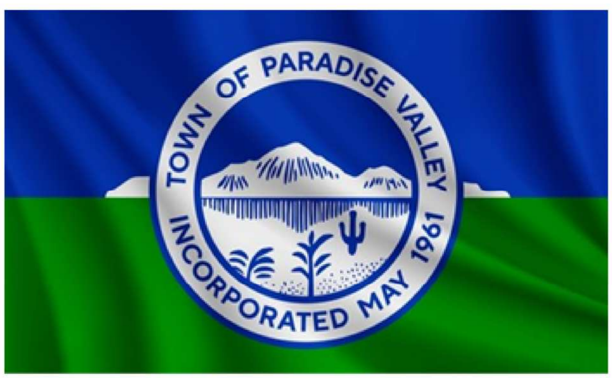
# Town of Paradise Valley

Paradise Valley

Arizona

# ELECTRICAL ASSESSMENT REPORT

Prepared For:




Prepared By:

120 DEGREEZ ENGINEERING

Registered Professional Engineer (Electrical)
CERTIFICATE NO.
60515
AMIR AMIRI RAZAVIAN
Date Signed 6-18-2025
ARIZONA, U.S.A.
Expires 9/30/2027

**June 12, 2025**

**REVISED: June 18, 2025**

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## EXECUTIVE SUMMARY

120 Degreez Engineering has been engaged to provide an assessment and Arc-Flash study for several of the Town of Paradise Valley's municipal building's electrical distribution systems.

This report addresses deficiencies and observations identified during the data collection phase for the ongoing Arc-Flash hazard analysis. As of the issuance date of this report, the Arc-Flash evaluations are still ongoing and will be submitted under separate cover upon completion.

The primary objective of this report is to identify potential deficiencies within the electrical distribution systems that could adversely affect facility operations, highlight associated safety hazards, and recommend appropriate corrective actions to mitigate identified risks.

In identifying system issues, this report presents a high-level overview of observed deficiencies and outlines potential operational and safety consequences should corrective measures not be implemented. To support mitigation planning, recommended actions have been categorized into three levels as follows:

- **Low**: Corrective action is recommended. While the issue poses a relatively minor risk, addressing it will enhance system reliability and safety.
- **High**: Corrective action is required. These issues present a significant risk to personnel safety or property and must be addressed in a timely manner.
- **Critical**: Immediate corrective action is mandatory. Items in this category represent an imminent hazard to life or property and demand urgent remediation.

This report focuses primarily on the major components of the electrical distribution systems. Evaluation of electrical installations beyond these components was not included within the scope of this assessment. However, this exclusion should not be interpreted as implying that such areas are without concern or do not warrant further review. Based on the deficiencies identified within the assessed systems, it is reasonable to anticipate that similar issues may exist elsewhere within the broader electrical infrastructure.

Electrical single line diagrams for each building included in this assessment will be provided alongside the Arc-Flash reports. While every effort has been made to ensure the accuracy of these diagrams, it is important to note that due to inconsistent equipment identification and labeling, absolute accuracy cannot be guaranteed. As such, these diagrams should be used for reference purposes only and not as definitive representations of the electrical systems.

## ASSESSMENT METHODOLOGY

This report is based on visual and non-invasive observations conducted during the assessment. In certain instances, it was determined that opening specific electrical equipment posed an unacceptable risk to personnel safety or carried the potential for unintended de-energization of critical systems. In such cases, the equipment were not accessed. These limitations should be considered when interpreting the findings and recommendations presented in this report.

The National Electrical Code (NEC) serves as the primary standard for evaluating the safety and compliance of electrical equipment and systems referenced in this report. The NEC is a nationally recognized consensus standard developed by industry experts and maintained by the National Fire Protection Association (NFPA). It is widely adopted by jurisdictions across the United States and often incorporated into local laws and regulations. As such, it provides the authoritative basis for determining whether an electrical installation meets the minimum requirements for safety.

Failure to comply with the National Electrical Code (NEC) and other nationally recognized standards is considered unsafe by the Uniform Building Code (UBC), Uniform Fire Code (UFC), and the NEC itself. However, the degree of hazard associated with non-compliance can vary significantly depending on the specific condition and the nature of the risk involved.

It is important to note that not all code violations constitute an immediate life safety hazard. Some deviations may pose minimal risk under normal conditions. That said, non-compliant conditions—especially those not initially deemed hazardous—can deteriorate over time, sometimes rapidly, and evolve into imminent safety threats. Therefore, even seemingly minor violations should be addressed proactively to prevent escalation into more dangerous situations.

**PROJECT DESCRIPTION**

The following facilities were included in this assessment:

- **EMT Ambulance Building** – Constructed in 1966
- **Town Hall** – Constructed in 1973
- **Public Works (3 buildings)** – Constructed in 1996
- **Police Department (2 buildings)** – Constructed in 1996
- **Fire Station #91** – Constructed in 2009
- **Fire Station #92** – Constructed in 2011
- **Municipal Court** – Constructed in 2014
- **Communications Building** – Constructed in 2017

All buildings listed above are located within the Town of Paradise Valley's Municipal Complex, with the exception of **Fire Station #91** and the **Communications Building**, which are situated off-site.

## POLICE DEPARTMENT

### 1.0 Electrical Service Condition and Maintenance Requirements
**Priority: CRITICAL**

The electrical service is currently in fair condition; however, it has not undergone the preventive maintenance recommended by the equipment manufacturer. Regular maintenance is essential for the reliable and safe operation of electrical systems. Accumulation of dust, dirt, and debris can impair the mechanical function of overcurrent protection devices and switches. Without proper maintenance, these devices may fail to operate correctly during a fault condition, potentially resulting in fire or shock hazards.
Additionally, dirt buildup can cause overheating of overcurrent devices, leading to nuisance tripping and a reduction in equipment lifespan.

According to **NFPA 70B – Standard for Electrical Equipment Maintenance**, electrical equipment must be maintained in accordance with the manufacturer's recommendations (Section 4.1.1). As a general guideline, equipment should be cleaned and overcurrent devices exercised **annually**, unless otherwise specified by the manufacturer.

Furthermore, **NFPA 70B Table 9.2.2** stipulates that equipment classified under Condition 3 must be maintained every 12 months. Per Section 9.2.2, Condition 3 applies when any of the following criteria are met:

1. The equipment has missed the last two successive maintenance cycles as outlined in the Electrical Maintenance Program (EMP).
2. The previous two maintenance cycles revealed issues requiring repair or replacement of major components.
3. There is an active or unresolved alert from a continuous monitoring system.
4. Predictive maintenance techniques have identified urgent corrective actions.

Failure to adhere to these standards may compromise system reliability and safety.

**2.0 Improper Installation of Electrical Demand Meter**
**Priority: HIGH**

An E-Mon D-Mon electrical demand meter has been improperly installed on the deadfront enclosure of the service equipment. Specifically, the device has been mounted on a panel that is required to remain accessible for maintenance and operation. This installation violates NEC Section 110.3(B), which mandates that electrical equipment must be installed and used in accordance with its listing and labeling instructions .

Improperly mounting equipment on access panels can:

- **Obstruct required access** to internal components,
- **Create safety hazards** for personnel during maintenance or emergency operations,
- **Compromise the integrity** of the enclosure and its intended function.

To ensure compliance with NEC requirements and maintain safe working conditions, the demand meter should be removed and relocated to a suitable location that does not interfere with required access or violate manufacturer installation guidelines.

**3.0 Improper Parallel Feeder Installation – Town Hall Distribution Board "HA"**
**Priority: CRITICAL**

The Town Hall building's distribution board "HA" is fed from the Police Department's electrical service via a 400-ampere switch and parallel feeder conductors. The feeder consists of two sets of three #4/0 copper ungrounded conductors (phase conductors) wired in parallel.
Per NEC Section 310.10(H)(2), parallel conductors are permitted only when the following conditions are met:

1. All conductors are of the same length.
2. All conductors are made of the same material.
3. All conductors are of the same size (circular mil area).
4. All conductors have the same insulation type.
5. All conductors are terminated in the same manner

Additionally, NEC Section 310.10(H)(3) requires that when parallel conductors are installed in separate raceways, each raceway must contain the same number of conductors and have the same electrical characteristics to ensure balanced current sharing and prevent overheating

In this installation, the electrical contractor failed to install a grounded (neutral) conductor in each raceway, violating:

- NEC 300.3(B) – which requires all circuit conductors, including the grounded conductor, to be grouped together to reduce inductive heating and ensure proper fault current paths.
- NEC 300.20 – which addresses the need to minimize inductive effects by grouping conductors of the same circuit together

This improper configuration introduces significant impedance in the fault current path, which can prevent overcurrent protective devices from operating correctly, posing a serious fire and life safety hazard.
Required Corrective Action

- Remove all existing conductors from both raceways.
- Install new, code-compliant parallel conductors, ensuring each raceway contains a complete set of phase and neutral conductors.

- Clean and inspect both raceways by pulling a mandrel through each to ensure they are free of debris and damage.
- Verify compliance with all applicable NEC requirements before re-energizing the system.

**4.0 Improper Bonding of Grounding Electrode Conductor Raceway**
**Priority: CRITICAL**

The grounding electrode conductor (GEC) for the Police Department's electrical service is installed in a metallic (ferrous) raceway but is not bonded at both ends, as required by NEC Section 250.64(E). This section mandates that ferrous metal raceways and enclosures containing a GEC must be electrically continuous and bonded at each end to the grounding electrode or the conductor itself to establish an electrically parallel path.

**Hazards of Improper Bonding**

Failure to bond the raceway at both ends can result in:

- Conductor fusing (melting) during high-current events such as lightning strikes or fault-induced overvoltages.
- Arcing hazards, which can lead to fire or equipment damage.
- Voltage fluctuations (dips and surges) that may damage sensitive electrical equipment.
- Shock and electrocution risks due to potential differences between grounded metal objects and electrical enclosures.
  Code-Compliant Installation
  While the NEC permits the use of metallic raceways for GECs, this is only allowed if both ends are properly bonded. In this case:
- The raceway is routed underground, making it impractical to bond the below-grade end.
- The termination fitting at the service enclosure does not support bonding provisions.

**Recommended Corrective Action**

To ensure compliance and safety:

- Remove the existing GEC from the metallic raceway.

- Reinstall the GEC in a non-magnetic, non-metallic raceway such as PVC, which does not require bonding at either end.
- This approach maintains physical protection for the conductor while eliminating the risks associated with improper bonding.

## 5.0 Lightning Protection System – Bonding Deficiency
**Priority: HIGH**

The Police Department appears to have a lightning protection system installed. These systems are highly specialized and must meet stringent design and installation standards to effectively protect both the building structure and the electrical distribution system.

A single lightning strike can carry hundreds of millions of volts and tens of thousands of amps, far exceeding the capacity of standard electrical systems. Without proper integration, this energy can cause catastrophic damage.

Upon review, there is no visible evidence that the lightning protection system is bonded to the building's electrical distribution system or grounding electrode system, as required by the National Electrical Code (NEC):

- NEC 250.60 prohibits using the lightning protection grounding electrode as the sole grounding means for electrical systems.
- NEC 250.58 requires that all grounding electrodes present at a building be interconnected to form a common grounding electrode system.
- NEC 250.104 mandates bonding of metal piping systems and structural steel to the grounding electrode system to ensure equipotential bonding.

### Risks of Improper Bonding

Failure to bond the lightning protection system to the electrical and grounding systems can result in:

- Arcing between lightning conductors and nearby electrical or metallic components.
- Equipment damage due to voltage surges and potential differences.
- Fire and shock hazards during a lightning event.

### Recommended Action

A qualified lightning protection system specialist should be retained to:

- Evaluate the current installation for compliance with UL 96A and NFPA 780 standards.
- Verify bonding between the lightning protection system, electrical distribution system, and grounding electrode system.
- Recommend corrective actions where deficiencies are found.
  Proper bonding ensures that lightning energy is safely and effectively directed to ground, protecting both personnel and infrastructure.

### 6.0 Leaking Utility Transformer – Immediate Action Required
**Priority: HIGH**

The utility transformer serving the facility is exhibiting signs of oil leakage. This condition requires immediate attention from the serving utility, Arizona Public Service (APS).

Transformer oil serves two critical functions:

1. Electrical insulation – preventing internal arcing and short circuits.
2. Thermal regulation – dissipating heat generated during operation.

A continued loss of insulating oil can lead to:

- Overheating, potentially resulting in catastrophic failure, including fire or explosion.
- Environmental contamination, as oil seeps into the surrounding soil, potentially triggering costly remediation efforts.

It is important to note that leaks do not self-correct and will worsen over time. Therefore, APS should be contacted immediately to assess the condition of the transformer and determine whether repair or replacement is necessary.

**7.0 Standby Generator Lighting – Battery Backup Verification**
**Priority: LOW**

It is recommended to verify that the lighting provided for the standby generator area includes a minimum 1½-hour battery backup. This is a lower priority item, but ensuring adequate emergency lighting is important for safe access and operation of the generator during power outages or low-light conditions.

**8.0 Improper Neutral Conductor Installation at Generator ATS**
**Priority: CRITICAL**

A 100A, 4-pole Automatic Transfer Switch (ATS) located on the exterior wall of the generator enclosure is missing a neutral (grounded) conductor between the generator and the service entrance section, which serves as a junction point feeding the Public Works Building.

**System Configuration and Code Requirements**

The generator includes a System Bonding Jumper (SBJ)—formerly known as the Main Bonding Jumper—connecting the generator’s neutral to the equipment grounding and grounding electrode systems. This configuration classifies the generator as a Separately Derived System due to the use of a 4-pole ATS, which transfers all three phases and the neutral conductor between normal and standby power sources.

Per NEC 250.30(A), a separately derived system must include a properly installed SBJ at the source (generator) to ensure a low-impedance path for ground-fault current, enabling overcurrent protective devices to operate correctly. The absence of a neutral conductor from the generator to the ATS and onward to the system violates this requirement.

**Observed Violations**

- NEC 250.4(B): Requires electrical systems to be grounded in a manner that ensures the operation of overcurrent protection devices during ground faults.
- NEC 250.30(A): Mandates a complete and properly bonded grounding system for separately derived systems.

- NEC 300.3(B): Requires all conductors of the same circuit—including grounded and grounding conductors—to be routed together in the same raceway or cable assembly.
- NEC 300.20: Addresses the need to minimize inductive heating and impedance by maintaining proximity of all circuit conductors.

**Hazards**

- Fire and electrocution risk due to the inability of overcurrent devices to clear ground faults.
- Overheating and insulation degradation from separated conductors.
- Unpredictable voltage behavior and potential equipment damage.

**Additional Concern**

A neutral conductor is present from the service and enters the feeder conduit to the Engineering Building, but it was not found in the building's disconnecting means. Its termination point is currently unknown, adding further uncertainty and risk.

**Recommended Corrective Action**

- Install a properly sized neutral conductor from the generator through the ATS to the feeder serving the Public Works Building.
- Ensure the neutral is not connected to the service neutral bus, as this violates SDS isolation requirements.
- Route all conductors of the circuit together in the same raceway to comply with NEC 300.3(B) and 300.20.
- Engage a qualified electrical engineer to perform a comprehensive review of the standby power system and develop a corrective action plan.

## POLICE DEPARTMENT – MAIN ELECTRICAL ROOM

### 9.0 Available Fault Current (AFC) and Equipment Suitability
**Priority: CRITICAL**

Available Fault Current (AFC) refers to the maximum current that can be delivered to a fault at a specific point in the electrical distribution system. The magnitude of this current is influenced by the impedance of the system at the fault location—the lower the impedance, the higher the fault current. As a result, faults occurring closer to the service entrance typically experience significantly higher fault currents.

The National Electrical Code mandates that all equipment and overcurrent devices be suitable for the Available Fault Current under sections 110.9 (for overcurrent devices) and 110.10 for all other electrical equipment.

During the review of the distribution equipment in this building—and across other buildings on the campus—it was observed that multiple circuit breakers may not be adequately rated for the Available Fault Current (AFC) at their respective installation points.

Unless these breakers are part of a listed series-rated system, their interrupting capacity may be insufficient to safely clear a fault. This condition poses a significant safety risk, as breakers that are not properly rated for the AFC may fail to interrupt fault current, potentially resulting in equipment damage, fire, or personal injury.

Where overcurrent devices are installed and not suitable for the Available Fault Current they represent a very serious fire and life safety hazard. A ruptured device may not safely open on a fault condition, it can expel molten material and shrapnel. The failure of a device can cause an arc flash and arc blast, both of which can be life threatening.

A brief video of a moderate arc flash and blast can be viewed at the internet web address below. Please note that the authors of this video do not identify the voltage or the Available Fault Current so the total energy release is unknown.

https://youtu.be/6hpE5LYj-CY

A review of the electrical distribution systems revealed that many 480/277-volt panels, and some 208/120-volt panels, are equipped with circuit breakers that do not have an Ampere Interrupting Capacity (AIC) rating sufficient for the Available Fault Current (AFC) at their respective locations.

Using circuit breakers with an AIC rating below the calculated AFC is a serious safety hazard. In the event of a fault, these breakers may fail to interrupt the current, potentially resulting in:

- Catastrophic equipment failure
- Arc flash incidents
- Fire or explosion

- Severe injury or fatality

This condition is a direct violation of NEC Section 110.9, which requires that overcurrent protective devices have an interrupting rating not less than the available fault current at the line terminals of the equipment.

It should be noted that some of these circuit breakers may be suitable if they have been tested, and listed by a Nationally Recognized Testing Laboratory (NRTL) as part of a Series Rated System. NRTLs include originations such as Underwriters Laboratories (UL).

A series rated system is a combination of fuses or circuit breakers that have been tested in a laboratory, in the enclosures they are to be installed in, and found to safely interrupt or open a faulted circuit where the upstream device (1$^{st}$ device) that is fully rated for the available fault current and the downstream device(s) which are not rated for the available fault current. This can only be verified through testing, there is no mathematical formula than can predict if overcurrent devices can successfully and safely be series rated.

Manufacturers of overcurrent protective devices publish detailed information identifying which devices have been tested and approved for use in series-rated systems. This information is typically provided in the form of labels, booklets, or technical documentation, and is required to be maintained with the equipment after installation.

Per NEC Section 110.22(C), any equipment utilizing a series-rated combination must be clearly and permanently marked to indicate that a series rating is being used. This labeling is critical to:

- Ensure safe maintenance and servicing.
- Prevent unauthorized or unsafe modifications.
- Maintain compliance with code and manufacturer specifications.

Failure to maintain proper documentation or labeling can result in misapplication of protective devices, potentially leading to equipment failure or safety hazards during fault conditions.

Series-rated system requirements were first formally introduced into the National Electrical Code (NEC) in the 1980s, although manufacturers had been identifying and publishing series rating compatibility data well before that time. Despite this, the concept remained poorly understood in many regions until the early 1990s.

Even today, many designers, contractors, and inspectors may be unfamiliar with or misunderstand the principles and hazards associated with series-rated systems. One particularly misguided but once common practice involved using a fuse to protect a downstream circuit breaker, relying on the current-limiting properties of the fuse to compensate for the breaker's lower interrupting capacity.

This practice, however, has not been legally permitted for over 40 years. The NEC requires that series-rated combinations be tested, listed, and labeled by the manufacturer, and that they be installed exactly as specified. Any deviation from the tested configuration invalidates the series rating and can result in dangerous fault conditions.

It appears, at least for older elements of this site, that the previous designers improperly used the let-through current properties of fuses to protect circuit breakers. Fuses may only be used to protect a circuit breaker if they have been tested as part of a series rated system. Failure to properly apply these requirements is a violation of the code, the listing of the equipment, voids equipment warranties, and places people and property at risk.

In all instances where the Available Fault Current (AFC) exceeds the Ampere Interrupting Capacity (AIC) rating of installed circuit breakers, a registered electrical engineer should be engaged to perform a thorough review of the electrical equipment. This review must include consultation with the equipment manufacturer to determine whether a listed series-rated system may be applied.

Extreme caution is warranted during this evaluation. Many panelboards, circuit breakers, and distribution systems may have been modified or upgraded over time to accommodate series-rated configurations. However, existing equipment may not reflect these changes, and older components may not be compatible with modern series-rated systems.

Critically, no assumptions should be made regarding the applicability of series ratings to older equipment. A series rating must be supported by manufacturer documentation that is specific to the equipment model and manufacturing date. Without this documentation, the use of a series rating is not permitted and may result in non-compliance with NEC requirements and serious safety hazards.

This should be considered a critical path corrective action and applies for almost all building’s and structures owned by the Town of Paradise Valley.

**10.0 Missing Short Circuit Current Rating Label – Automatic Transfer Switch**
**Priority: HIGH**

The Automatic Transfer Switch (ATS) for this building is designed to transfer power between the normal utility supply and the standby generator system during a power outage. However, the ATS is missing a label identifying its Short Circuit Current Rating (SCCR)—a critical specification required for safety and code compliance.

While the equipment appears to be suitable for the available fault current based on past experience, this could not be verified during the site visit. The SCCR must be confirmed through manufacturer documentation or engineering analysis.

**Importance of SCCR**

The Short Circuit Current Rating (also known as the withstand rating) defines the maximum fault current the equipment can safely endure without rupturing or failing. Unlike overcurrent devices that operate during a fault, the ATS is passive during such events and must be mechanically braced to withstand the extreme thermal and magnetic forces generated by fault currents, which can exceed tens of thousands of amperes.

Failure to verify the SCCR can result in:

- Equipment rupture or explosion.
- Fire hazards.
- Severe injury or fatality.
- Non-compliance with NEC Section 110.10, which requires all equipment to have a short circuit rating equal to or greater than the available fault current at its supply point.

**Required Actions**

- Contact the manufacturer or a licensed electrical engineer to verify the SCCR of the ATS.
- Obtain and affix proper labeling or documentation to the equipment.
- Do not open or service the ATS while energized until the SCCR is verified.
- If servicing is required, de-energize and lock out all power sources to the ATS to prevent inadvertent operation.

## 11.0 Improper Installation of Recent Circuit Additions
**Priority: HIGH**

Recent electrical work involving the addition of new circuits has not been completed in a workmanlike manner. Specific deficiencies observed include:

- Improperly supported cables and raceways
- Incorrect or incomplete terminations
- Physical damage to conductors and conduit

These issues are unacceptable, particularly in a facility where operational continuity and safety are critical. The current installation violates several provisions of the National Electrical Code (NEC), including:

- NEC 110.0 & 110.3(B) – Equipment must be installed in accordance with its listing and labeling.
- NEC 110.12(A) – Requires a neat and workmanlike installation.
- NEC 250.4(A)(5) – Mandates effective grounding and bonding paths.
- NEC 300.4 – Requires protection of conductors from physical damage.
- NEC 330.30 & 358.30 – Require that Type MC cable and EMT conduit be securely fastened and supported at specified intervals.

**Best Practices and Recommendations**

- Non-flexible conduit should be used unless flexibility is required for vibration isolation or movement.
- All conduits and cables must be terminated using listed fittings appropriate for the wiring method.
- Equipment and wiring must be:
    - Properly supported
    - Correctly terminated
    - Securely connected

This ensures mechanical integrity, electrical safety, and the reliable operation of overcurrent protective devices.

**Action Required**

A qualified electrical contractor should:

- Inspect all recent installations
- Correct all code violations
- Ensure compliance with NEC requirements and manufacturer specifications

**12.0 Feeder conduits to and from the UPS**
**Priority: HIGH**

The feeder conduits to and from the Uninterruptible Power Supply (UPS) system have not been properly supported. As noted in Item #8, this is unacceptable in a facility where operational continuity is critical.

Improperly supported conduits can result in:

- Mechanical strain on conductors and terminations
- Increased risk of conductor insulation damage
- Potential failure of critical power infrastructure

**13.0 Improper Flexible Conduit Installation and Conductor Termination – Panelboard "L1E"**
**Priority: CRITICAL**

At Panelboard "L1E", a section of flexible conduit has been installed without an equipment grounding conductor, which is a violation of NEC Section 250.118. Flexible conduit types that are not listed as effective ground-fault current paths must include a separate equipment grounding conductor. Without it, the conduit may not provide a low-impedance path to ground, potentially preventing overcurrent devices from clearing a fault, which poses a serious fire and shock hazard.

Additionally, the conductors terminated on one of the circuit breakers are oversized for the breaker lugs. To force the termination, the conductors were trimmed and damaged, which is a dangerous and unacceptable practice. This can result in:

- Overheating at the termination point
- Nuisance tripping
- Increased risk of fire or equipment failure

These conditions violate the following NEC sections:

- 110.3(B) – Equipment must be installed in accordance with its listing and labeling.
- 110.10 – Equipment must withstand the available fault current without damage.
- 110.12(A) – Requires a neat and workmanlike installation.
- 110.14(A) – Conductors must be properly sized and terminated to prevent overheating and ensure reliable connections.

**Recommended Action**

- Remove and replace the improperly installed flexible conduit with a compliant wiring method that includes an equipment grounding conductor.
- Replace the damaged conductors with properly sized conductors that match the circuit breaker's terminal rating.
- Ensure all terminations are made using listed and approved methods to maintain electrical and mechanical integrity.

**14.0 Improper Grounding Conductor Termination – Panelboard "L1E"**
**Priority: CRITICAL**

At Panelboard "L1E", technicians have improperly connected equipment grounding conductors (EGCs) to the neutral bar, which is a direct violation of NEC Section 250.24(A)(5). This section prohibits the connection of grounding conductors to the grounded (neutral) conductor on the load side of the service disconnect.

**Safety and Operational Concerns**

This improper connection causes current to flow on the equipment grounding system, including:

- Metal enclosures
- Conduit systems
- Potentially grounded structural components

This condition effectively energizes these components, creating:

- Shock hazards—especially dangerous if the neutral conductor becomes loose, damaged, or disconnected.
- Interference with sensitive electronic and data systems due to stray currents on grounding paths.
- Code non-compliance and increased liability for facility operators.

**Broader Issue**

This condition was also observed at other equipment locations throughout the facility. It indicates a systemic issue with grounding practices that must be addressed immediately.

**Recommended Action**

- All improper connections between equipment grounding conductors and neutral bars should be immediately removed.
- A licensed electrical contractor should inspect all affected panels and equipment to:
    - Correct grounding terminations
    - Verify compliance with NEC grounding and bonding requirements

**15.0 Reduced Neutral Conductor Size at Automatic Transfer Switch**
**Priority: LOW**

At the automatic transfer switch (ATS), the neutral conductor from the generator has been reduced in size. Whether this installation is acceptable cannot be determined without a comprehensive review of all connected loads, particularly the presence of non-linear loads that may introduce harmonic distortion into the system.

Per NEC Section 310.15(A)(5)(4), non-linear loads—such as computers, servers, variable frequency drives (VFDs), and LED lighting—can cause triplen harmonics (multiples of the 3rd harmonic) to accumulate in the neutral conductor. This can result in:

- Overloading of the neutral conductor
- Excessive heating
- Insulation damage
- Failure of sensitive electronic equipment
- Fire hazards in extreme cases

**Important Consideration**

While the neutral conductor will only carry current when the generator is operating (i.e., during a power outage), and the risk of insulation damage is reduced, the potential for harmonic-related issues remains if the generator serves non-linear loads.

**Recommended Action**

- A qualified electrical engineer should evaluate the load profile of the system, including:
    - The types of loads served
    - The presence and magnitude of harmonic currents
    - The neutral conductor sizing relative to these conditions
- If non-linear loads are present, the neutral conductor may need to be increased in size or derated in accordance with NEC guidelines.

## POLICE DEPARTMENT – BUILDING EXTERIOR

### 16.0 Improper Installation of 15 kVA Transformer
**Priority: HIGH**

The 15 kVA transformer located on the exterior of the building appears to be improperly installed. Electrical equipment installed in wet or outdoor environments must be specifically listed and rated for such conditions to ensure safe and reliable operation.

According to the National Electrical Manufacturers Association (NEMA):

- NEMA 1 enclosures are rated for indoor use only, providing minimal protection against dust and no protection against moisture.
- NEMA 3R enclosures are required for outdoor use in wet locations, offering protection against rain, sleet, and external ice formation.

The transformer in question appears to have a NEMA 1 rating, which is not suitable for outdoor exposure. Most transformers intended for outdoor use are equipped with rain shields or weatherproof kits that upgrade the enclosure to a NEMA 3R rating.

**Recommended Action**

- The equipment manufacturer should be consulted to:
    - Confirm the current NEMA rating of the transformer.
    - Determine if a weatherproofing kit or rain shield is available to upgrade the enclosure to NEMA 3R.

- If the manufacturer cannot provide the necessary components, the transformer should be replaced with a unit listed for outdoor use.

Failure to address this issue may result in moisture ingress, leading to electrical faults, corrosion, insulation failure, and potential fire or shock hazards.

**17.0 Improper Circuit Breaker Installation – Panelboard Fed from 15 kVA Transformer**
**Priority: HIGH**

The panelboard fed from the 15 kVA transformer contains multiple circuit breakers that are not listed for use within the panelboard. This is a serious code and safety violation.

Only overcurrent protective devices (OCPDs) that are specifically identified by the panelboard manufacturer may be installed. These devices are tested and listed as part of a recognized assembly, and their use is essential to:

- Maintain the UL listing of the panelboard
- Ensure safe operation under fault conditions
- Preserve manufacturer warranties

**Hazards of Using Unlisted Breakers**
Installing circuit breakers not listed for use in the panelboard can result in:

- Improper mechanical fit or electrical contact
- Failure to trip under fault conditions
- Increased risk of arcing, overheating, or fire
- Serious injury to personnel servicing or operating the equipment

This practice voids the panelboard's listing and may also violate NEC Sections 110.3(B) and 110.14, which require that equipment be installed in accordance with its listing and labeling, and that terminations be made using approved methods.

**Recommended Action**

- A licensed electrical contractor should:
    - Identify and remove all unlisted breakers
    - Replace them with manufacturer-approved devices
    - Verify compatibility using the panelboard's documentation or by consulting the manufacturer directly

**INFORMATION TECHNOLOGY BUILDING**

## 18.0 Absence of Grounding Electrode System
**Priority: HIGH**

The building currently lacks a grounding electrode system, which is a direct violation of NEC Section 250.32. This section mandates that all buildings supplied by a feeder or branch circuit must have a grounding electrode system installed and connected to the electrical distribution system.

**Purpose and Importance**

A grounding electrode system is essential for:

- Limiting voltage differences between the electrical system and conductive building components such as structural steel and metallic water piping
- Safely dissipating overvoltages caused by lightning, utility switching, or accidental contact with higher-voltage systems
- Providing a reference point for the electrical system voltage to stabilize operation and enhance safety

This requirement is functionally similar to the grounding requirements for service equipment, ensuring that the building's electrical system is properly bonded to earth.

**Recommended Action**

- A qualified electrical contractor should:
  - Install a code-compliant grounding electrode system, that may include ground rods, building steel, or a concrete-encased electrode (Ufer ground)
  - Bond the grounding electrode system to the building's electrical distribution system in accordance with NEC 250.32 and 250.50

## 19.0 Lack of Bonding Between Electrical and Low Voltage Systems
**Priority: High**

The building's electrical distribution system does not appear to be properly bonded to the low voltage system, which is a violation of NEC Article 800, Part IV – Grounding Methods.

Specifically, NEC 800.100 requires that the primary protector and metallic members of communication cables be bonded to the building's grounding electrode system.

**Importance of Proper Bonding**

Bonding the low voltage system to the building's grounding electrode system is essential to:

- Limit voltage differences between systems
- Protect sensitive data and communication equipment from overvoltage conditions
- Prevent equipment damage and data corruption
- Ensure personnel safety by eliminating shock hazards from stray voltages

Failure to establish this bond can result in erratic system behavior, data errors, and equipment failures, particularly during lightning events or utility switching surges.

**Recommended Action**

- A qualified electrical engineer, preferably with expertise in low voltage and data systems, should:
  - Review the current installation
  - Verify compliance with NEC Article 800.100
  - Recommend corrective actions, including proper bonding to the grounding electrode system and exposed metallic components

**20.0 Transformer Bonding to Grounding Electrode System – Verification Required**
**Priority: High**

The transformer located on the exterior of the building should be verified for proper bonding to the building's grounding electrode system. During the site visit, no visible connection to the grounding electrode system was observed.

According to NEC Section 250.50 and 250.53(C), all grounding electrodes present at a building must be bonded together to form a single grounding electrode system. The use of ground rods alone, without bonding to the building's primary grounding electrode system (e.g., building steel, water pipe, or concrete-encased electrode), is not permitted.

**Importance of Proper Bonding**

- Ensures equipotential bonding between all conductive systems
- Reduces voltage differences that can lead to shock hazards
- Provides a low-impedance path to ground for fault and lightning currents
- Maintains compliance with NEC grounding requirements

**Recommended Action**

- A qualified electrical contractor or engineer should:
    - Verify the presence and continuity of the bonding connection between the transformer and the building's grounding electrode system
    - Install bonding conductors if missing, using listed connectors and methods

## TOWN HALL

**1.0 Code Violation: Missing Equipment Grounding Conductor**
**Priority: CRITICAL**

The existing electrical service inside the structure is currently fed from the new electrical service located on the north side of the building. However, an equipment grounding conductor (EGC) has not been installed between the two systems. This condition constitutes a violation of the National Electrical Code (NEC), specifically:

- NEC 250.24(A)(5): This section prohibits the connection of grounded conductors (neutrals) to normally non–current-carrying metal parts or equipment grounding conductors on the load side of the service disconnect. Doing so can create parallel paths for return current, which compromises the integrity of the grounding system and can delay the operation of overcurrent protection devices.
- NEC 250.110: This section requires that all non–current-carrying metal parts of electrical equipment be connected to an equipment grounding conductor to ensure a safe and effective ground-fault current path.

**Recommendation:** Install a properly sized equipment grounding conductor between the old and new electrical services to comply with NEC requirements and ensure personnel safety and system reliability.

For further context, refer to Town Hall Issue #2.0.

**2.0 Code Violation: Improper Main Bonding Jumper Installation**
**Priority: CRITICAL**

The old electrical service within the building has a Main Bonding Jumper (MBJ) installed, which connects the neutral (grounded conductor) to the equipment grounding conductors. This connection is located downstream of the main service disconnect, which is a direct violation of the National Electrical Code (NEC).

NEC Requirements:

- NEC 250.24(C) mandates that the main bonding jumper must be installed only at the service disconnecting means. This is the single point where the neutral is permitted to be bonded to the equipment grounding system and the grounding electrode system.
- Downstream of this point (i.e., in subpanels or secondary service equipment), the neutral must remain isolated from the equipment grounding conductors and the grounding electrode system.

**Safety Implications:**

Improper bonding downstream of the service disconnect creates multiple return paths for neutral current. This can result in:

- Unintended current flow on metal parts of the building or conduit systems.
- Shock hazards due to energized enclosures or exposed conductive parts.
- Fire hazards, especially if the neutral connection becomes loose or fails, causing excessive current on grounding paths.

**Recommendation:**

- Remove the main bonding jumper from the old service equipment.
- Ensure that the neutral is isolated from the equipment grounding system in all downstream panels. The only location where the neutral-to-ground bond should exist is at the main service disconnect on the north side of the building.
- Remove the existing conductors and install a complete set of conductors which include the ungrounded, grounded, and equipment grounding conductors.

**3.0 Installation Deficiency: Improper Raceway Termination at Distribution Board**
**Priority: LOW**

The feeders to the distribution board located in the electrical room nearest the post office have not been installed in accordance with standard workmanlike practices. Specifically, the raceway was either not installed properly or not terminated correctly at the enclosure. While there appears to be a sufficient electrical connection to the equipment, the current installation lacks the mechanical and grounding integrity expected in a compliant system.

**NEC and Best Practice Considerations:**

- NEC 300.12 requires that raceways be installed in a neat and workmanlike manner.
- NEC 250.96(A) and NEC 300.10 emphasize the importance of maintaining electrical continuity and proper bonding of metal raceways to ensure effective grounding.

**Recommendation:**
To enhance safety and ensure compliance:

- Install a bonding bushing on the raceway where it enters the distribution board.
- This will ensure a reliable ground path and protect the conductors from potential abrasion or damage at the raceway termination point.

This corrective action will help mitigate the risk of electrical faults and improve the overall integrity of the grounding system.

**4.0 Missing Covers on Boxes and Condulets**
**Priority: LOW**

During inspection, it was observed that boxes and condulets across multiple facilities are missing covers, leaving electrical conductors exposed. This condition is a direct violation of the National Electrical Code (NEC) and presents both safety and operational hazards.

**NEC Requirements:**

- NEC 314.28(C): Requires that all pull boxes, junction boxes, and conduit bodies be provided with covers that are compatible with the box or conduit body construction and suitable for the conditions of use.
- NEC 110.12(A): States that electrical equipment shall be installed in a neat and workmanlike manner, and that unused openings shall be closed to afford protection equivalent to the wall of the equipment.

**Safety Implications:**

- Exposed conductors increase the risk of accidental contact, which can lead to electrical shock or arc flash incidents.
- Open boxes allow for the ingress of dust, moisture, and debris, which can degrade insulation and lead to short circuits or equipment failure.

**Recommendation:**

- Immediately install appropriate covers on all open boxes and condulets.
- Ensure that all covers are securely fastened and rated for the environment in which they are installed (e.g., damp or wet locations if applicable).

**5.0 Inadequate Working Clearance at Panel “B”**
**Priority: CRITICAL**

A permanent shelf has been installed directly below Panel “B” in one of the electrical closets. This installation violates the National Electrical Code (NEC) Section 110.26, which mandates minimum working space requirements around electrical equipment to ensure safe operation and maintenance.

**NEC 110.26 Requirements:**

- A minimum clear working space of:
  - 30 inches wide
  - 36 inches deep
  - 6.5 feet high (or the height of the equipment, whichever is greater)
- This space must be free of obstructions, including permanent fixtures like shelves, and must not be used for storage, especially of combustible materials.

**Safety Implications:**

- Obstructed access can delay emergency response or prevent safe de-energization of circuits.
- Stored materials, particularly combustibles, increase the risk of fire and electrical hazards.
- Technicians may be unable to safely service or troubleshoot equipment, increasing the risk of injury.

**Additional Observations:**

- Similar violations involving storage within required working clearances have been observed in multiple locations and buildings.
- While the NEC does not prohibit storage in electrical rooms, the practice should be strongly discouraged.

**Recommendation:**

- Remove the shelf and any stored materials from the working clearance area around Panel “B”.
- Conduct a facility-wide review to ensure all electrical equipment maintains the required clearances.
- Consider implementing signage or barriers to prevent future encroachment into these critical safety zones.

**6.0 Improper Termination and Grounding of MC Cable**
**Priority: HIGH**

In the computer room, a Metal Clad (MC) Cable has been improperly terminated and is not securely fastened to the panel from which it originates. Additionally, the cable has been improperly sleeved in Electrical Metallic Tubing (EMT) without proper grounding. This installation violates the National Electrical Code (NEC) and poses a significant safety risk.

**NEC Violations:**

- NEC 250.132: Requires that equipment grounding conductors be installed with the circuit conductors to ensure a continuous and effective ground-fault current path.
- NEC 250.134: Specifies that non–current-carrying metal parts of equipment (such as MC cable armor and EMT) must be connected to an equipment grounding conductor to ensure proper bonding and grounding.

**Safety Implications:**

- Improper termination can lead to mechanical strain on conductors, increasing the risk of insulation damage and arcing.
- Lack of grounding creates a shock hazard and may prevent overcurrent protection devices from operating correctly during a fault.
- Improper sleeving in EMT without bonding both ends can result in the conduit becoming energized, posing a severe electrical and fire hazard.

**Recommendation:**

- Immediately correct the termination of the MC cable using an approved MC connector.
- Properly bond the EMT sleeve using listed fittings and ensure it is grounded in accordance with NEC requirements.
- Verify that an equipment grounding conductor is present and continuous from the panel to the load.

## 7.0 Restricted Access Due to Soil Erosion at The Electrical Service and Distribution Board "HA"

**Priority: HIGH**

At the building's electrical service and distribution board "HA", soil erosion from a nearby grade change has raised the ground level directly in front of the equipment. As a result, the equipment doors can no longer open fully, which violates NEC requirements and creates a significant safety hazard.

**NEC Requirements:**

- NEC 110.26(A)(2) requires that doors or hinged panels on electrical equipment be able to open a minimum of 90 degrees to provide the required working space for safe operation and maintenance.

**Safety Implications:**

- Restricted door movement limits technician access, increasing the risk of accidental contact with live components.
- In an emergency, delayed access to disconnects or breakers can compromise safety and response time.

- Soil contact with equipment enclosures may also lead to corrosion or moisture intrusion, further degrading system integrity.

**Recommendation:**

- Immediately remove the excess soil in front of the panel to restore the required clearance and allow the doors to open fully.
- Install a permanent barrier or retaining structure to prevent future soil encroachment and maintain compliance with NEC clearance requirements.

**8.0 Parallel Feeders to Distribution Board "HA"**
**Priority: CRITICAL**

Distribution Board "HA" fed from the PD building has only on neutral in one raceway for the parallel feeders. Please reference Police Department issue #3 for further information.

**9.0 Equipment Grounding Conductors Terminated on Neutral Bar - Distribution Board "HA"**
**Priority: *Critical***

Equipment grounding conductors been improperly terminated on the neutral bar. This is a violation of the National Electrical Code unless it occurs at the main service panel, where such bonding is specifically allowed. Please reference Issue #14 under the Police Department section.

**10.0 Improper Installation of Flexible Cables**
**Priority: LOW**

In the referenced area (see Police Department Issue #11), flexible cables have been installed in a manner that does not comply with the National Electrical Code (NEC). These cables are not properly secured or terminated, which can lead to mechanical strain, grounding issues, and safety hazards.

## 11.0 Inadequate Clearance for Transformer "TTH"
**Priority: LOW**

The 150 kVA transformer "TTH", located adjacent to the building's electrical service, has not been installed with the required 6-inch clearance from the wall, as mandated by the National Electrical Code.

**NEC Requirements:**

- NEC 110.3(B): Requires that equipment be installed and used in accordance with its listing and labeling, which typically includes manufacturer-specified clearance requirements for ventilation and heat dissipation.
- NEC 450.9: States that ventilation shall be provided to prevent the transformer from operating at a temperature higher than its rating. This includes maintaining minimum clearances from walls or other obstructions to allow for proper airflow.

**Safety and Operational Implications:**

- Transformers generate significant heat during operation. Inadequate clearance can:
  - Restrict airflow, leading to overheating
  - Shorten equipment lifespan
  - Increase fire risk, especially in enclosed or poorly ventilated spaces

**Recommendation:**

- Reposition the transformer to provide at least 6 inches of clearance from the wall, or as specified by the manufacturer's installation instructions.

## 12.0 Cracked Nylon Insulation on Conductors in Distribution Board "HA"
**Priority: HIGH**

During assessment of Distribution Board "HA", it was observed that some conductors exhibit visible cracks in their nylon insulation. This condition may compromise the dielectric integrity of the insulation and poses a potential shock or arc fault hazard.

**Reference:**

- See Police Department Issue #3 for a related occurrence and further context.
  Why This Matters:
- Cracked insulation can expose the conductor, increasing the risk of:
  - Short circuits
  - Electrical arcing
  - Shock hazards
  - Fire risks, especially in high-load environments

**Recommendation:**

- Conduct insulation resistance testing (commonly referred to as a "megger test") on the affected conductors to assess the integrity of the insulation.
- If the insulation fails to meet acceptable resistance thresholds, the conductors should be replaced.

**13.0 Improper Overcurrent Protection for Feeder Conductors – Panel "B1-TH"**
**Priority: CRITICAL**

The feeder conductors supplying Panel "B1-TH" are not adequately protected in accordance with NEC 240.4, which requires protection against short circuits, ground faults, and overloads. The conductors are #2/0 AWG, which have an ampacity of 175 amperes per NEC Table 310.15(B)(16) and Section 110.14. However, the upstream overcurrent protection device is rated at 200 amperes, exceeding the allowable protection for these conductors.

It appears that 175-amp fuses, which are appropriate for these conductors, may have been mistakenly installed in the fusible switch serving Panel "A1-TH" instead. This condition should be verified promptly. If confirmed, the 175-amp fuses should be relocated to the correct fusible switch serving Panel "B1-TH" as soon as possible to ensure compliance and safety.

**Key Issues Identified:**

1. Overrated Overcurrent Protection:
   - The feeder conductors are #2/0 AWG copper, which are rated for a maximum of 175 amperes per NEC Table 310.15(B)(16) and NEC 110.14(C).
   - The upstream overcurrent protection device is rated at 200 amperes, exceeding the allowable protection for these conductors.

2. Potential Fuse Misplacement:
    - It appears that 175-amp fuses, which are appropriate for the #2/0 AWG conductors, may have been mistakenly installed in the fusible switch serving Panel "A1-TH" instead of Panel "B1-TH".
    - This misplacement compromises the protection of the feeder conductors and increases the risk of overheating and electrical failure.

**NEC and Safety Considerations:**

- NEC 240.4: Requires conductors to be protected against overcurrent in accordance with their ampacity unless otherwise permitted.
- NEC Table 310.15(B)(16): Specifies the ampacity of conductors based on insulation type and temperature rating.
- NEC 110.14(C): Requires conductor ampacity to be based on the temperature rating of equipment terminals.
- NEC 240.6(A): Lists standard ampere ratings for overcurrent protective devices.

**Recommendation:**

- Verify the placement of the 175-amp fuses to determine if they are incorrectly installed in the switch for Panel "A1-TH".
- If confirmed, relocate the 175-amp fuses to the correct fusible switch supplying Panel "B1-TH".
- Clearly label all fusible switches and associated panels to prevent future misidentification.

**14.0 Improper Overcurrent Protection for Feeder Conductors – Switchboard "LC"**
**Priority: CRITICAL**

The feeder conductors supplying Switchboard "LC" are not adequately protected in accordance with NEC 240.4, which requires protection against short circuits, ground faults, and overloads. The conductors are #350 kCMIL copper conductors which have a rated ampacity of 310 amperes per NEC Table 310.15(B)(16) and Section 110.14. However, the upstream overcurrent protection device is rated at 400 amperes, exceeding the allowable protection for these conductors.

Section 240.4(B) of the NEC allows conductors to be "protected" by the next standard size overcurrent protective device above the rating of the conductors. In this case the next standard size is 350 amperes, however it is imperative to understand that it is not permitted for the load served by conductor to exceed its rated ampacity of 310 amperes.

There is also a potential issue with the use of 350 ampere fuses as they are considered a standard size, however they are not a typical size and availability for installation and future replacement can be an issue. Additionally, it is unknown what the actual loads are supplied by this equipment nor are the types of loads known so it will not be possible, without further study, to determine if the use of 350 ampere fuses will meet all requirements of the NEC.

**Key Issues Identified:**

1. Overrated Overcurrent Protection:
    - The feeder conductors are #350 kCMIL copper, rated for 310 amperes per NEC Table 310.15(B)(16) and NEC 110.14(C).
    - The upstream overcurrent protection device is rated at 400 amperes, which exceeds the allowable protection for these conductors.
2. Misapplication of NEC 240.4(B):
    - NEC 240.4(B) permits the use of the next standard overcurrent device rating (350 amperes) above the conductor ampacity only if the load does not exceed the conductor's ampacity.
    - In this case, the actual load characteristics are unknown, making it impossible to confirm compliance with this exception.
3. Fuse Availability and Practicality:
    - While 350-amp fuses are considered a standard size under NEC 240.6(A), they are not commonly stocked, which may present challenges for installation and future maintenance.
    - The lack of load data further complicates the decision to use 350-amp fuses, as it cannot be confirmed whether they will meet all NEC requirements.

**NEC and Safety Considerations:**

- NEC 240.4: Requires conductors to be protected against overcurrent in accordance with their ampacity.
- NEC 240.4(B): Allows the next standard size overcurrent device if the conductor does not supply a continuous load exceeding its ampacity.
- NEC Table 310.15(B)(16): Specifies ampacity values for conductors based on insulation and temperature ratings.

- NEC 110.14(C): Requires conductor ampacity to align with the temperature rating of equipment terminals.
- NEC 240.6(A): Defines standard ampere ratings for overcurrent protective devices.

**Recommendation:**

- A registered electrical engineer should conduct a detailed load analysis to determine the actual current demand on the feeder conductors.
- If the load does not exceed 300 amperes, consider replacing the 400-amp overcurrent device with a 300-amp device, ensuring availability and future serviceability.
- If the load exceeds 310 amperes, upgrade the feeder conductors to match the 400-amp protection or reconfigure the system to comply with NEC 240.4.

### 15.0 Improper Installation – Switchboard "LA"
**Priority: CRITICAL**

The Town Hall building's electrical service was originally supplied directly by Arizona Public Service via a utility transformer connected to Switchboard "LA." This setup was later altered: the utility transformer was removed, and a new transformer—owned by the Town of Paradise Valley and fed from the Police Department—was installed to supply 208/120V power.

**Issue:**
The new transformer, classified as a separately derived system, has been improperly installed. A System Bonding Jumper (SBJ) was placed inside the transformer enclosure. However, the Main Bonding Jumper (MBJ) at Switchboard "LA" was not removed during the refeed process.

According to NEC Section 250.30, only one bonding jumper (either SBJ or MBJ) is allowed to connect the neutral to the grounding system. Having both creates a parallel path for return current, which violates NEC 250.24(A)(5). This can result in:

- Return current flowing over equipment grounding conductors and metallic building components.
- Energizing building frames and equipment.
- Increased risk of shock and fire hazards.

**Additional Concern:**

A similar improper neutral-to-ground connection exists at **Switchboard "LB"**, compounding the safety risks. See **Issues #1 and #2** under the Town Hall section for more details.

**Action Required:**
Immediate correction is necessary to bring the installation into compliance with NEC and eliminate hazardous conditions.

## MUNICIPAL COURT

### 1.0 Obstructed Access to Electrical Panels in Courthouse
**PRIORITY: HIGH**

In the courthouse, three electrical panels have been identified as being obstructed by furniture, which restricts access to the equipment. This condition is a violation of the National Electrical Code (NEC) and poses a safety risk to personnel.

**Reference:**

- See Town Hall Item #5 for a similar issue and additional context.

### 2.0 Engineering Review Required: AIC and Series Ratings of Circuit Breakers
**PRIORITY: HIGH**

In the building's electrical system, concerns have been raised regarding the AIC (Ampere Interrupting Capacity) and series ratings of the installed circuit breakers. These ratings are critical for ensuring that the breakers can safely interrupt fault currents without failure.

**Reference:**

- See Police Department Issue #9 for related context.

### 3.0 Storage of Combustible Materials in Electrical Equipment Working Clearance
**PRIORITY: HIGH**

It has been observed that combustible materials are being stored within the required working clearance of electrical equipment in this facility. This practice is a violation of the National Electrical Code (NEC) and presents a serious fire and safety hazard.

## FIRE STATION #92

### 1.0 Improper Mounting and Damaged Enclosure for Generator Circuit Breaker
**Priority: CRITICAL**

The generator's circuit breaker has been found to be loosely mounted to the deadfront (cover) of the enclosure, rather than to a structural frame, which is the standard and safe practice for most electrical equipment.

**Key Issues Identified:**

1. Improper Mounting:
    - The circuit breaker is attached to the removable deadfront, meaning it must be disconnected or removed to service the equipment.
    - The breaker is loosely mounted presenting a serious hazard to technicians serving the equipment.
2. Damaged Deadfront:
    - The deadfront is physically damaged, and the breaker is loosely attached, increasing the risk of:
        - Mechanical failure
        - Electrical arcing
        - Shock hazards during operation or servicing
3. Missing Rear Cover:
    - A second cover at the rear of the enclosure is missing, leaving generator conductors exposed.
    - This presents a serious electrical hazard to personnel and increases the risk of accidental contact or short circuits.

**NEC and Safety Considerations:**

- NEC 110.3(B): Equipment must be installed in accordance with its listing and labeling, which includes proper mounting and enclosure integrity.
- NEC 110.27(A): Requires that live parts be guarded to prevent accidental contact.
- NEC 408.3(A): Mandates that overcurrent devices be securely mounted and readily accessible.

**Recommendation:**

- Immediately source and install replacement deadfront covers from the original equipment manufacturer (OEM).
- Install a rear cover to fully enclose and protect the generator conductors.
- Consider a qualified electrical inspection to assess the full extent of the hazard and verify compliance after repairs.

**2.0 Deteriorated warning labels on the Photovoltaic System**
**Priority: LOW**

The required warning labels on the Photovoltaic System (PV) have deteriorated and are no longer clearly legible. The labels should be replaced.

**3.0 Engineering Review Required: AIC and Series Ratings of Circuit Breakers**
**Priority: HIGH**

In the building's electrical system, concerns have been raised regarding the AIC (Ampere Interrupting Capacity) and series ratings of the installed circuit breakers. These ratings are critical for ensuring that the breakers can safely interrupt fault currents without failure.

**Reference:**

- See Police Department Issue #9 for related context.

### 4.0 Storage of Combustible Materials in Electrical Equipment Working Clearance
**Priority: HIGH**

It has been observed that combustible materials are being stored within the required working clearance of electrical equipment in this facility. This practice is a violation of the National Electrical Code (NEC) and presents a serious fire and safety hazard.

## PUBLIC WORKS / ENGINEERING

### 1.0 Service Bay Fire
**Priority: Critical**

There has been a fire in one of the service bays in this facility. The cause of the fire is outside the scope for this evaluation. The fire appears to have caused slight to no damage, other than smoke damage, to the electrical distribution system.

A Guideline published by the National Electrical Manufacturers Association (NEMA), titled: Evaluating Fire- and Heat-Damaged Electrical Equipment (NEMA GD 2-2021), recommendations when electrical equipment has been compromised due to a fire or smoke damage. The Guideline, which is a consensus of the opinions of Electrical Manufacturers, outlines the suggestions (which may also be requirements of the equipment manufacturers) as it pertains to electrical equipment. The document does state the document is “not intended to override the recommended guidance of the specific equipment manufacturer.”

The Guidelines indicate that it is necessary to consult with the equipment manufacturer to determine the steps necessary to recondition the equipment or if it will be necessary to replace the equipment. The document states, in part:

> *A working knowledge of electrical systems and the equipment in question is required to evaluate damage related to a fire event. The original manufacturer of the equipment should be contacted if any questions arise or specific*

> *recommendations are needed. In many cases, equipment replacement will be necessary.*
>
> *After consultation with the manufacturer, some larger types of electrical equipment may be reconditioned by properly trained personnel. The potential for reconditioning can vary with the nature of the electrical function, the significance of the heat and fire residue, the age of the equipment, and the length of time the equipment was exposed to excessive heat or other damaging conditions. Because other damage to affected equipment can occur (e.g., chemical or structural damage), the equipment subject to the stresses of exposure to fire and/or heat needs to be carefully examined and evaluated to ensure that safety and performance are not negatively impacted.*
>
> *Attempts to recondition equipment without consulting the manufacturer can result in additional hazards due to the use of improper cleaning agents, which can further damage the equipment (see National Electrical Code® [NEC] Section 110.11, Informational Note No. 2) or due to improper reconditioning techniques.*

The Guideline states that overcurrent devices (fuses and circuit breakers) that have been exposed to fire residue should be replaced. Additionally, it recommends that panelboards, enclosed switches, and transformers should be replaced. Due to the age and condition of the equipment, and the added impact the event had on the equipment, it is recommended that all electrical distribution equipment should be replaced.

The document also indicates that conductors, devices (receptacles and switches), light fixtures all be replaced with the possibility that conduit may be reconditioned. We concur with the replacement of the indicated products. The conduit and non-flexible raceways that were not directly exposed to the heat of the fire may be reused where practical provided a separate equipment grounding conductor is installed with the circuit conductors.

### 2.0 Inadequate Clearance for Transformer
**Priority: CRITICAL**

The 150 kVA transformer has not been installed with the required 6-inch clearance from the wall, as mandated by the National Electrical Code (NEC). This condition restricts proper ventilation and heat dissipation, which can lead to overheating, reduced equipment lifespan, and potential fire hazards.

In addition to the previously noted clearance issue (see Town Hall Item #11), the 150 kVA transformer is producing elevated sound levels, which may indicate improper installation procedures.

**Likely Cause:**
It is believed that the shipping bolts were not properly relaxed during installation. These bolts are used to secure the transformer core and coil assembly during transport and must be loosened or removed upon installation to allow the vibration isolation mounts to function correctly.

**Consequences of Improper Setup:**

- Increased vibration and noise, which can:
  - Transmit through the building structure
  - Cause discomfort or distraction in nearby occupied spaces
- Accelerated wear on internal components due to mechanical stress
- Reduced transformer lifespan and potential for premature failure

Due to these conditions, it is recommended that this equipment be relocated and replaced.

## 3.0 Improper installation of Panel "A/C"
**Priority: CRITICAL**

### 3.1 Inadequate Working Clearances (NEC 110.26 Violation)

Panel "A/C" has been installed directly behind the building's transformer, violating NEC 110.26 clearance requirements. This placement forces technicians to lean on the grounded transformer while operating or servicing the panel. In the event of accidental contact with an energized component, this setup creates a direct path through the technician's body—posing a severe shock and electrocution hazard. The risk of being immobilized by the current further increases the danger. Immediate relocation of the panel is required.

### 3.2 Missing Neutral Conductor and Improper Connections

The panel was installed without a dedicated neutral conductor as required by NEC Sections 200.2(B), 200.3 and 250.20. Instead, both neutral (white) and equipment grounding (green) conductors are connected to the insulated neutral bar, which is isolated from the panel enclosure. It appears that equipment grounding conductors are being misused as neutral conductors.

This creates a serious life safety and fire hazard and must be corrected immediately.

### 3.3 Improper Grounding and Lack of Fault Path

The neutral bar is being used for both grounding and ungrounded conductors, and there is no dedicated equipment grounding conductor bonded to the panel enclosure. This condition can energize downstream equipment enclosures and fails to provide a proper ground fault path. Without this path, overcurrent protection may not be activated during a fault, especially given the poor raceway installation.

### 3.4 Improper installation of Panel "A/C"

The panelboard includes overcurrent devices that are not listed for use with the equipment.

## 4.0 Improperly Installed Wiring and Compromised Grounding Path
**Priority: CRITICAL**

The wiring within the building has not been installed in a workmanlike manner, as required by the National Electrical Code (NEC). Several deficiencies have been identified:

**Observed Issues:**

- There are conduits that are not properly supported, leading to mechanical strain and potential conductor damage.
- Improper terminations and loose fittings compromise the integrity of the raceway system.
- The grounding path is unreliable, as the raceways (used as equipment grounding conductors) may not provide a continuous and effective fault current path.

**NEC References:**

- NEC 110.12(A): Requires that electrical equipment be installed in a neat and workmanlike manner.
- NEC 300.10: Mandates that raceways be securely fastened and electrically continuous.
- NEC 250.96(A): Requires that metal raceways used as equipment grounding conductors be properly bonded to ensure a low-impedance fault current path.

**Safety Implications:**

- A compromised grounding path can result in arcing during a ground fault, especially dangerous in areas with combustible or flammable materials.
- Loose or unsupported conduits can lead to mechanical failure, conductor insulation damage, and shock hazards.
- In the event of a fault, overcurrent protection devices may not operate correctly, increasing the risk of fire or equipment damage.

**Recommendation:**

- Secure all conduits with appropriate supports and ensure proper termination using listed fittings.

**5.0 Potential Hazard: Electrical Room Adjacent to Vehicle Service Bays**
**Priority: CRITICAL**

The electrical room in this facility is located adjacent to service bays, and the nature of the work performed in those bays is currently unknown. This raises a potential safety concern depending on whether the facility qualifies as a Major Repair Garage under applicable codes.

**Key Definitions and Code Requirements:**
Major Repair Garage (per NEC and NFPA 30A):
A facility where **major repairs** are performed, such as:

- Engine overhauls
- Fuel system repairs (including draining fuel tanks)
- Painting or body work

If gasoline, diesel, or natural gas is involved, and fuel system work is performed, the area is considered a Class I Division 2 hazardous location.

**NEC 511.7 and Related Guidance:**

- Electrical rooms adjacent to classified areas must be:
    - Separated by an unpierced wall or partition, or
    - Maintained at positive pressure relative to the classified area, with mechanical ventilation providing at least four air changes per hour.
- If these conditions are not met, all electrical equipment in the room must be:
    - Installed 18 inches or more above the floor, or
    - Rated for Class I Division 2 (explosion-proof or hazardous location-rated).

**Current Assessment:**

- The facility is not currently in use, so this is a minor issue at present.
- However, if the facility is intended to operate as a Major Repair Garage, the current configuration may pose a significant fire or deflagration hazard if:
    - The electrical room is not positively pressurized
    - The electrical equipment is not rated for hazardous locations

**Recommendation:**

- Confirm the intended use of the service bays (Major vs. Minor Repair Garage).
- If Major Repair Garage use is planned:
    - Engage registered Mechanical and Electrical Engineers to evaluate:
        - Ventilation system design
        - Room pressurization
        - Electrical equipment compliance
    - Implement necessary modifications to ensure safe occupancy and code compliance.

**6.0 Improper Grounding – Storage Building**
**Priority: CRITICAL**

In the storage building to the south of the repair facility there is a panelboard that has been installed just inside the building. Equipment grounding conductors been improperly terminated on the neutral bar. This is a violation of the National Electrical Code unless it occurs at the main service panel, where such bonding is specifically allowed. Please reference Issue #14 under the Police Department section.

**7.0 Missing Grounding Electrode Connection at Storage Building Panelboard**
**Priority: HIGH**

The panelboard serving the storage building does not appear to be connected to the building's grounding electrode system (GES). This is a serious violation of the National Electrical Code (NEC) and presents a significant shock hazard.

**Reference:**

- See Police Department Issue #18 for additional context and a similar condition.

## FIRE STATION #91

**1.0 Engineering Review Required: AIC and Series Ratings of Circuit Breakers**
**PRIORITY: HIGH**

In the building's electrical system, concerns have been raised regarding the AIC (Ampere Interrupting Capacity) and series ratings of the installed circuit breakers. These ratings are critical for ensuring that the breakers can safely interrupt fault currents without failure.

**Reference:**

- See Police Department Issue #9 for related context.

**2.0 Storage of Combustible Materials in Electrical Equipment Working Clearance**
**Priority: HIGH**

It has been observed that combustible materials are being stored within the required working clearance of electrical equipment in this facility. This practice is a violation of the National Electrical Code (NEC) and presents a serious fire and safety hazard.

**3.0 Obscured Short Circuit Current Rating Label – Automatic Transfer Switch**
**Priority: LOW**

The Automatic Transfer Switch (ATS) for this building is designed to transfer power between the normal utility supply and the standby generator system during a power outage. However, the ATS is missing a label identifying its Short Circuit Current Rating (SCCR)—a critical specification required for safety and code compliance.

This is a low priority as it is believed the equipment is suitable for the conditions it is installed in but still must be verified. Technicians who investigate this may be required to de-energize the equipment to safely view the labels.

## EMT BUILDING

**1.0 Electrical Panel Condition and Suitability**
**Priority: CRITICAL**

The electrical panel in this building is original to the structure and presents multiple serious concerns that compromise both safety and code compliance.

**Identified Issues:**

1. Unsuitable for Location:
   - The panel is not rated for the environmental conditions of its current location (e.g., moisture, dust, or corrosive atmosphere).

   - This violates NEC 110.3(B) and NEC 110.11, which require equipment to be installed in accordance with its listing and protected from environmental deterioration.
2. Inadequate Overcurrent Protection:
   - The installed overcurrent devices are not rated for the available fault current, violating NEC 110.9, which mandates that interrupting ratings must be sufficient for the available fault current at the equipment.
3. Lack of Maintenance and Missing Seals:
   - Conduit entry seals are missing, exposing the panel to dust, moisture, and pests.
   - This compromises the integrity of the enclosure and violates NEC 300.15 and NEC 110.12(A), which require proper sealing and maintenance.
4. Improperly Installed Overcurrent Devices:
   - Devices have been installed that are not listed or labeled for use within the enclosure, violating NEC 110.3(B) and NEC 408.36, which require that all components be listed for use in the specific panelboard.
   - 

**Safety Implications:**

- Shock and arc flash hazards
- Increased risk of fire
- Failure of protective devices during faults
- Non-compliance with insurance and inspection requirements

**Recommendation:**

- Engage a licensed electrical contractor to:
  - Replace the panel with a modern, listed panelboard suitable for the environment and fault current.

**2.0 Improper Raceway and Cable Installation from Electrical Service**
**Priority: HIGH**

The raceways and cables installed from the electrical service into the building have been found to be improperly supported and potentially unsuitable for the environment in which they are installed.

**NEC Requirements:**

- NEC 300.11(A): Requires that raceways and cables be securely fastened in place and supported at intervals in accordance with their type and use.
- NEC 300.5 and 300.6: Address installation conditions (e.g., underground, wet locations) and require that materials be suitable for the environment to prevent corrosion or degradation.
- NEC 110.12(A): Mandates that all electrical installations be performed in a neat and workmanlike manner.

**Safety and Performance Implications:**

- Unsupported raceways or cables can sag, pull on terminations, or become damaged, leading to:
  - Mechanical failure
  - Conductor insulation damage
  - Shock or fire hazards
- Improper cable type for the location (e.g., indoor-rated cable used outdoors or underground) can result in premature failure and code violations.
-

**Recommendation:**

- When the electrical service is replaced, ensure that:
  - All raceways and cables are properly supported using listed hardware.
  - Cable types are verified for suitability based on location (e.g., wet, corrosive, or underground environments).
  - The installation is reviewed by a licensed electrical contractor to ensure full NEC compliance.

## COMMUNICATIONS BUILDING

### 1.0 Storage of Combustible Materials in Electrical Equipment Working Clearance
**Priority: HIGH**

It has been observed that combustible materials are being stored within the required working clearance of the facilities automatic transfer switch. This practice is a violation of the National Electrical Code (NEC) and presents a serious fire and safety hazard.

### 2.0 Engineering Review Required: AIC and Series Ratings of Circuit Breakers

**Priority: Critical**

In the building's electrical system, concerns have been raised regarding the AIC (Ampere Interrupting Capacity) and series ratings of the installed circuit breakers. These ratings are critical for ensuring that the breakers can safely interrupt fault currents without failure.

**3.0 Improper Conductor Terminations in ATS**
**Priority: Critical**

Several locations within the Automatic Transfer Switch (ATS) have been identified where three conductors are terminated under a single lug that is only rated for two conductors. Additionally, some conductors are too small for the lugs they are terminated in, violating multiple sections of the National Electrical Code (NEC).

**NEC Violations:**

- NEC 110.3(B): Requires that equipment be installed and used in accordance with its listing and labeling, including the number and size of conductors permitted per terminal.
- NEC 110.10: Mandates that the electrical system be designed and installed to withstand the available fault current without damage.
- NEC 110.14(A): Requires that terminals be used only with conductors of the correct size and number, as specified by the terminal's listing.

**Functional and Safety Concerns:**

1. **Electrical Performance:**
    - Terminations are responsible for:
        - Transferring current from the conductor to the equipment
        - Securing the conductor to the equipment
    - When conductors are undersized or overcrowded in a lug:
        - The electrical contact area is reduced
        - Current-carrying capacity is compromised
        - Overheating can occur, leading to insulation damage or fire

**2. Mechanical Security:**

- Improperly secured conductors may loosen or pull free during a fault condition.
- This can:
    - Prevent overcurrent devices from operating properly
    - Leave energized conductors exposed, posing a shock or arc flash hazard to technicians
    - Jeopardize system reliability and continuity of service

**Recommendation:**

- Engage a **licensed electrical contractor** to:
    - Re-terminate all affected conductors using lugs rated for the correct number and size of conductors
    - Replace or upgrade terminals where necessary to accommodate the existing wiring
    - Verify all terminations for torque and compliance with manufacturer specifications

## COMMON ISSUES – PROJECT WIDE

The following issues were observed across multiple facilities and represent systemic concerns that should be addressed to improve safety, reliability, and maintainability of the Town's electrical infrastructure:

**1. Inadequate Equipment Labeling**

Many electrical components are either poorly labeled or not labeled at all. This significantly impairs a technician's ability to identify circuits and equipment, leading to extended troubleshooting times. More critically, the inability to quickly identify and de-energize circuits may result in technicians working on energized equipment, increasing the risk of electrical shock, arc flash incidents, and unintentional power outages

**2. Noncompliance with Design Documents**

A review of historical construction documents indicates that, in several cases, contractors either failed to follow the engineer's design intent or lacked the technical understanding to interpret the drawings correctly. These deviations have resulted in serious deficiencies that were not identified during inspections by design professionals or the Building Official.

3. **Improper Grounding and Bonding**

Numerous instances of improper or missing grounding and bonding were identified. Proper grounding and bonding are essential for the safe operation of electrical systems. Noncompliance with NEC requirements can lead to catastrophic equipment failure, increased fire risk, and serious life safety hazards.

4. **Missing or Improperly Installed Equipment Covers**

In many locations, electrical equipment covers and deadfronts are either missing or not properly secured. While this may appear minor, it poses a significant safety risk. Covers are designed to contain arc flash and arc blast events. Missing or loose hardware compromises the structural integrity of enclosures and may expose technicians to falling debris or energized components. All missing or damaged hardware should be replaced with components that meet or exceed the original specifications.

5. **Lack of Preventive Maintenance**

There is a widespread lack of routine maintenance across the Town's electrical systems. Preventive maintenance is critical to ensuring equipment operates as intended. Neglecting maintenance not only shortens equipment lifespan but also increases the likelihood of unsafe conditions and unexpected failures.

## ADDITIONAL RECOMMENDATIONS

The following recommendations are supplementary to the primary issues identified in this report. While considered secondary in priority, these best practices are intended to support long-term system reliability, enhance safety, and assist municipal technicians in effectively maintaining and troubleshooting electrical infrastructure. Implementing these measures can help prevent future issues and streamline response efforts when problems arise.

### 1.0 Electrical System Reference Documentation

It is recommended that a **laminated, up-to-date single-line diagram** be framed and permanently mounted on the interior wall of the main electrical room for each facility. This diagram should clearly illustrate the building's electrical distribution system, enabling technicians to quickly and accurately understand system configuration during routine maintenance or emergency response.

The diagram must be kept current and revised promptly to reflect any modifications to the electrical infrastructure. Maintaining accurate documentation in this manner supports operational efficiency, enhances safety, and reduces the risk of service errors.

### 2.0 Equipment Identification and Labeling

All transformers, panelboards, transfer switches, disconnect switches, and distribution boards should be assigned a **unique identifier** and clearly marked with a **permanent, durable label** appropriate for the environmental conditions in which the equipment is installed (e.g., indoor, outdoor, high-moisture, or corrosive environments).

While this may appear to be a minor task, it plays a **critical role in both equipment servicing and asset management**. Proper labeling ensures that technicians can quickly and accurately identify components during maintenance or emergency response, and it supports effective tracking and documentation of electrical assets over the lifecycle of the facility.

### 2.1 Equipment Naming and Source Identification

**a. Unique Site-Wide Naming Convention**

To avoid confusion and ensure clarity across the facility, each piece of electrical equipment should be assigned a **unique identifier** that is consistent and non-repetitive across the entire site. Generic labels such as “Panel A” or “Panel B” should be avoided, as multiple components with similar names may exist within the same property.

A standardized naming convention—developed in consultation with a qualified electrical engineer—should be implemented. This convention should be intuitive, scalable, and reflective of the equipment’s location and function within the system.

**b. Source and Load Labeling**

In addition to unique identifiers, all equipment should be clearly labeled to indicate both the source of supply and, where applicable, the equipment or circuits it serves. This enhances operational awareness and facilitates efficient troubleshooting.

***Example:***

A panelboard located in the Police Department and fed from a distribution board might be labeled as follows:

**PANEL “H1-PD”**

***FED FROM DISTRIBUTION BOARD “DB1-PD”***

This level of detail allows technicians and staff to quickly trace power paths, understand system relationships, and respond effectively during maintenance or emergency situations.

### 3.0 Electrical System Mapping

It is recommended that a **qualified electrical contractor** be engaged to perform a comprehensive mapping of the facility's electrical distribution system. This process should include:

- Identification and documentation of all electrical system components
- Determination of each component's **source of supply**
- Mapping of all **downstream equipment** served by each component

This task is essential for developing a complete understanding of the system's configuration, interdependencies, and potential vulnerabilities. It also aligns with the equipment identification and labeling recommendations outlined in **Item 2**, supporting improved maintenance, troubleshooting, and future planning.

### 4.0 Preventive Maintenance Program

It is recommended that a **qualified electrical contractor** be retained to implement a comprehensive preventive maintenance program for all critical components of the electrical distribution system. This includes, but is not limited to:

- Panelboards
- Disconnect switches
- Transformers
- Transfer switches
- Standby generators
- Distribution boards
- Service entrance equipment

The selected contractor should have demonstrated expertise in the application of the following standards and regulations:

- **NFPA 70E** – *Standard for Electrical Safety in the Workplace*

- **NFPA 70B** – *Standard for Electrical Equipment Maintenance*
- **OSHA** – *Occupational Safety and Health Administration requirements*

Strict adherence to these standards is essential to ensure personnel safety, minimize the risk of equipment failure, and maintain the operational integrity of the facility's electrical infrastructure.

### 5.0 Lightning Protection System Bonding Verification

It is recommended to verify that any existing **lightning protection system** is properly bonded to the building's **grounding electrode system**, in full compliance with applicable codes and standards, including:

- **NFPA 780** – *Standard for the Installation of Lightning Protection Systems*
- **NEC Article 250** – *Grounding and Bonding Requirements*

Proper bonding is essential to ensure the safe dissipation of lightning energy and to eliminate potential differences that could pose serious hazards to personnel, equipment, and building infrastructure.

This verification should be conducted by a **qualified professional** with proven experience in the **design, installation, and inspection** of lightning protection systems.

### 6.0 Standby Generator Maintenance and Reliability Assurance

At present, it is unclear whether the standby generators serving the facilities are being exercised and maintained in accordance with the manufacturers' recommended schedules. Adherence to these guidelines is **critical to ensuring reliable generator performance** during utility outages or emergency conditions.

**Visual observations** indicate that routine maintenance may not be occurring as required. To address this concern, it is strongly recommended that a **qualified and certified service provider** be engaged to:

- Conduct a thorough evaluation of each generator's current condition and operational readiness

- Verify compliance with manufacturer-recommended maintenance procedures and **industry standards**, such as **NFPA 110 – Standard for Emergency and Standby Power Systems**
- Develop and implement a **documented maintenance and testing program**, including periodic load testing, fuel system inspections, battery checks, and control system diagnostics

Establishing a structured maintenance protocol will help ensure the generators operate as intended during critical events, reduce the risk of failure, and extend the service life of this essential equipment.

## 7.0 Design Professional Involvement in Construction Oversight

For all future capital improvement and renovation projects, it is strongly recommended that the respective design architects and engineers be engaged to conduct periodic site assessments throughout the construction phase and again upon project completion—prior to the final inspection by the Town of Paradise Valley's Building Official.

Design professionals possess in-depth knowledge of their construction documents and performance specifications, enabling them to effectively support contractors and inspectors in verifying compliance with both the Town's adopted codes and the original design intent. Their involvement can significantly reduce the likelihood of equipment or system failures, extend the operational life of installed systems, and, most importantly, help ensure a safe and code-compliant installation.

### 7.1 Independent Third-Party Peer Review

In certain cases—particularly those involving critical infrastructure or facilities where public safety is a primary concern—it may be advisable to engage an independent third-party engineering consultant. This consultant would be responsible for conducting a peer review of the design professional's construction documents and performing site inspections throughout the project lifecycle.

Independent third-party reviewers bring an objective perspective and are solely focused on ensuring the final product meets the highest standards of quality and compliance with nationally recognized codes and best practices. Their involvement can serve as an additional layer of assurance, helping to identify potential oversights, enhance system reliability, and support the delivery of safe, code-compliant installations.

**8.0 Recommendation for Electrical Distribution Equipment Standardization**

To ensure consistency, compatibility, and ease of maintenance across all electrical systems, it is recommended that all electrical distribution equipment—whether newly added or replaced—be sourced from a single major equipment manufacturer. Standardizing on one manufacturer helps streamline spare parts inventory, simplifies training for maintenance personnel, and enhances system reliability.
The following manufacturers are recommended for their proven performance, reliability, and widespread industry support:

- **Eaton**
- **Schneider Electric (Square D)**
- **Siemens**

Selecting one of these manufacturers for all future installations and replacements will support long-term operational efficiency and reduce the risk of compatibility issues.

**9.0 Final Safety Advisory**

There is a significant concern for the safety of individuals who may service or interact with the electrical systems and equipment described in this report. It is strongly recommended that only qualified personnel — those who have received formal training in the installation, operation, and maintenance of electrical systems — be permitted to perform any work on this equipment.

Evidence suggests that untrained or inexperienced individuals may have made modifications or additions to the system. This introduces an elevated risk of electric shock, particularly due to potentially hidden hazards such as energized equipment grounding conductors, which are not intended to carry current under normal conditions.

**As a result, it is strongly advised that no maintenance or service be performed on any energized system.** Due to the possibility of unseen hazards, all power to the structure should be completely de-energized before any work is undertaken. This precaution is essential to ensure that technicians are not unknowingly exposed to unsafe or life-threatening conditions.

## SUMMARY

The building distribution systems reviewed during this assessment and arc-flash study exhibited widely varying conditions.

For structures built prior to 1980, the condition of electrical equipment and installations typically ranges from fair to very poor. Equipment over 30 years old is at or beyond its expected service life, and replacement parts are increasingly difficult—or impossible—to obtain, as manufacturers no longer support outdated models. In many cases, years of neglect and improper modifications have further compromised the safety and reliability of these systems. Unless otherwise noted in this report, such systems should be replaced during any future building modifications.

For equipment and systems that we installed between 20 and 40 years ago, proper maintenance of the equipment is critical assure the continuity of operations and the equipment's ability to safely perform their desired functions. Furthermore all works should be performed and inspected by individuals who are specialists in the electrical field. Maintenance engineers and inspectors who are not specialists in the electrical field will not have the knowledge or experience to understand the requirements or recognize the hazards in this very complex discipline.

In viewing the distribution systems in these buildings, it is apparent that a significant amount of work has been done improperly and, in some cases, in an unsafe manner. This may have been avoided if the design professionals who were engaged to provide the electrical design also completed periodic inspections. The additional fees associated with these services would more than offset the cost to make the corrective actions that are suggested within this document.

Proper maintenance also should not be overlooked: Maintenance of the electrical systems is critical to reduce failures, extend equipment life, assure proper operation of equipment, and provide for a safe built environment for the Citizens and Employees of the Town of Paradise Valley.

This report should be shared with the Managers and Directors who are responsible for the ongoing operations and maintenance of the Town of Paradise Valley's facilities. Additionally, the document should be presented to those who may be contracted to provide further and more detailed assessments, make corrective actions, or provide designs or modifications to the electrical systems.

Respectfully submitted,

Mark Ptashkin CBO
Chief Operating Officer
120 Degreez Engineering