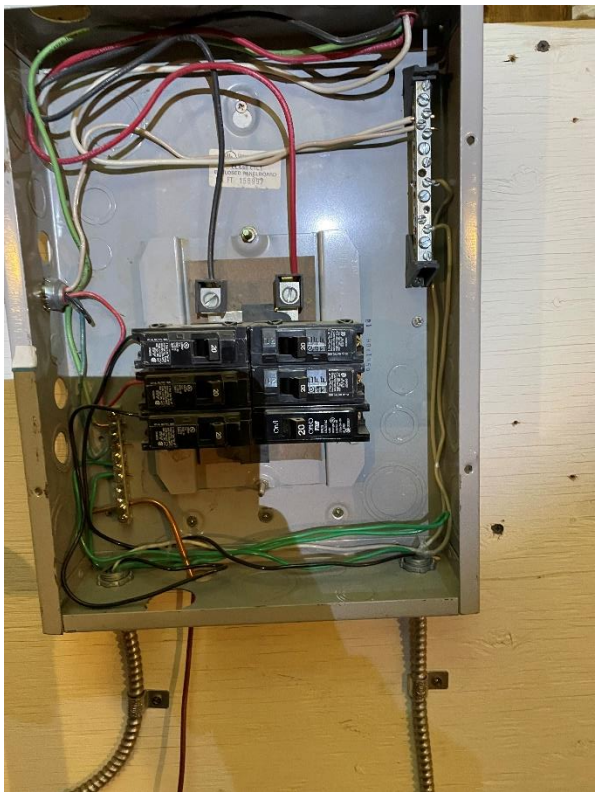

Image #13 – Headquarters Panel 'C'

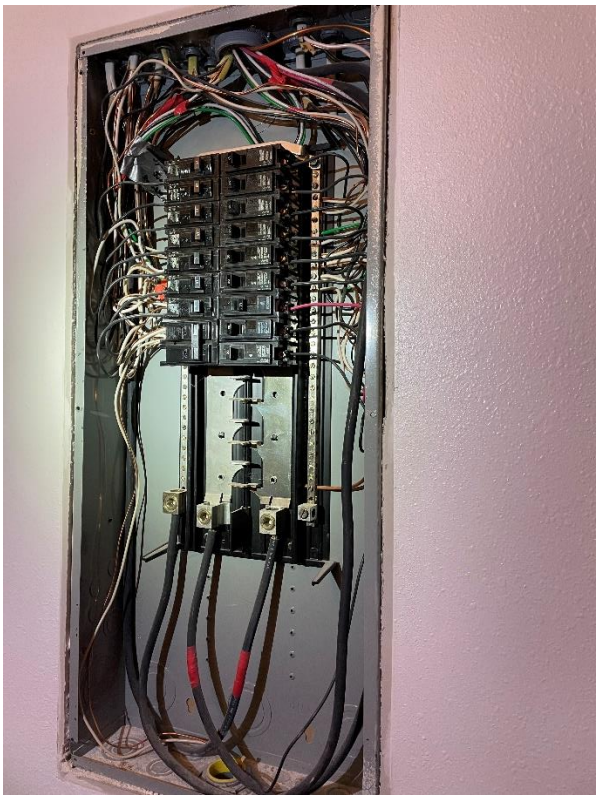

Image #14 – PA-7 Panel 'A'

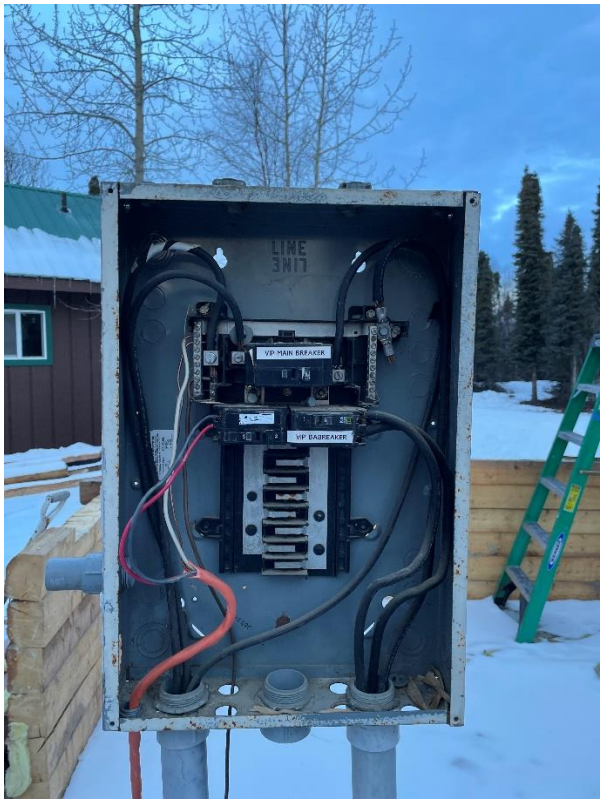

Image #15 – Sauna Panel 'S'

Image #16 – Mini Extension Cord

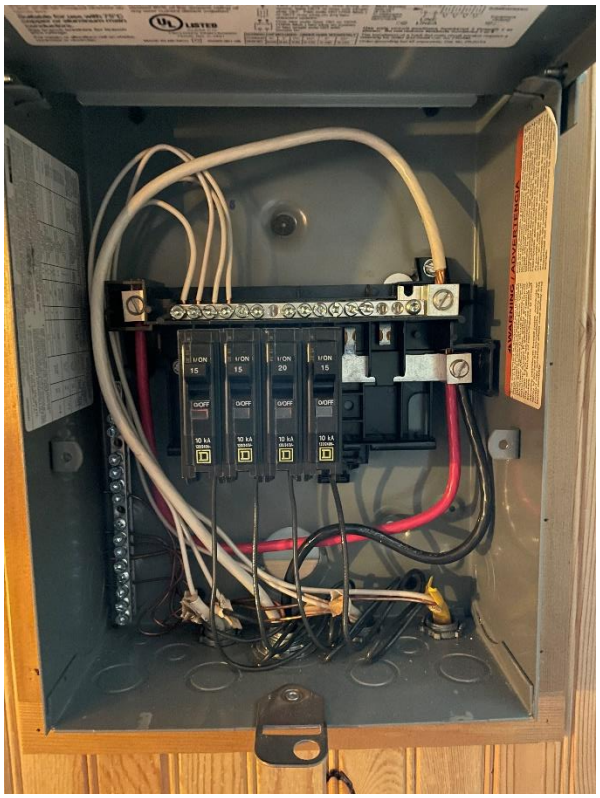

Image #17 – Mini Panel 'M'

Image #18 – VIP Panel 'V'

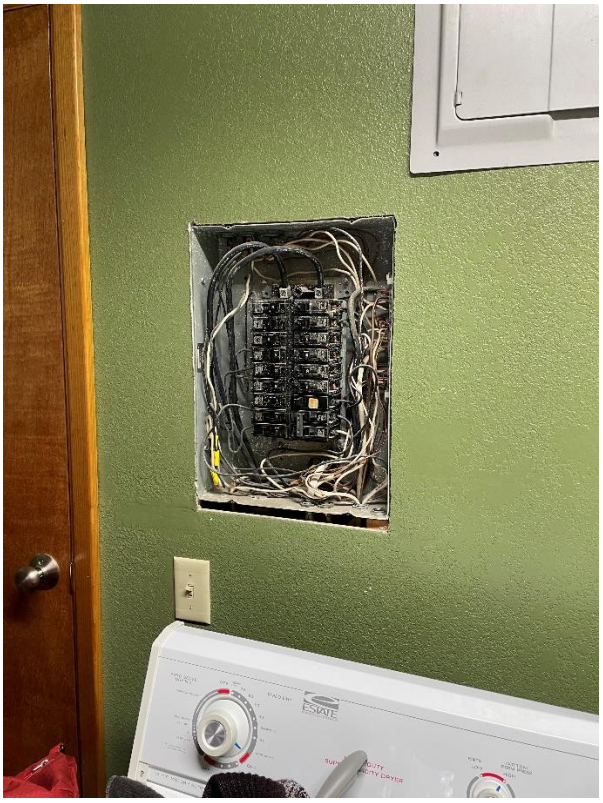

Image #19 – PA-2 Panel 'A'

Image #20 – PA-4 Service Entrance

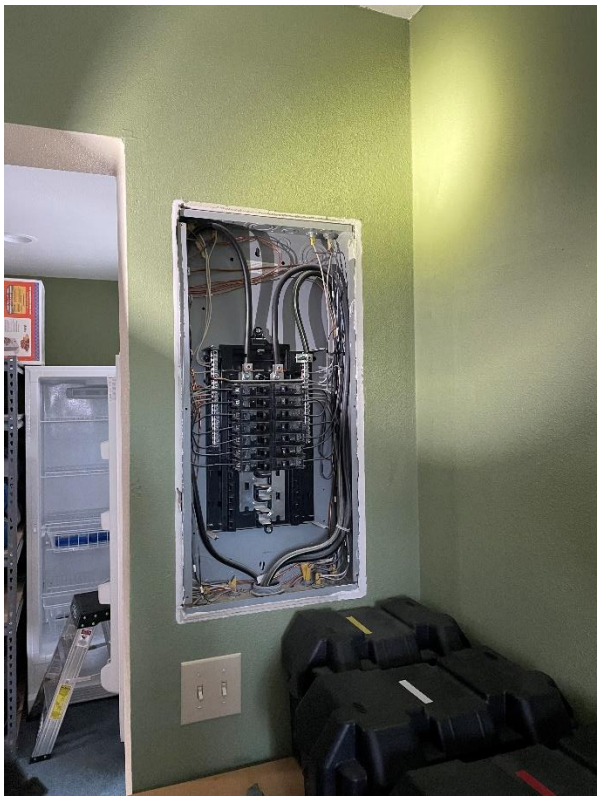

Image #21 – PA-4 Panel 'B'

Image #22 – Redoubt Panel 'A'

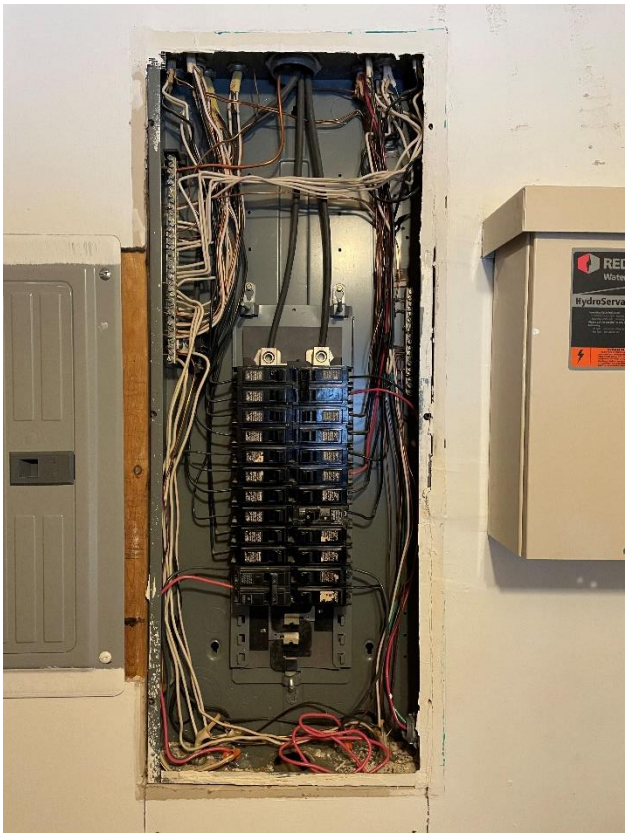

Image #23 – Birch Hill Panel 'A'

Image #24 – Birch Hill Shop Feeder LBs

Image #25– Homestead Panel 'A'

Image #26 – Homestead Panel 'S'

Image #27 – Cafe Panel 'A'

Image #28 – Incinerator Building Junction Box

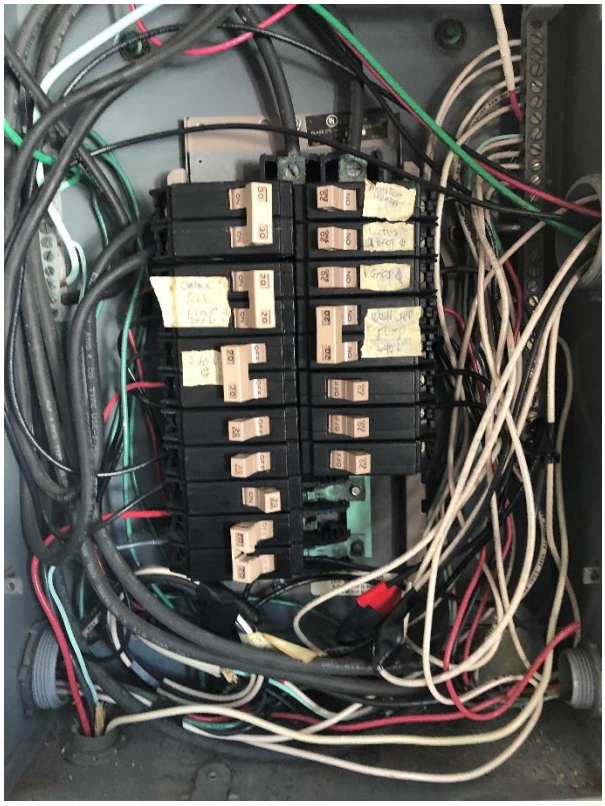

Image #29– Wellhouse Panel 'W'

Image #30 – PT Panel 'F'

If you have any questions concerning the above, please do not hesitate to call me.

Sincerely,

Patrick Collins

Patrick Collins, P.E.
Electrical Project Engineer

pcc/hhm
24-0349/M3144