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Level _2_ Program Requirements Document

Revision	Record of Issue/Revision	Affected Pages
13	Minor Revision: Updated FBP-OS-PRD-00001-F02, *Electrical Task Risk Assessment Form*, to clarify a section of the form to address PR FBP-PR-FY23-0315.	45-46

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CONTENTS

1.0 PURPOSE

1.1 This document establishes the Fluor-BWXT Portsmouth LLC (FBP) Electrical Safety Program (ESP) implemented at the Portsmouth Gaseous Diffusion Plant (PORTS).

1.2 Compliance with this program when implemented reduces the likelihood of unplanned exposure to electrical hazards for all employees of FBP, sub-contractors, sub-tier contractors, and vendors. It also minimizes risk of damage to equipment and facilities from electrical energy.

1.3 Definitions of terms specific to this program may be found in NFPA and Code of Federal Regulations (CFR) source documents listed in Section 11.0, *References*.

EXCEPTION: Work performed on the supply side of the service point is excluded from the requirements contained within this document, and is covered in FBP-OS-PRD-00003, *Electrical Utility Safety Program*. Other electrical systems excluded from this document include:

- Related equipment for communication and metering of the electrical transmission and distribution (T&D) systems.
- Street and security lights mounted on utility poles.

1.4 This document implements applicable regulatory requirements. They are listed in Appendix A, *Regulatory Requirements Flow Down*.

2.0 SCOPE AND APPLICABLITY

2.1 The scope of this document includes work performed on the load side of the defined service point (premises wiring system).

2.2 The ESP provides the requirements for electrical installations and removal of electrical components, electrical safe work practices for construction conditions, maintenance, inspections, and operations and electrical safety training.

2.3 Although the service point is uniquely established at each facility and structure served, it is generally defined at PORTS as one of the following:

- For electrical service to a building or other structure that operates at a nominal voltage less than 13,000 volts and is provided from an overhead drop, the service point shall be the splice point near the weather head of the raceway containing the service entrance conductors.
- For electrical service to a building or other structure that operates at a nominal voltage less than 13,000 volts and is provided from an underground service lateral supplied from an elevated transformer, the service point shall be the connection of the lateral conductors at the first equipment mounted on or near the building or other structure served.

- For electrical service to a building or other structure that operates at a nominal voltage less than 13,000 volts and is provided from a pad-mounted transformer, the service point shall be the connection of the secondary conductors to the secondary terminals of the transformer.

3.0 TRAINING AND QUALIFICATIONS

3.1 General Electrical Safety Training and Qualifications

3.1.1 Consistent training is critical to successful implementation of the program. Training material intending to meet the requirements of this program shall be reviewed and accepted by the FBP Training Manager. Individual training equivalencies, waivers, and extensions shall be approved and documented by the Training Manager.

3.1.2 Electrical safety training for workers who face a risk of exposure to electrical hazards shall meet the following when applicable:

- Be in accordance with 10 CFR 851
- Shall have electrical safety training commensurate to their assigned duties.
- Electrical Safety training shall include a hands-on element(s) to reinforce learning objectives associated with hazardous electrical work tasks.
- Personnel shall be trained on the proper use and maintenance of Personal Protective Equipment (PPE).
- Documented evidence of electrical training may be in the form of required reads, classroom and on-the-job training, annual assessments or pre-job briefings.
- Personnel shall be permitted to perform electrical work only to the level for which they have been trained and qualified.

3.2 All Employees

- All employees whether qualified or unqualified shall receive electrical training (initial and refresher) through completion of the Electrical Safety module of General Employee Training (GET).
- Contractor/Subcontractor training requirements must meet any and all applicable electrical safety requirements called out in the FBP program in the event the contractor chooses to follow the FBP Electrical Safety Program to perform work.
- Subcontractors exempted from following the FBP Electrical Safety program shall be trained and qualified with respect to the equipment they interact with and work task they are performing. Training and qualifications shall be reviewed by the AHJ and verified and documented by FBP Safety.

3.3 Unqualified Workers

- Employees who are not considered qualified electrical workers shall be trained in and familiar with any electrical safety related work practices commensurate with their work task.

3.4 Qualified Electrical Worker

Qualification

3.4.1 Documented evidence of qualification shall be provided and maintained for each Qualified Electrical Worker. The employer shall make the determination as to qualification based on experience, training and/or education.

- An electrical worker who is undergoing on-the-job training under the direct supervision of a Qualified Electrical Worker and who has demonstrated an ability to perform duties safely at his or her level of training shall be considered qualified for the performance of those duties.

Training

3.4.2 Qualified Electrical Worker shall attend the following training:

- Safe release of victims from contact with energized circuit conductors or parts. Contact release refresher training shall occur annually.
- Electrical Safety training at intervals not to exceed three years
- Qualified Electrical Worker permitted to work within the Limited Approach Boundary (LAB) of exposed energized electrical conductors and circuit parts operating at 50 volts or more shall, at a minimum, be trained in all of the following:
    - The skills and techniques necessary to distinguish exposed energized electrical conductors and circuit parts from other parts of electrical equipment
    - The skills and techniques necessary to determine the nominal voltage of exposed energized electrical conductors and circuit parts
    - The approach distances specified in Table 7.3A and 7.3B for Shock Protection Approach Boundaries to Energized Electrical Conductors or Circuit Parts, and the corresponding voltages to which the Qualified Electrical Worker will be exposed
    - The decision-making process necessary to determine the degree and extent of the hazard, PPE, and job planning necessary to perform the task safely

- Demonstrated proficiency to select, use, interpret indications, and understand limitations of each specific test instrument used for their task assignments

- The employer shall document that the training required by this section has occurred.

3.5 Supervisor of Qualified Electrical Workers

3.5.1 Supervisors that oversee electrical work tasks shall verify a pre-job briefing is held with a qualified electrical worker(s) that includes topics discussed in Step 6.1.4 prior to the start of work activities.

3.5.2 The supervisor shall verify annually the training required by Step 3.4.2 is up to date.

3.6 National Electrical Code Inspectors

National Electrical Code (NEC) inspections shall be performed by designated NEC Inspectors who have been authorized by the Authority Having Jurisdiction (AHJ) to perform such inspections.

3.7 Qualification

3.7.1 NEC Inspectors shall have at least one of the following:

- No less than four years' experience as a journeyman electrician installing and maintaining electrical equipment

- Two years electrical training in a college of electrical engineering of recognized standing and four years continuous practical electrical experience in installation work

- Four years of electrical training in a college of electrical engineering of recognized standing and two years continuous practical electrical experience in electrical installation work approval and designation from the AHJ based upon years of experience in the electrical field

3.8 Training

NOTE

The AHJ, FBP Management, or the Electrical Safety Committee (ESC) may prescribe additional training for NEC inspectors to ensure continued competency.

3.8.1 NEC Inspectors shall attend the following training:

- NFPA 70E, *Standard for Electrical Safety in the Workplace*, training at intervals not to exceed three years

- NFPA 70, *National Electrical Code*, training at intervals not to exceed three years

3.9 Workers Interacting With Electrical Equipment

3.9.1 Individuals who perform tasks on electrical equipment such as operating circuit breakers, opening or closing disconnect switches, or racking electrical equipment shall be considered qualified to perform the task if trained in and have demonstrated the skills and knowledge to understand and perform the task and apply the necessary related electrical safe work practices.

3.9.2 Evidence of training will be documented.

4.0 PROGRAM RESPONSIBILITES

4.1 Environmental, Safety, Health, and Quality (ESH&Q)

4.1.1 ESH&Q administers the ESP by:

- Appointing an ESP Administrator.
- Providing representatives to the ESC
- Coordinating electrical safety activities and initiatives with Department of Energy (DOE) and other Portsmouth site contractors
- Ensuring industrial safety professionals observe and provide oversite to work tasks which involve electrical hazards and are trained in electrical safety requirements
- Providing Qualified Electrical Inspectors as determined by the Electrical Authority Having Jurisdiction
- Identifying approved PPE for electrical work
- Ensuring safe work practices (as described in this program and NFPA 70E) are used by workers under their direction including non-electrical workers
- Facilitating discussions of electrical events or trends across the DOE Complex

4.2 Engineering

4.2.1 Engineering implements the ESP by:

- Appointing the Electrical Safety Committee Chairperson and Vice Chairperson
- Designating an Electrical AHJ to represent FBP

- Providing representatives to the ESC
- Ensuring engineers are competent
- Documenting decisions/interpretations and recommendations by the ESC and AHJ
- Ensuring that meeting summaries, interpretations, lessons learned, and other information related to electrical safety is effectively communicated
- Supporting the electrical hazard analysis process
- Conducting periodic meetings to serve as open forums for discussion of issues presented by ESC representatives and other stakeholders

4.3 Electrical Authority Having Jurisdiction

4.3.1 The AHJ shall:

- Enforce and interpret all required documents stated in Section 1.0, *Purpose*.
- Document company specific AHJ decisions and interpretations.
- Execute responsibilities as described in DOE G 440.1-1B 10-20-11, *Worker and Safety Health Program for DOE Federal and Contractor Employees*, paragraph 6.4.1.
- The AHJ may delegate responsibility as necessary to ensure adequate field implementation of applicable electrical codes, standards, and procedure requirements; but ultimate authority and accountability reside with the appointed AHJ. Potential delegates may include: deputies, inspectors, and industrial safety professionals.
- Consult on electrical designs, installations, inspections, and other electrical safety matters.
- Determine the demarcation of the service point.

4.4 National Electrical Code Inspectors

4.4.1 National Electrical Code (NEC) Inspectors shall:

- Be independent from the work they inspect. They shall not inspect work for which they have direct line management, engineering, or construction responsibility.
- Act as a field representative of the AHJ(s) to administer and enforce the NEC.

- Maintain qualifications established by the AHJ(s).
- Issue electrical inspection reports.
- Consult with designers and installers on NEC compliance issues.
- Perform field inspections for new installations, temporary installations, and modifications of existing electrical systems and equipment.
- Present disputed NEC inspection reports and issues to the AHJ for resolution.
- Issue and approve electrical installation requests for electrical inspections.

4.5 Qualified Electrical Workers

4.5.1 Qualified Electrical Workers shall:

- Perform work within the controls of the work document(s).
- Understand and follow the electrical task risk assessments or procedure requirements.
- Perform work commensurate with qualifications.
- Identify and communicate potentially unsafe electrical conditions.

4.6 Electrical Supervisors

4.6.1 Electrical Supervisors shall:

- Perform a proficiency evaluation on their employees annually to ensure compliance with electrical safety related work practices.
- Verify through training records that employees have the required training commensurate with the task the employee is performing.

4.7 Site Project Director

Appoints and recommends to DOE an Electrical AHJ to represent DOE at the field level.

5.0 ELECTRICAL EQUIPMENT

5.1 Electrical Installation Equipment Requiring Approval

5.1.1 All equipment that is part of an electrical installation or electrical utilization equipment within the scope of the NEC or Occupational Safety and Health Association (OSHA) Subpart S not exempted by 5.2 shall be approved by and acceptable to the Electrical AHJ or designee. Approved equipment shall be suitable for its intended purpose and used in accordance with instructions or requirements of the Nationally Recognized Testing Laboratories (NRTL) certification.

5.1.2 Criteria for approval shall include the following in order of priority:

[1] Certification, (listing or labeling) by a NRTL recognized pursuant to 29 CFR 1910.7, through application by the manufacture or otherwise determined to be safe for the intended use through field evaluation by a representative of an NRTL.

[2] Equipment of a kind that no NRTL accepts, certifies, lists, labels, or determines to be safe:

a. Documentation of compliance with the NEC through inspection or testing by another Federal agency, State, municipal, or other local authority responsible for enforcing occupational safety provisions of the NEC.

b. Documentation through test data from an equipment manufacturer their equipment which has been designed and fabricated for use exclusively by FBP (custom-made) or equipment that has been recertified or refurbished is safe for the intended use. FBP shall keep the test data and make it available for inspection by DOE or its representatives upon request,

5.2 Electrical Equipment Not Requiring Approval

5.2.1 The following equipment does not require approval by the electrical AHJ:

- Equipment connected to the load side of a class 2 or 3 power supply
- NRTL listed equipment operating at less than 50 volts such as cable assemblies, instruments, security systems, low voltage lighting, communication systems, etc.

NOTE

These products should be listed by NRTL and acceptable to the Industrial Safety representative for the work area.

- Consumer products such as phone chargers, electric staplers, coffee pots, portable heaters below 2,000 watts, etc.

- Legacy non-NRTL equipment installed prior to implementation of this Program may remain in service and does not require reevaluation so long as it has not been modified, found to be defective or damaged, and does not present a hazard to the workers or facility.

5.3 Electrical Test Equipment

NOTE

Electrical test instruments used only for verification of absence of voltage are not required to be included in the Measuring and Testing Equipment (M&TE) program.

5.3.1 Only qualified electrical workers shall perform tasks such as testing, troubleshooting, and voltage measuring.

NOTE

Test instrument Category ratings are identified as Category 1 through 4. Voltage ratings are 600 or 1000 volts, AC.

5.3.2 All electrical multi-meters or other test instrument including the external test leads used on electrical equipment that operate over 50 volts shall be marked as certified (listed) by a NRTL. The multi-meter or other test instrument used shall be rated at the appropriate voltage and category ratings for the particular application.

5.3.3 The minimum Category rating for test instruments used by qualified electrical workers shall be Category 3. The minimum voltage rating for test instruments used by qualified electrical workers shall be 600 volts.

5.3.4 Qualified electrical workers may use proximity (detectors) test equipment for performing cursory checks of voltage such as testing before touching or unattended testing, but shall not be used to verify the absence of voltage for establishing an Electrically Safe Work Condition unless the system operates at over 1000 volts.

5.3.5 Qualified electrical workers shall perform operational checks on testing equipment prior to and after performing work on electrical systems, (live-dead-live) by checking the test instrument on a known live voltage source.

5.4 Ground Fault Circuit Interrupters (GFCIs)

WARNING

GFCIs are for personnel protection to limit the severity of a shock to a non-injury level (4 to 6 milliamps). They are not intended for the protection of equipment.

5.4.1 GFCI protection shall be provided in accordance with the NEC and when employees are interacting with portable electric tools and equipment in the following conditions:

- With temporary wiring methods including extension cord sets
- In wet or other conductive locations
- Outdoors

5.4.2 Portable GFCIs shall be listed and located closest to the source unless the equipment configuration requires locating the GFCI device closer to the worker.

5.4.3 GFCI devices shall be confirmed to function properly using the following criteria:

- Permanently installed GFCI protection devices shall not be used unless they have been tested within the past month.
- Testing for permanently installed GFCI protection devices shall be performed per the requirements of FBP-SM-PRO-00981, *Inspection and Testing of Ground Fault Circuit Interrupter Receptacles*.
- GFCI devices located in areas that are not accessible, in unoccupied facilities under long-term surveillance or undergoing deactivation/demolition, or that would create a greater hazard when tested, shall be tested prior to use.

NOTE

For the purposes of this program a portable GFCI is a factory assembled, listed, in-line device with a cord, and attachment plug.

- Portable GFCIs shall be tested prior to use.
- GFCI receptacles/in-line GFCI devices that trip during use shall be permitted to be reset by the user one time. If the GFCI trips a second time, the supervisor shall be contacted to determine the proper response.

5.5 Portable Tools, Extension Cord Sets, Relocatable Power Taps and Cord and Plug-Connected Utilization Equipment

5.5.1 Portable electric tools, extension cord sets, relocatable power taps, and surge protective devices shall be used and maintained in a manner to minimize risk to workers.

5.5.2 Flexible power cords supplying cord and plug-connected utilization equipment shall not:

- Be routed through walls, ceilings, floors, or doorways
- Be concealed behind building walls, ceilings, or floors
- Be attached to building surfaces

5.5.3 Cords and attachment plugs connected to utilization equipment and extension cord sets shall be visually inspected prior to each use and removed from service if evidence of damage is detected. The inspection shall consider:

- Breaks or cracks exposing energized conductors and circuit parts
- Missing cover plates
- Missing, loose, altered, or damaged cord, blades, or pins/prongs, etc.
- Interruption in the continuity of the equipment grounding conductor

5.5.4 Attachment plugs connected to utilization equipment shall not be cut off to render them inoperable when found to be defective. Refer to FBP-OS-PRO-00014, *Accident Prevention/Equipment Control Tags*, for proper disposal requirements. Attachment plugs on extension cords may be removed/replaced by a qualified electrical worker when repairs are needed.

5.5.5 Extension cord sets shall:

- Contain an equipment grounding conductor
- Not be fastened in place in a manner that may damage the cords or restrict their movement
- Not be used as a substitute for the fixed wiring of a structure
- Not be routed through walls, windows, ceilings, or floors
- Have a current rating that is greater than the connected load
- Not be connected in series (daisy-chained) unless specifically designed and approved for this use

- Be unplugged and properly stored when not in use
- Not create a trip hazard
- Be protected from damage (sharp corners and projections shall be avoided)
- Be provided with substantial protection provided to avoid damage where passing through doorways or other pinch points. Fire doors shall not be blocked open without the Fire Marshal's approval.
- Be rated and labeled as suitable for outdoor use when used outdoors

5.5.6 Extension cords sets, including 480-volt cord sets, shall be permitted to be field-assembled by a Qualified Electrical Worker provided that:

- Each component is compatible with the other components and is NRTL listed for the purpose.
- A Qualified Electrical Worker verifies correct polarity of the extension cord set and the continuity of the grounding conductor before it is used.
- The extension cord set is durably marked to indicate the organization responsible for its assembly.
- The extension cord set is durably marked to indicate the maximum allowable load in amps and whether or not it is suitable for outdoor use.

5.5.7 The following tests shall be performed on all 480-volt extension cord sets:

[1] All equipment grounding conductors shall be tested for continuity and shall be electrically continuous.

[2] Each receptacle and attachment plug shall be tested for correct attachment of the equipment grounding conductor. The equipment grounding conductor shall be connected to its proper terminal.

[3] All required tests shall be performed as follows:

- Before first use on site
- When there is evidence of damage
- At intervals not exceeding 3 months

[4] The tests required in 5.5.7.[3] shall be recorded and made available to the Authority Having Jurisdiction (AHJ).

[5] A means of identifying the 3-month interval testing shall be provided on both ends of the cord set.

5.5.8 Relocatable power taps shall:

- Be used in accordance with the NRTL Certification (listing and labeling)
- Be directly connected to a permanently installed branch circuit receptacle outlet (not daisy chained or connected with an extension cord)
- Not be used on construction sites
- Not be permanently secured to building structures, tables, or similar structures
- Not be used as a substitute for fixed wiring
- Not have the supply cord routed through walls, windows, ceilings, floors, doorways, or similar openings of buildings

5.6 Temporary Electrical Equipment

5.6.1 Generators

[1] Portable or vehicle mounted generators shall not be required to be connected to a grounding electrode provided the generator only supplies equipment on the generator or cord and plug connected equipment through receptacles mounted on the generator.

[2] Noncurrent carrying metal parts of equipment such as the fuel tank, engine and generator housing must be bonded to the generator frame and/or vehicle frame.

[3] Portable or vehicle mounted generators that provide electric power to a structure such as a building or office trailer/conex, shall be connected to a grounding electrode.

- Electrical installations supplying buildings or other structures from portable or vehicle mounted generators shall be inspected by the FBP NEC inspector or AHJ.

5.6.2 Portable Power Unit

[1] Portable power units shall have a grounding electrode conductor, sized to NEC 250.66, installed on the portable power units by a qualified electrical worker.

[2] Grounding electrode conductors of portable power units shall be connected to the nearest metal water line or building structural metal using prescriptive methods and listed components.

5.6.3 480 Volt Portable Heaters

[1] Power cord assembly to heaters shall be performed by a qualified electrician.

[2] Heaters shall be kept a minimum of three feet from combustible materials.

[3] Power cords and plugs shall be inspected before use for damage and loose connections.

[4] Portable heaters shall not be supplied from a disconnect switch controlling more than one receptacle.

[5] Portable heaters shall be visually inspected annually to ensure there are no signs of degradation to cords, plugs and heater components, or restrictions to heater ventilating openings from dust, etc.

[6] Portable heaters shall be inspected at not more that 3-year intervals for continuity of conductors, integrity of cord ends and associated receptacles.

5.7 Physical Isolation of Electrical Equipment (Air-gapping)

5.7.1 The physical isolation of electrical components (e.g., air-gapping) refers to engineered changes that permanently disconnect and deenergize electrical systems and ensures that they cannot be inadvertently re-energized without engineering approval and significant field effort beyond normal maintenance practices. When establishing a physical isolation, the following requirements shall apply:

[1] A physical isolation can be accomplished by the cutting of a conductor, cable, or raceway with a minimum separation of six inches from the equipment it was connected to.

[2] The final configuration of the air-gapped circuit must provide adequate visible separation to ensure the circuit cannot be re-energized. Lifting and taping of leads, removing fuses, removing bus links, and opening disconnects do not qualify as physical air gaps.

[3] The area/equipment disconnected as the result of the air gap shall be labeled to indicate the separation has occurred.

5.7.2 Conductors cut inside panel enclosures must be cut back far enough to prevent them from being re-terminated to any termination point in the enclosure.

5.7.3 The physical isolation of electrical equipment as described above indicates that an electrical energy source is no longer present and establishing an electrically safe work condition is not required.

6.0 ELECTRICAL WORK PLANNING

6.1 General Planning

6.1.1 The FBP policy regarding electrical hazards is such that no worker shall be permitted to be intentionally exposed to an electrical hazard with or without PPE. When it can be demonstrated that it is infeasible to complete a task with the equipment, component, or system deenergized, appropriate safe work practices, including the use of PPE, shall be implemented.

6.1.2 Any event that exposed or had the potential to expose (near miss) an electrical hazard to personnel or damage to equipment shall follow the reporting requirements of FBP-QP-PRO-00019, *Occurrence Reporting and Processing*.

6.1.3 Work on or around electrical equipment that is no longer considered safe by the applicable installation codes and standards (not in the normal operating condition) shall be performed according to Integrated Safety Management System (ISMS) principles using safe work practices identified in NFPA 70E, FBP procedures, and the following:

- An electrical hazard evaluation including both an arc flash risk assessment and a shock hazard risk assessment shall be performed and documented in accordance with NFPA 70E and this program. The electrical hazard information shall be provided on FBP-OS-PRD-00001-F02, *Electrical Task Risk Assessment*, for all maintenance work or a hazard warning label is permitted to be placed on electrical equipment at construction locations.

- The electrical hazard evaluation shall consider the potential for human error and its negative consequences on people, processes, the work environment, and equipment relative to the electrical hazards in the workplace.

- All electrical equipment, circuit conductors, and circuit parts shall be considered energized until placed in an electrically safe work condition in accordance with NFPA 70E, Article 120.

NOTE

For a comprehensive list of items that should be discussed during a pre-job briefing, refer to Appendix B, *General Considerations For Pre-Job Briefing And Planning.*

6.1.4 Pre-job briefings shall be conducted for all electrical work that involves exposure to electrical hazards. The person in charge shall complete a pre-job briefing form and conduct a briefing with the employees involved. The pre job briefing shall include:

- A description of the job and individual tasks

- Identification of the electrical hazards associated with the task

- An electrical task risk assessment

- Any work procedures involved, special precautions and energy source controls

6.1.5 Appropriate safety signs or tags shall be used to warn employees about electrical hazards that could endanger them.

6.1.6 Barricades shall be used in conjunction with safety signs where it is necessary to limit or prevent employee access to work areas containing energized conductors or circuit parts.

[1] Barricades shall not be placed closer than the limited approach boundary or arc flash boundary whichever is greater.

[2] Barricades shall remain in place until the equipment doors are closed and secured and all equipment covers are in place and secured.

6.1.7 If signs and barricades do not provide sufficient warning or protection from electrical hazards, then an attendant shall be stationed to warn and protect employees.

6.1.8 It shall be permissible to station an attendant without safety sign(s) and barricade(s) to warn employees where the task is performing voltage measurements or applying jumpers for testing purposes.

[1] The attendant shall have no other duties than to warn others in area.

[2] The area shall never be left unattended unless covers and doors are replaced to a normal position.

6.1.9 When work is performed on deenergized electrical equipment that has been placed into an electrically safe work condition in an area with energized equipment that is similar in size, shape, and construction (look-alike equipment), an alerting method shall be used to prevent personnel from entering the look-alike equipment. The alerting method shall be in the form of signs, tags, barricades, or attendants.

NOTE

An electrically safe working condition is a state wherein all hazardous electrical conductors or circuit parts to which a worker might be exposed are placed and maintained in a deenergized state, for the purpose of eliminating electrical hazard(s) for the period of the electrically safe working condition.

6.1.10 The hierarchy of controls shall be:

- Elimination
- Substitution
- Engineered controls (barriers)
- Administrative controls
- PPE

6.1.11 Electrical PPE and other protective equipment shall meet the requirements of Section 8.0, *Electrical Personal Protective Equipment*.

6.1.12 Where the work to be performed inside the arc flash boundary exposes the worker to multiple hazards, PPE without an arc rating shall be permitted with special permission by the AHJ.

6.1.13 Test instruments including probes, cables, leads, and connectors shall be designed, rated, and approved for their application and visually inspected for external damage before each use. Instruments with evidence of damage shall be removed from service until determined safe for use.

6.1.14 A documented maintenance program shall be implemented that ensures electrical equipment will operate safely, within anticipated parameters, and without causing increased risk of hazard exposures to employees in the work area.

6.2 Planning Activities Involving Cranes and Derricks Working Within 20 Feet of Energized Overhead Power lines

NOTE

Deenergized and grounded is the preferred condition under which equipment operation should be performed because the hazard of injury or death due to electrocution has been removed.

6.2.1 Mandatory Barrier Control

[1] Power Operations shall be informed of work near overhead lines.

[2] Trained Operators and Spotters shall be used and shall meet the following requirements.

- The spotter shall be in place prior to movement of the equipment and be positioned to effectively gauge the clearance distance.
- Operators of equipment and spotters who work near energized overhead power lines shall be trained to:
    - Visually determine when equipment is nearing the LAB for overhead power lines
    - To establish and maintain effective communications between the operator and spotter
- The spotter shall have no duties other than being a spotter for a single specific operation.

- Spotters shall have direct communication with the equipment operator. The method of communication must take into account potentially high noise levels common with heavy equipment operation.

6.2.2 Secondary Barrier Control

As a minimum, one of the following secondary barrier controls shall be used in addition to a trained spotter:

- Install physical barriers to prevent encroachment into the LAB.
- Use stakes, cones, or painted lines to provide constant reminders to operators and spotters of the proximity to energized overhead lines.
- Use materials to enhance visibility of energized overhead lines for spotters.
- Have qualified personnel measure line height. Signs shall be posted to indicate overhead power line height to warn of energized overhead power lines and enable the spotter to accurately determine the clearance distance.
- Have qualified personnel raise or relocate energized overhead power lines and enable the spotter to accurately determine the clearance distance.
- Other control(s) may be permitted following review and approval by the electrical AHJ. This review shall verify the alternate controls are as effective as the controls listed above.

6.3 Planning Work with Potential to be Within the LAB of Overhead Lines

NOTE

This section shall apply to activities conducted in the vicinity of, but NOT on, overhead electrical conductors. It shall NOT apply to workers qualified to work on or near overhead line distribution systems.

6.3.1 If the area 360 degrees around the equipment up to the equipment's maximum working radius intersect with the LAB, then work shall be considered to have the potential to come within the LAB.

6.3.2 Overhead lines shall be deenergized when work is planning to be performed in the LAB or when the work activity/equipment has the potential to enter the LAB unless it is determined after a documented evaluation, considering probability, consequence, and risk for each phase/activity of the work scope that de-energizing is infeasible or creates a greater hazard.

6.3.3 If work will be performed within the LAB of energized overhead power lines under the exclusive control of Power Operations, then it is the responsibility of the organization performing the work to contact Power Operations to determine if:

- Overhead lines can be deenergized and grounded
- De-energizing overhead power lines are infeasible

6.3.4 If energized overhead lines are to be deenergized, then arrangements shall be made with the person or organization that operates or controls the overhead lines to deenergize them and implement appropriate hazardous energy control measures.

6.3.5 Where any mobile equipment will be elevated near communication lines, it shall be operated to avoid contact.

6.3.6 The lowest overhead line shall be flagged in construction areas and construction routes where there is a potential for mobile equipment to contact the overhead line.

NOTE

This section addresses performing core drilling, saw cutting, excavations, and other blind penetrations into surfaces containing concealed electrical conduits and cables.

6.4 Core Drilling, Excavations, and Blind Penetrations

6.4.1 Excavations shall be performed per the requirements of FBP-OS-PRO-00022, *Excavation/Penetration*.

6.4.2 If the presence and location of electrical circuits or conductors cannot be accurately identified and completely deenergized, appropriate mitigating controls shall be used. At a minimum:

[1] All applicable drawings and documentation shall be reviewed. The job site shall be inspected to the maximum extent possible to determine if obstructions are present before starting the job.

[2] A scan shall be performed if penetrating deeper than 1 ½ inches into concrete or masonry surfaces or excavating more than 11 inches into the earth.

[3] Circuits or conductors shall be deenergized to the maximum extent possible and placed in an electrically safe work condition if necessary.

[4] A JHA and a penetration permit shall be completed for work requiring penetrations deeper than 1 ½ inches into or through walls, floors, or other surfaces that may contain concealed electrical systems.

[5] When required, a drill stop box shall be used to ensure that the power is interrupted if a metal embedment is contacted during drilling operations. A drill stop box shall not be relied upon for shock protection. If the possibility of contacting a hidden energized circuit cannot be ruled out, appropriate electrical PPE based upon a documented risk assessment shall be used.

[6] When using water during drilling operations, a GFCI shall be used (see Section 4, *Ground Fault Circuit Interrupters [GFCIs]).*

6.5 Confined or Enclosed Work Spaces

When an employee works in a confined or enclosed space (such as a manhole or vault) that contains exposed energized electrical conductors or circuit parts operating at 50 volts or more, or where an electrical hazard exists, protective shields, protective barriers, or insulating materials will be used as necessary to avoid inadvertent contact with these parts and the effects of the electrical hazards. Manholes, hand holes, vaults, and large sections of equipment could enable an employee to enter an area that has exposed conductors that could be energized. Only authorized qualified employees will be permitted to enter these areas.

7.0 WORK INVOLVING ELECTRICAL HAZARDS

7.1 General

Before any worker is permitted to perform any activity inside the Limited Approach Boundary (LAB) or Arc Flash Boundary (AFB) energized parts operating at 50 volts more shall be placed into an electrically safe work condition unless the energized work is justified.

7.2 Energized Work Permit

7.2.1 Unless permitted by Step 7.2.2, an FBP OS-PRO-00102-F01, *Energized Electrical Work Permit*, shall be completed before a worker is authorized to work inside the Restricted Approach Boundary (RAB) or Arc Flash Boundary of exposed energized circuit parts operating at 50 volts or more.

NOTE

If a problem is discovered during the troubleshooting and either a component must be removed or repairs must be performed the circuit must be deenergized and locked out.

7.2.2 An energized electrical work permit shall not be required for diagnostic or troubleshooting tasks (e.g., taking voltage measurements or current readings) or for absence-of-voltage checks for Lockout/Tagout (LOTO), and visual inspections outside the Restricted Approach Boundary provided:

[1] Results of the electrical hazard risk assessment are documented

[2] Appropriate safe electrical work practices are incorporated into the work task

[3] Proper PPE is provided and used

[4] Authorization is obtained before work proceeds

7.3 Working within the Shock Approach Boundaries in Table 7.3A and Table 7.3B

7.3.1 Only qualified electrical workers shall perform servicing or maintenance on electrical equipment within the Limited Approach Boundary of exposed energized parts operating at 50 volts or more.

7.3.2 Unqualified persons shall be continuously escorted by a qualified electrical worker person if their authorized task requires them to cross the Limited Approach Boundary of exposed energized parts operating at 50 volts or more. Under no circumstances shall an unqualified person cross the Restricted Approach Boundary.

7.3.3 Tools, test instruments, and handling equipment used inside the Limited Approach Boundary shall be insulated for the voltage of the exposed energized parts. Other equipment used inside the Limited Approach Boundary shall be nonconductive.

7.3.4 Insulated tools shall be inspected before use to determine if there is evidence of insulation failure.

7.3.5 Parts being tested to verify absence of voltage shall be considered energized for the purpose of completing an electrical hazard risk assessment.

Table 7.3 A
Shock Protection Approach Boundaries to Exposed Energized Electrical Conductors or Circuit Parts for AC SYSTEMS

Nominal System Voltage Range	Limited Approach Boundary		Restricted Approach Boundary
Phase to Phase	Exposed Movable Conductor	Exposed Fixed Circuit Part	Includes Standard Inadvertent Movement Adder
Less than 50 V	Not Specified	Not Specified	Not Specified
50 V to 150V	10 ft 0 in.	3 ft 6 in	AVOID CONTACT
151 V to 750 V	10 ft 0 in.	3 ft 6 in.	1 ft 0 in.
751 V, not over 15 kV	10 ft 0 in.	5 ft 0 in.	2 ft 2 in.

Table 7.3 B Shock Protection Approach Boundaries to Exposed Energized Electrical Conductors or Circuit Parts for DC SYSTEMS			
Nominal System Voltage Range	**Limited Approach Boundary**		**Restricted Approach Boundary**
Nominal Potential Difference	Exposed Movable Conductor	Exposed Fixed Circuit Part	Includes Standard Inadvertent Movement Adder
Less than 50 V	Not Specified	Not Specified	Not Specified
50 V to 300 V	10 ft 0 in.	3 ft 6 in.	AVOID CONTACT

7.4 Working within the Arc Flash Boundary

7.4.1 Arc-rated apparel and other arc flash PPE shall be provided and used by any worker inside the arc flash boundary of exposed energized parts operating at 50 volts or more. Arc flash PPE shall be used when energized parts are not exposed, but the arc flash risk assessment identifies a potential arc flash hazard.

7.4.2 Arc flash PPE shall be identified by a task-specific risk assessment or information taken from an arc flash label on the equipment.

7.4.3 Servicing or maintenance including voltage testing on equipment identified with greater than 40 calorie per square centimeter (cal/cm^2) at the assumed working distance from the source of the prospective arc shall require an energized electrical work permit.

7.4.4 Conductive articles of jewelry and clothing (e.g., watchbands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, metal headgear, or metal frame glasses) shall not be worn within the restricted approach boundary or where they present an electrical contact hazard with exposed energized conductors or circuit parts.

7.4.5 Where conductors are deenergized in order to cut, remove, or re-route them and conductor termination points are not within sight, such as a junction or pull box or when fed through enclosures, additional steps to verify absence of voltage or identify the conductors shall be taken prior to cutting, removing, or re-routing the conductors.

7.5 Operating Overcurrent Protective Devices

7.5.1 An employee who operates a circuit breaker shall have demonstrated the knowledge in the safe operation of the equipment and the hazards involved. At a minimum, leather gloves and safety glasses shall be worn when operating an overcurrent protective device.

7.5.2 After a circuit is deenergized by the automatic operation of an overcurrent protective device (e.g., tripped circuit breaker, blown fuse), the circuit shall not be manually reenergized until the facility manager has been notified and it has been determined by a Qualified Electrical Worker(s) the equipment and circuit may be reenergized safely unless one of the following apply:

[1] Molded case circuit breakers with a maximum amperage of 20 amps and 120 volts may be reset one time by the Facility Manager or their designee after it has been determined the automatic operation of the breaker was caused by an overload condition before requesting the service of a qualified electrical worker.

[2] After it has been determined the automatic operation of an overload device or molded case circuit breaker was caused by an overload, operators of equipment controlling pump motors may reset the device one time before requesting the services of a qualified electrical worker where there are no exposed energized conductors or circuit parts and management has determined the operator is:

- Trained and knowledgeable in the construction and operation of the equipment
- Trained to identify and avoid the electrical hazards associated with the equipment and task

7.6 Batteries or Battery Banks Operating over 100 Volts

7.6.1 An electrical task risk assessment shall be completed before working within the Limited Approach Boundary of exposed energized parts operating at 100 volts direct current (vdc).

7.6.2 When performing work on batteries where chemical exposures may exist, the following chemical resistant PPE shall be worn as required by the Job Hazard Analysis.

- Goggle and face shields
- Gloves
- Protective aprons
- Protective footwear

7.6.3 Portable or stationary water facilities shall be available for rinsing eyes and skin in case of electrolyte spillage in accordance with FBP-IH-PRO-00081 *Emergency Safety Stations and Eyewash Equipment.*

7.6.4 Do not use tools or conductive objects that may short circuit any battery components.

7.6.5 Before making or breaking connections within a group of cells, open the battery system disconnecting means to minimize the possibility of arcing.

7.7 Multi-wire Branch Circuits

7.7.1 When a multi-wire branch circuit is being placed into an electrically safe work condition, all ungrounded conductors of the circuit shall be isolated.

7.7.2 Neutral conductors supplied from 120/240 volt, 208Y/120 volt and 277Y/480 volt systems shall be tested to determine if voltage is present when continuity of the neutral conductor is interrupted. The neutral conductor shall be considered energized until verification of the absence of voltage. This includes neutral conductors of circuits under Lockout/Tagout.

7.7.3 A shock risk assessment shall be performed to determine the proper controls, including the use of PPE during verification of absence of voltage on a neutral conductor on a suspected multi-wire branch circuit.

7.8 Inserting or Removing (Racking) a Circuit Breaker

7.8.1 Deenergized Equipment

[1] Inserting or removing (racking) a circuit breaker from a cubicle shall be done with the cubicle in a deenergized condition unless the manufacturer's operating instructions specifically allow for energized racking.

[2] The following steps shall be considered when racking circuit breakers:

a) Verify the circuit breaker and/or disconnect switch being used to deenergize the cubicle(s) will isolate power to the cubicle(s) by confirming the system configuration through consulting drawings, diagrams, or other engineering documents or by walk downs or visual inspections.

NOTE

If a circuit breaker or disconnect switch is not in its normal operating condition, it cannot be used to deenergize the cubicle.

b) Perform a risk assessment to establish the circuit breaker and/or disconnect switch being used to deenergize the cubicle where the circuit breaker is being racked from is in its normal operating condition.

c) Properly interrupt the load current. Use established procedures where applicable.

d) Confirm the equipment has been deenergized by using any available means (e.g., indicating lights or permanently installed volt meters or downstream three phase receptacle outlets) that does not expose the worker to greater risk (e.g., voltage testing at the cubicle where the racking is taking place).

e) Use the appropriate procedures and/or manufacturer's instructions to rack the circuit breaker.

7.8.2 Energized Equipment

[1] Inserting or removing (racking) a circuit breaker from a cubicle that has not been deenergized is considered energized electrical work unless the manufacturer's operating instructions specifically allow for energized racking.

[2] If the work can be justified by one of the following three options, the activity shall be approved by use of an energized electrical work permit (FBP-OS-PRO-00102, *Energized Electrical Work Permit*):

- Where it can be demonstrated there are additional hazards or an increased risk
- Where it can be demonstrated the task to be performed is infeasible in a de-energized state
- Where a normal operating condition exists

8.0 ELECTRICAL PERSONAL PROTECTIVE EQUIPMENT

8.1 General Information

8.1.1 Electrical PPE includes, but is not limited to, the equipment and clothing necessary to protect personnel performing electrical work from hazards involving electrical shock, arc flash, batteries, and any other electrical hazards that may be encountered.

8.1.2 Electrical PPE and other protective equipment that fails visual or functional inspection shall be removed from service.

8.1.3 PPE shall be:

- Maintained in a safe, reliable condition
- Stored in a manner that protects against physical damage, moisture, dust, or other deteriorating agents
- Visually inspected before each use

- Periodically inspected or tested in accordance with manufacturer's instructions and/or the applicable ANSI or ASTM standard(s)

8.1.4 All personnel are to be provided with and shall use PPE appropriate for potential shock or arc flash hazards to which they may be exposed.

8.1.5 Personnel shall be instructed in the proper use and maintenance of PPE prior to use.

8.2 Testing and Inspections

8.2.1 Gloves and sleeves shall have markings to indicate a test or retest date.

8.2.2 Voltage rated gloves with leather protectors shall be used when there is a danger of injury from electric shock due to contact with exposed energized electrical conductors or circuit parts.

8.2.3 If voltage rated gloves are used without leather protectors for a work task, the gloves shall be removed from service until electrically tested before a different work task is performed.

8.2.4 Electrical PPE shall be subject to periodic electrical tests per the applicable ASTM standard with the maximum test intervals as identified below.

Rubber Insulating Equipment	Testing Interval
Blankets	Before first issue; every 12 months thereafter ASTM F 479
Covers	If insulating value is suspect ASTM F 478
Gloves	Before first issue; every 6 months thereafter ASTM F 496
Line hose	If insulating value is suspect ASTM F 478
Sleeves	Before first issue; every 12 months thereafter ASTM F 496
Dielectric Footwear	If insulating value is suspect ASTM F 1117

8.2.5 An inspection shall be performed on voltage rated gloves and leather protectors prior to using them and immediately following any incident that is suspected of having caused damage.

8.2.6 The date on electrical PPE shall be verified to assure it is within the use period specified.

8.2.7 Visually inspect voltage rated gloves for cracks, holes, tears, foreign substances, and other visible defects before each use.

8.2.8 Perform air leakage test on voltage rated gloves.

8.2.9 Voltage rated gloves found with any defects that may affect the insulating properties shall not be used and immediately removed from service.

8.2.10 Voltage rated insulating sleeves shall also be used when there is an additional danger of arm injury from electric shock due to contact with energized electrical conductors or circuit parts.

8.2.11 Voltage rated gloves exposed to chemicals, damaged, or requiring periodic testing, cleaning, and sanitizing shall be taken from service until tested.

8.3 PPE Selection

8.3.1 Personnel shall wear appropriate layers of arc-rated clothing wherever there is potential exposure to an arc flash above the threshold incident energy level for a second-degree burn (1.2 cal/cm2).

8.3.2 The electrical task risk assessment provided with the work documents or as part of the procedure shall be the principle information used for the selection of PPE. The requirements in Table 8.7.13, *Arc Flash PPE Identification and Selection*, are designed to protect qualified electrical workers from arc flash hazards with incident energy levels up to 40 cal/cm^2. If the calculated incident energy exceeds 40 cal/cm^2, an electrical energized work permit shall be required to perform the work.

8.3.3 Table 8.7.13 uses two protection systems identified as Level 2, and Level 4. For situations which may be outside the standard applications, Management and Safety with advice from engineering, shall determine the PPE requirements.

8.3.4 Meltable fibers such as acetate, nylon, polyester, polypropolylene, and spandex shall not be permitted as fabric underlayers while donning arc flash PPE.

- An incidental amount of elastic used on non-melting fabric underwear or socks shall be permitted.

Table 8.7.13
Arc Flash PPE Identification and Selection

Incident Energy Value	PPE Level	Protective Clothing and Equipment
Equal to or greater than 1.2 cal/cm^2 up to 8.0 cal/cm^2	2	Minimum 8 cal/cm^2 Arc-rated Long Sleeve Shirt and Pants or Arc-rated Coveralls, Class E Hard Hat w/Arc-rated Wraparound Face Shield and Arc-rated Balaclava or Arc-rated Flash Suit Hood; Protective Leather Footwear; Safety Glasses; Ear Canal Inserts; Heavy Duty Leather Gloves or Voltage-Rated Gloves w/Leather Protectors
Greater than 8.0 cal/cm^2 up to 40 cal/cm^2	4	Minimum 40 cal/cm^2 Arc-rated Flash Suit Pants and Jacket; Arc-rated Coveralls; Class E Hard Hat w/Arc-rated Flash Suit Hood; Protective Leather Footwear; Safety Glasses; Ear Canal Inserts; Arc Rated Gloves, or Voltage-Rated Gloves w/Leather Protectors

9.0 INSPECTIONS AND ASSESSMENTS

9.1 NEC Inspections

9.1.1 All new electrical installations, modifications of existing electrical installations, and temporary electrical installations shall require an Electrical Inspection Request (EIR) unless it is determined by the NEC Inspector or Electrical AHJ the work does not require an EIR.

9.1.2 NEC Inspections are not required for installation or replacement of electrical utilization equipment approved for connection to permanently installed receptacles with cord attachments or for minor maintenance and repair work including like-for-like replacement of switches, fuses, lamp sockets, receptacles, replacing worn cords, and tightening connections on a wiring device.

NOTE

Contact Industrial Safety for listing and labeling of electrical components not part of an electrical installation.

9.1.3 Electrical equipment that is not part of an electrical installation that provides heat, light, or power to a work place is not required to be inspected to the NEC.

9.1.4 Design organizations should consult with an NEC Inspector during the design of new facilities, modification of existing facilities, and temporary installations to assure compliance with NEC codes, and to promote early identification of problems.

9.1.5 NEC Inspectors shall immediately notify the requestor of non-compliant conditions.

9.1.6 NEC Inspectors shall verify corrections of deficiencies per AHJ acceptance.

9.1.7 An NEC inspection is required to energize an electrical service, feeder, or branch circuit subject to inspection.

9.1.8 The NEC Inspector shall document the inspection.

9.1.9 Code compliance issues the requestor and the NEC Inspector cannot resolve satisfactorily shall be referred to the Electrical AHJ.

9.2 Electrical Task Risk Assessment

9.2.1 Electrical task risk assessments are required for tasks involving electrical maintenance work. The risk assessment will identify the hazards, assess the risks, and implement controls.

9.2.2 The electrical task risk assessment shall consider the potential for human error and its negative consequences on people, processes, the work environment, and equipment relative to the electrical hazards in the workplace.

9.2.3 FBP-OS-PRD-00001-F02 or the detailed information from the electrical hazard warning label placed on the equipment shall be used as documentation for electrical work packages to provide incident energy values, voltage ratings, and Personal Protective Equipment (PPE) levels.

9.2.4 FBP-OS-PRD-00001-F02 may be re-used for previously evaluated electrical equipment provided no information on the form has changed (excluding Work Order number) and the Arc Flash evaluation stated in Section 9 (Document number) has been validated as current each time it is used.

9.2.5 Other methods to determine electrical risks such as shock and arc flash hazards may be used in lieu of the Electrical Task Risk Assessment form for written procedures, D&D, or project work. The hazards and controls shall be documented in the work plan or procedure.

9.3 Program Assessments

The FBP ESP shall be assessed to help ensure that the principles and procedures of the Program are being followed. Where the assessment determines that the principles and procedures of the Program are not being followed, actions shall be taken to correct any observations or findings. Deficiencies and findings shall be documented in accordance with the FBP corrective action system. Issues concerning the FBP ESP that are identified through assessments and surveillance reports shall be forwarded to the FBP ESC. The ESP assessment shall be performed at intervals not to exceed three years.

10.0 DEFINITIONS/ACRONYMS

10.1 Definitions

A. **Authority Having Jurisdiction –** Appointed by the Site Project Director to be the ultimate authority on electrical issues at PORTS. Individual will have extensive experience in application of the NEC and the NFPA 70E.

B. **Approach Boundaries to Live Parts:**

[1] Arc Flash Boundary – When an arc flash hazard exists, an approach limit at a distance from an arc source at which incident energy equals 1.2 cal/cm^2.

[2] Limited Approach Boundary – An approach limit at a distance from an exposed energized electrical conductor or circuit part within which a shock hazard exists. To enter this boundary, a person must be qualified or continuously escorted by a qualified electrical worker.

[3] Restricted Approach Boundary – An approach limit at a distance from an exposed energized electrical conductor or circuit part within which there is an increased likelihood of electric shock, due to electrical arc-over combined with inadvertent movement. To work within this boundary, shock protection techniques must be employed. Unqualified persons cannot enter this boundary.

C. **Arc Flash Hazard –** A source of possible injury or damage to health associated with the release of energy caused by an electric arc.

D. **Arc Flash Suit –** A complete arc-rated clothing and equipment system that covers the entire body except for the hands and feet. This includes pants or leggings, jacket, and bee-keeper type hood fitted with a face shield and integrated hard hats all with appropriate arc ratings to protect against hazards.

E. **Arc Rating –** The value attributed to materials that describe their performance to exposure to an electrical arc discharge. The arc rating is expressed in cal/cm^2 and is derived from the determined value of the Arc Thermal Performance Value (ATPV) or Energy of Break open Threshold (EBT). Arc rating is reported as either ATPV or EBT whichever is the lower value.

F. **Barricade –** A physical obstruction such as boundary tape, cones, saw-horses, fence, or similar warning markers intended to provide warning and limit access to a **hazardous** area.

G. **Barrier –** A physical obstruction which is intended to prevent contact with energized **conductors**, circuit parts, lines, or equipment or to prevent unauthorized access to a work area.

H. **Balaclava (Sock Hood) –** An arc-rated head-protective fabric that protects the neck and head except for a small portion of the facial area.

I. **Dead Front –** Without live parts exposed to a person on the operating side of the equipment.

J. **Deenergized –** Free from any electrical connection to a source of potential difference and from electrical **charge**; not having a potential different from that of the earth.

K. **Electrical Hazard –** A dangerous condition such that contact or equipment failure can result in electric shock, arc **flash** burn, thermal burn, or arc blast injury.

L. **Electrically Safe Work Condition –** A state in which an electrical conductor or circuit part has been disconnected from **energized** parts, locked/tagged in accordance with established procedures, tested to verify the absence of voltage, and, if necessary, temporarily grounded for personnel protection..

M. **Electrical Task Risk Assessment.** An overall process that identifies hazards, estimates the likelihood of occurrence of injury or damage to health, estimates the potential severity of injury or damage to health and determines if protective measures are required. The term includes arc flash and shock risk assessments.

N. **Exposed (as applied to live parts) –** Parts that are not suitably guarded, isolated, or insulated and that are capable of being **inadvertently** touched or approached nearer than a safe distance by a person's body, tools, or material.

O. **Ground –** The earth.

P. **Ground Fault –** An unintentional, electrically conducting connection between an ungrounded conductor of an electrical **circuit** and the normally non-current carrying conductors, metallic enclosures, metallic raceways, metallic equipment, or earth.

Q. **Ground-Fault Circuit Interrupter (GFCI) –** A device intended for the protection of personnel that functions to deenergize a circuit or portion thereof within an established period of **time** when a current to ground exceeds the values established for a Class A device (4 milliamp [mA] to 6mA).

R. **Guarded –** Covered, **shielded**, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood or approach or contact by persons or objects to a point of danger.

S. **Incident Energy –** The amount of energy impressed on a surface, a certain distance from the source, **generated** during an electrical arc event. Incident energy is typically expressed in calories per square centimeter. (cal/cm^2).

T. **Normal Operating Condition –** A condition that exists when all the following conditions are met:

- The equipment is properly installed.
- The equipment is properly maintained.
- The equipment is used in accordance with instructions included in the listing and labeling and in accordance with the manufacturer's instructions.
- The equipment doors are closed and secured.
- All covers are in place and secured.
- There is no evidence of impending failure (e.g., loose or bound equipment parts, evidence of overheating or arcing, or deterioration).

U. **Overcurrent –** Any current in excess of the rated current of equipment or the ampacity of a conductor. It may result from overload, short circuit, or ground fault.

V. **Overload –** Operation of equipment in excess of normal, full-load rating, or of a conductor in excess of rated ampacity that would cause damage or dangerous overheating when it persists for a sufficient length of time. A fault such as a short circuit or ground fault is not an overload.

W. **Qualified Electrical Worker –** One who has demonstrated skills and knowledge related to the construction and **operation** of electrical equipment and installations and has received safety training to identify the hazards and reduce the associated risk.

X. **Risk.** A combination of the likelihood of occurrence of injury or damage to health and the severity of injury or damage to health the results in a hazard.

Y. **Service Point –** The point of connection between the facility of the serving utility and the premises wiring.

Z. **Shock Hazard -** A source of possible injury or damage to health associated with current through the body caused by contact or approach to energized electrical conductors or circuit parts.

AA. **Step Potential –**A ground potential gradient difference that can cause current flow from foot to foot through the body.

BB. **Touch Potential –** A ground potential gradient difference that can cause current flow from hand to hand, hand to foot, or another path other than foot to foot through the body.

CC. **Working Distance –** The distance between a person's face and chest area from a prospective arc source.

10.2 Acronyms

A. **AC –** Alternating Current

B. **AHJ -** Authority Having Jurisdiction

C. **ASTM –** American Society for Testing and Materials

D. **ATPV –** Arc Thermal Performance Value

E. **Cal/cm^2** – Calorie per centimeter squared

F. **CFR –** Code of Federal Regulations

G. **CPR –** Cardiopulmonary Resuscitation

H. **EBT** - Energy of Break open Threshold

I. **EIR -** Electrical Installation Request

J. **ESC –** Electrical Safety Committee

K. **ESP –** Electrical Safety Program

L. **FBP –** Fluor BWXT Portsmouth LLC

M. **GET –** General Employee Training

N. **GFCI** - Ground Fault Circuit Interrupters

O. **LAB -** Limited Approach Boundary

P. **NEC –** National Electrical Code

Q. **NFPA -** National Fire Protection Association

R. **NRTL –** Nationally Recognized Testing Laboratory

S. **OSHA –** Occupational Safety and Health Administration

T. **PORTS –** Portsmouth Gaseous Diffusion Plant

U. **PPE –** Personal Protective Equipment

V. **RAB –** Restricted Approach Boundary

11.0 REFERENCES

A. 10 CFR 851, *Worker Safety and Health Program*

B. 29 CFR 1910, Subpart I, *Personal Protective Equipment*

C. 29 CFR 1910, Subpart S, *Electrical*

D. 29 CFR 1910.137, *Electrical Protective Equipment*

E. 29 CFR 1910.269, Subpart R, *Electrical Power Generation, Transmission, and Distribution*

F. 29 CFR 1926, Subpart K, *Electrical*

G. 29 CFR 1926, Subpart CC, *Cranes & Derricks in Construction*

H. ASTM D 1048 - *Standard Specification for Rubber Insulating Blankets*

I. ASTM F 478 - *Standard Specification for In-Service Care of Insulating Line Hose and Covers*

J. ASTM F 479 - *Standard Specification for In-Service Care of Insulating Blankets*

K. ASTM F 496 - *Standard Specification for In-Service Care of Insulating Gloves and Sleeves*

L. ASTM F 696 - *Standard Specification for Leather Protectors for Rubber Insulating Gloves and Mittens*

M. ASTM F 1117 - *Standard Specification for Dielectric Footwear*

N. ASTM F 1236 - *Standard Guide for Visual Inspection of Electrical Protective Rubber Products*

O. ASTM F 1506 - *Standard Performance Specification for Flame Resistant and Arc Rated Textile Materials for Wearing Apparel for Use by Electrical Workers Exposed to Momentary Electric Arc and Related Thermal Hazards*

P. ASTM F 1891 - *Standard Specification for Arc and Flame Resistant Rainwear*

Q. DOE-HDBK-1092, DOE Handbook, *Electrical Safety*

R. DOE O 414.1, *Quality Assurance*, as amended

S. FBP-IH-PRO-00081 *Emergency Safety Stations and Eyewash Equipment*

T. FBP-NSE-PRO-00002, *Pre-Job Briefing and Post Job Review*

U. FBP-OS-PRO-00014, *Accident Prevention/Equipment Control Tags*

V. FBP-QP-PRO-00019, *Occurrence Reporting and Processing*

W. FBP-SM-PRO-00981, *Inspection and Testing of Ground Fault Circuit Interrupter Receptacles*

X. NFPA 70-2017, *National Electrical Code (NEC)*

Y. NFPA 70E-2018, *Standard for Electrical Safety in the Workplace*

Appendix A
REGULATORY REQUIREMENTS FLOW DOWN

10 CFR 851*, Worker Safety and Health Program*

Appendix B
GENERAL CONSIDERATIONS FOR PLANNING AND PRE-JOB BRIEFING

Identify the following:
- The hazards
- Voltage levels involved
- Skills required
- Secondary voltage sources
- Unusual work conditions
- Number of people needed to do the job
- Shock protection boundaries
- Available incident energy
- Potential for arc flash
- Flash protection boundary

Ask:
- Can the equipment be deenergized?
- Are backfeeds of the circuits to be worked on possible?
- Is a "standby person" required?
- Is temporary grounding required?
- Is there a potential for human error? Such as distractions, time pressure, repetitive work, etc.?

Check:
- Job plans/work package
- Single-line diagrams
- Procedures
- Vendor information
- LOTO Permit
- Energized Electrical Work Permit
- Other permits (confined space, hot work)
- Tools and equipment
- Personal protective equipment
- Procedures

Prepare for Emergencies:
- Is the standby person CPR trained?
- Is required emergency equipment available?
- Where is the nearest telephone? Fire alarm?
- How is equipment shut off in an emergency?
- Where is the fire extinguisher?

Are radio communications available?

Attachment A
ELECTRICAL INSTALLATION REQUEST
Page 1 of 3

ELECTRICAL INSTALLATION REQUEST

(Includes new, existing modifications and temporary installations)

Electrical Installation Request Form Instructions

To use this form:

1. The originator (e.g., engineer, planner, supervisor, project manager) shall complete blocks 5-11.
2. After completing Step 1, send form to the National Electrical Code (NEC) inspector. The NEC inspector will assign an inspection request number, complete blocks 1 -4 and return a copy to the originator for placement into the project work control documents.
3. The original request for inspection is maintained by the NEC inspector. A copy of the inspection request shall be provided to work control by the originator and maintained by the work control process. The working "field" copy of the inspection request may be placed in the work control documents.
4. Blocks 12 - 15 (applicability determined by the inspector) will be completed by the NEC inspector and may involve multiple inspections under one inspection request (i.e., service, backfill or cover, rough in).
5. When the final inspection has been completed, the NEC inspector places a copy of the completed inspection request form into the project work control document(s), sends a copy (usually scanned PDF, emailed) of the completed permit to the originator and company AHJ for the record.
6. All blank fields shall be marked N/A.

Attachment A
ELECTRICAL INSTALLATION REQUEST
Page 2 of 3

ELECTRICAL INSTALLATION REQUEST

(Includes new, existing modifications and temporary installations)

1. Request No.:					
2. Issue Date:		3. Close Date *(if applicable)*:			
4. Issued By:	Print Name:		Signature:		
5. Location Area:		6. Building:		7. Room:	
8. Project or Work Package No:					
9. Description of Electrical Installation including designated NEC inspection points:					
10. Job Supervisor:	Print Name:				
Signature:		Phone No.:			
11. Point of Contact:	Print Name:	Phone No.:			

12. *TO BE COMPLETED BY DESIGNATED NEC INSPECTOR ONLY*

The following inspection areas shall not be concealed until inspected.					**Inspection Type**	**Inspected By**		**Field Report**	
Inspection Type (Rough)	**Inspected By**		**Field Report**			Initials	Date	Yes	No
	Initials	Date	Yes	No	**Service**				
Walls					**Transformer**				
Ceiling					**Generator**				
Grounding					**Feeder/Subpanel**				
Trench					**Mobile Office Service**				
Slab					**Final**				
Underground									
Raceway									

13. Notes:	

Attachment A
ELECTRICAL INSTALLATION REQUEST
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ELECTRICAL INSTALLATION REQUEST

(Includes new, existing modifications and temporary installations)

14. Actions (s):	

15.	NEC Inspector (print name and signature):		Date Completed:	

Attachment B
ELECTRICAL TASK RISK ASSESSMENT FORM
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Electrical Task Risk Assessment Form

Section A, Task Identification *(To Be Completed by the Requestor)*			
Facility:		**Electrical Equipment:**	
Work Order No.:			
Electrical Task: *(Include specific location where task (AVT) is being performed)*			
Location:			
Submitter: *(Print)*		**Submitter Signature:**	**Date:**

Section B, General
(To be Completed by the Work Planner/Electrical Supervisor)
Check "Y" or "N" as appropriate

No.	Item	Yes	No	Instructions
1.	Is the equipment operating at more than 50 volts?	☐	☐	*If **No**, hazard analysis is not required. If **Yes**, proceed to Line 2.*
2.	Does Engineering Evaluation EVAL-DE-2013-0269 (Working on 120-240 VAC Energized Equipment) apply?	☐	☐	*If **No**, proceed to Line 3. If **Yes**, proceed to Line 6.*
3.	Is the maintenance of the upstream overcurrent protective device(s) current?	☐	☐	*If **Yes**, enter the PM completion date. If **No**, enter "No Date"*
	PM Completion Date:			***Proceed** to Line 4.*
4.	Approximate working distance (in inches) from the face and chest area required to perform the task:			*Determine the distance from the source to the workers face and chest. **Proceed** to Line 5.*
5.	Is there clear working space to support the required working distance?	☐	☐	*If **Yes**, **Proceed** to Section C, Line 6 If **No**, **Note** any working space restrictions and then **Proceed** to Section C, Line 6*
	Working Space Restrictions (if applicable):			

Section C, Shock Information
(To be Completed by the Work Planner/Electrical Supervisor)
Use FBP-OS-PRD-00001 Tables 7.3A (AC Systems) or 7.3B (DC Systems) as applicable
Check "Y" or "N" as appropriate

		Yes	No	Instructions
6.	Will there be exposed live parts?	☐	☐	*If **Yes**, proceed to line 7. If **No**, sign and submit to engineering.*
7.	Will work be performed inside the restricted approach boundary?	☐	☐	*If **yes**, shock protection is required. **Proceed** to Line 8*

Item		Instructions
8.	Voltage between phases:	***Establish** the shock boundaries.*
	Limited Approach Boundary:	***Sign** and submit to engineering.*
	Restricted Approach Boundary:	

Attachment B
ELECTRICAL TASK RISK ASSESSMENT FORM
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Electrical Task Risk Assessment Form

Planner:		**Planner Signature:**		**Date:**	

Section D, Arc Flash Information – Incident Energy Analysis Method
(To Be Completed by Engineering)

Item				Instructions
9.	Incident energy:		Working Distance:	***Establish*** *the incident energy, working distance and arc flash boundary.*
	Arc Flash Boundary:			
	Bus Location:			***Provide*** *bus location if known*
	Document No.:			***Provide*** *Engineering Evaluation or Design Analysis Calculation (DAC) No. (include revision No. if applicable)*

Completed By:		**Signature:**		**Date:**	

Section E, Arc-rated Clothing and Other PPE Information
(To be Completed by Industrial Safety if Not Previously Identified)

Item			Instructions
10.	Minimum voltage level for shock protection:		
11.	Minimum level of arc flash PPE required:		***Establish*** *the required arc-rated clothing and other PPE.*

Site-Specific PPE Levels

	Level 2 *(Greater than 1.2 cal/cm^2 up to 8.0 cal/cm^2 incident energy)*	**Level 4** *(Greater than 8.0 cal/cm^2 up to 40 cal/cm^2 incident energy)*
12.	*Minimum 8 cal/cm^2 Arc-rated Long Sleeve Shirt and Pants or Arc-rated Coveralls* *Class E Hard Hat w/Arc-rated Wraparound Face Shield and Arc-rated Balaclava or Arc-rated Flash Suit Hood* *Protective Leather Footwear* *Safety Glasses* *Ear Canal Inserts* *Voltage-Rated Gloves w/Leather Protectors or Heavy Duty Leather Gloves*	*Minimum 40 cal/cm^2 Arc-rated Flash Suit Pants and Jacket FR Coveralls* *Class E Hard Hat w/Arc-rated Flash Suit Hood* *Protective Leather Footwear* *Safety Glasses* *Ear Canal Inserts* *Voltage-Rated Gloves w/Leather Protectors or Arc-Rated Gloves*

JHA No.:					
Completed By:		**Signature:**		**Date:**	

Return to Initiator or Planner Upon Completion.

☐ **Validated for Reuse By:**		**Signature:**		**Date:**	