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Hanford Site Electrical Safety Program (HSESP)

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Approved for Public Release;
Further Dissemination Unlimited

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1.0 Purpose and Scope

This document establishes the Hanford Site Electrical Safety Program (HSESP), herein called the Program. The Program provides the requirements for electrical safe work practices and electrical safety training. Compliance with this Program ensures a workplace free from unplanned exposure to electrical hazards for all employees of participating Hanford-site contractors, sub contractors, sub-tier contractors, and vendors. This Program will also minimize the risk to Hanford-site equipment and facilities from the hazards of electricity.

This Program implements specific requirements of the following.

- National Fire Protection Association (NFPA) 70-2008, National Electrical Code (NEC)
- NFPA 70E-2009, Standard for Electrical Safety in the Workplace
- Code of Federal Regulations (CFR), Title 29, Occupational Safety and Health Administration (OSHA), 1910 Subpart S (29 CFR 1910), Electrical
- OSHA 29 CFR 1926, Subpart K, Electrical
- OSHA 29 CFR 1926, Subpart CC, Cranes & Derricks in Construction
- OSHA 29 CFR 1926, Subpart O, Motor Vehicles, Motorized Equipment, and Marine Operations
- 10 CFR Part 851 Worker Safety and Health Program
- American Society of Mechanical Engineers B30.5, Mobile and Locomotive Cranes

NOTE: *This Program does not contain all requirements of the above documents.*

This document does ***not*** cover any of the following.

- Installations or work involving automotive, watercraft, and similar equipment
- Installations under the exclusive control of Electrical Utilities (EU) for the purpose of metering, transmission, and distribution of electrical energy
- Lockout/Tagout activities; Department of Energy (DOE)-0336, *Hanford Site Lockout/Tagout*, provides requirements for lockout/tagout and shall take precedence over similar requirements in NFPA 70E if there is a conflict
- Telecommunications workers performing work under 29 CFR 1910.268

EU complies with the National Electric Safety Code (NESC) and 29 CFR 1910.269, Electric Power Generation, Transmission, and Distribution. EU participates in the Program by providing technical advice on matters relating to EU systems.

Definitions of terms specific to this Program may be found in NFPA and CFR source documents listed in Section 7.0, *References*.

This document supersedes DOE Richland Operations Office (RL) Richland Requirements Document (RRD)-005, Section D, *Electrical Safety Requirements*, and Section E, *Electrical Design and Installation Requirements*.

2.0 Implementation

This Program shall be implemented per DOE approved contractor implementation plans.

3.0 Roles and Responsibilities

3.1 Mission Support Contractor (MSC)

To administer the HSESP, the MSC shall:

- Appoint an Electrical Safety Program Coordinator
- Maintain two technical boards as the core of the HSESP, the Hanford Electrical Codes Board (HECB) and the Hanford Workplace Electrical Safety Board (HWESB)
- Maintain a current list of Authorities Having Jurisdiction (AHJs) for each participating contractor
- Provide administrative support for the HSESP Committee, the HECB, and the HWESB
- Coordinate electrical safety activities and initiatives with DOE and other Hanford-site contractors
- Ensure that meeting summaries, interpretations, lessons learned, and other information related to electrical safety is effectively communicated
- Maintain an HSESP website, accessible by all Hanford-site contractors, for electrical safety information
- Document decisions/interpretations and recommendations by the HSESP Committee, the HECB, and the HWESB

3.2 Prime Hanford Contractors

Each Prime Hanford Contractor shall ensure:

- The name(s) of the individual(s) appointed as AHJ, as defined in NFPA 70 and NFPA 70E, are submitted to DOE
- Personnel (to the lowest sub-tier contractor) who face a risk of electrical hazard are trained and qualified to perform the assigned work in accordance with this Program
- Safe work practices, as described in this Program, are used by workers under their direction, including non-electrical workers who use portable electric tools and equipment to perform maintenance, construction, and demolition activities
- Electrical equipment and supporting equipment (e.g. light poles, power poles) are installed using appropriate technical standards and approved instructions and procedures
- Qualified members of the HSESP Committee, HECB, and HWESB are appointed
- Electrical Installation Permits (EIPs) (Form A-6005-707) are obtained for all electrical system installations and modifications
- NEC inspections are scheduled at inspection points designated in the EIP and for re-inspection of corrected violations
- A database of NEC inspection reports is established and maintained
- Compliance with the Program requirements through periodic independent and self assessments

- Electrical incidents are investigated and trended, and significant incidents are communicated with the other Hanford-site contractors and the HSESP Committee in a timely manner

3.3 Hanford Site Electrical Safety Program (HSESP) Committee

The HSESP Committee shall be the collective interpretive authority for the HSESP, as per the Charter (Attachment 1**,** *Hanford Site Electrical Safety Program [HSESP] Committee Charter).*

3.4 Hanford Electrical Codes Board (HECB)

The HECB shall provide:

- Technical support and advice to the AHJ(s)
- The opportunity for all Hanford-site projects, facilities, and contractors to be represented by a designated point-of-contact (POC)
- Periodic meetings to serve as open forums for discussion of issues presented by NEC Inspectors, HSESP POCs, and other stakeholders
- Recommendations to the AHJ(s) on any disputes not resolved by the NEC Inspectors

3.5 Hanford Workplace Electrical Safety Board (HWESB)

The HWESB shall provide:

- Technical support and advice to the AHJ(s)
- The opportunity for all Hanford-site projects, facilities, and contractors to be represented by designated POCs
- Periodic meetings to serve as open forums for discussion of issues presented by POCs and other stakeholders
- Discussions of electrical events or trends across the DOE Complex

3.6 Authority Having Jurisdiction (AHJ)

The AHJ shall:

- Enforce and interpret all required documents stated in Section 1.0, *Purpose and Scope*
- Document company specific AHJ decisions and interpretations

3.7 National Electric Code (NEC) Inspectors

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 EIPs (Form A-6005-707)
- Consult with designers and installers on NEC compliance issues
- Perform field inspections for installations and modifications of electrical systems and equipment

- Issue NEC inspection reports to the EIP holder
- Present disputed NEC inspection reports and issues to the company AHJ(s) for resolution

3.8 Project/Construction/Maintenance/Operations/Engineering Manager

Project/construction/maintenance/operations/engineering managers shall ensure:

- Participation on the HECB and HWESB
- Safe work practices, as described in this Program and NFPA 70E, are used by workers under their direction, including non-electrical workers
- Approved personal protective equipment (PPE) for electrical work is provided and used by workers who are exposed to electrical hazards
- Personnel are trained to the requirements listed in Section 4.0, *Electrical Safety Training and Qualifications*

3.9 Qualified Electrical Workers

Qualified Electrical Workers shall:

- Perform work within the controls of the work document(s)
- Understand and follow the shock and arc flash hazard analysis
- Perform work commensurate with qualifications (See Section 4.0, *Electrical Safety Training and Qualifications*)
- Identify and communicate potentially unsafe electrical conditions

3.10 All Personnel

All personnel shall:

- Comply with applicable requirements of this Program
- Immediately report all electrical shocks, other than obvious static shocks, and be evaluated at a Hanford Site Occupational Medical Contractor first aid station

  NOTE: *Static shocks should be evaluated on a case-by-case basis, or as requested by the worker, to determine if medical evaluation is necessary.*

4.0 Electrical Safety Training and Qualifications

4.1 General Training Requirements

Consistent training is critical to successful implementation of the Program; it is recommended that training be provided by the Volpentest HAMMER Training and Education Center ("HAMMER"); however, contractors may provide their own training. All training shall meet the minimum requirements of the *Hanford Site Electrical Safety Program (HSESP) Course Descriptions, Objectives, and Training Requirements* and be reviewed and approved by the HSESP Committee.

Individual training equivalencies, waivers, and extensions shall be approved and documented by the appropriate Hanford-site contractor responsible training manager.

Training and/or retraining shall be commensurate with 10 CFR 851 and DOE O 414.1.

1. Workers who face a risk of exposure to electrical hazards shall have electrical safety training commensurate to their assigned duties. The degree of training provided shall be determined by the risk to the employee.

2. Documentation of training shall be available to supervisors/managers.

3. Initial NFPA 70E training shall include a hands-on element(s) to reinforce learning objectives.

4. An effort shall be made to ensure courses for continuing education units (CEUs) are certified by the State of Washington.

5. Personnel shall be instructed on the proper use and maintenance of PPE prior to use.

4.2 General Employees

General employees shall receive electrical training (initial and refresher) through completion of the Electrical Safety module of Hanford General Employee Training (HGET) (see *Hanford Site Electrical Safety Program [HSESP] Course Descriptions, Objectives, and Training Requirements*, Number 1, *HGET*).

4.3 Non-Electrical Workers

1. Non-electrical workers are employees who face a higher than normal risk of exposure to electrical hazards. This includes workers who operate electrical hand tools, such as drills and grinders, and who may operate electrical disconnect/breakers.

2. All non-electrical workers shall:
    a. Attend an OSHA based Electrical Cord and Power Tool Safety course (See *Hanford Site Electrical Safety Program [HSESP] Course Descriptions, Objectives, and Training Requirements*, Number 2, *OSHA Based Electrical Cord and Power Tool Safety Course*)
    b. Receive refresher training on an OSHA based Electrical Cord and Power Tool Safety course every 36 months

3. All non-electrical workers who operate electrical disconnects/breakers shall:
    a. Attend a Breaker Operation Electrical Safety course (See *Hanford Site Electrical Safety Program [HSESP] Course Descriptions, Objectives, and Training Requirements*, Number 3, *Breaker Operation Electrical Safety*)
    b. Receive refresher training on Breaker Operation Electrical Safety every 24 months

4.4 Qualified Instrument Specialists

1. It is the responsibility of the Qualified Instrument Specialist's employer to document and ensure that all Qualified Instrument Specialists are trained and qualified for their assigned task(s). Qualified Instrument Specialists shall meet at least one of the following criteria.
    a. Be an established instrument specialist working on the Hanford Site before the date of implementation
    b. Completion of an apprenticeship program
        - Employee provides verification of successfully completing a minimum of 8,100 hours in a recognized apprentice program and a minimum of three years of industry experience
    c. Equivalent military experience
        - Employee provides verification of a minimum of five years military training and/or experience applicable to the job responsibilities
    d. Equivalent industry experience
        - Employee provides verification of having worked in an industry for a minimum of five years with related responsibilities/job requirements
    e. Completion of a technical school and equivalent industry experience
        - Employee provides verification of successful completion of a minimum of two years at a recognized technical school and a minimum of three years of industry experience with related responsibilities/job requirements
    f. Management observation and evaluation
        - Management has conducted observations and evaluations and determined the employee, based on experience, training, and/or education, is qualified to perform job responsibilities

2. Qualified Instrument Specialists shall attend the following training.
    a. First Aid/CPR/AED training, at intervals not to exceed two years. Evidence of training shall be certified annually by a review of training records (See *Hanford Site Electrical Safety Program [HSESP] Course Descriptions, Objectives, and Training Requirements*, Number 4, *First Aid/CPR/AED*)
    b. NFPA-70E, Standards for Electrical Safety (See *Hanford Site Electrical Safety Program [HSESP] Course Descriptions, Objectives, and Training Requirements*, Number 5, *NFPA 70E Standards for Electrical Safety*). Qualified Instrument Specialists shall have refresher training to update regulations and electrical safety criteria, at intervals not to exceed three years

3. Qualified Instrument Specialists who are 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.

a. The skills and techniques necessary to distinguish exposed energized electrical conductors and circuit parts from other parts of electrical equipment
b. The skills and techniques necessary to determine the nominal voltage of exposed energized electrical conductors and circuit parts
c. The approach distances specified in Appendix A, *Limited Approach Boundaries for Overhead Lines*, NFPA 70E Table 130.2(C), and the corresponding voltages to which the Qualified Instrument Specialists will be exposed
d. The decision-making process necessary to determine the degree and extent of the hazard, PPE, and job planning necessary to perform the task safely

4. An instrument specialist, who is undergoing on-the-job training under the direct supervision of a Qualified Instrument Specialist, 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.

4.5 Qualified Instrument Specialist Supervisor

1. Qualified Instrument Specialist Supervisor includes, but is not limited to, first-line managers, fieldwork supervisors, and persons in charge (PIC); they shall have at least the same level of electrical safety training as the workers they supervise.

2. Qualified Instrument Specialist Supervisors shall have First Aid/CPR/AED training, at intervals not to exceed two years (See *Hanford Site Electrical Safety Program [HSESP] Course Descriptions, Objectives, and Training Requirements*, Number 4, *First Aid/CPR/AED*). Evidence of First Aid/CPR/AED training shall be certified annually by a review of training records.

3. Qualified Instrument Specialist Supervisors shall receive safety training to recognize and avoid the hazards involved. This includes:
   a. The skills and techniques necessary to distinguish exposed energized electrical conductors and/or circuit parts from other parts of electric equipment
   b. The skills and techniques necessary to recognize electrical shock hazards, arc flash hazards, and appropriate controls
   c. Familiarity with the proper use of the special precautionary techniques, PPE (including arc-flash, insulating, and shielding materials), and insulated tools and test equipment
   d. The approach distances specified in NFPA 70E, Table 130.2(C) and the corresponding voltages to which the Qualified Instrument Specialist will be exposed

4. Qualified Instrument Specialist Supervisors shall meet the company specific qualification requirements (e.g. Field Work Supervisor, PIC).

4.6 Qualified Electrical Worker

1. The responsible company shall document and ensure that all Qualified Electrical Workers are trained and qualified. Qualified Electrical Workers shall have, at a minimum, a general journeyman electrician state license or they shall meet one of the following criteria.
    a. Be an established electrician working on the Hanford Site before the date of implementation
    b. Completed 8,000 documented hours of electrical on-the-job training under the supervision of a journeyman electrician in light industrial, industrial, commercial, or construction and a minimum of 2,150 hours classroom training
    c. Electrical experience (e.g. military, other state) may be substituted for a portion of the 8,000 documented hours and 2,150 hours of classroom training requirements

2. Qualified Electrical Workers shall attend the following training.
    a. First Aid/CPR/AED training, at intervals not to exceed two years (See *Hanford Site Electrical Safety Program [HSESP] Course Descriptions, Objectives, and Training Requirements,* Number 4, *First Aid/CPR/AED*). Evidence of training shall be certified annually by a review of training records
    b. NFPA-70E, Standards for Electrical Safety (See *Hanford Site Electrical Safety Program [HSESP] Course Descriptions, Objectives, and Training Requirements*, Number 5, *NFPA 70E Standards for Electrical Safety*). Qualified Electrical Workers shall have refresher training to update regulations and electrical safety criteria, at intervals not to exceed three years

3. Qualified Electrical Workers shall maintain qualifications through continuing education: 28 hours per three-year cycle (at least eight hours of NFPA 70; four hours of Washington Administrative Code Chapter 246 updates; and 16 hours of additional state approved continuing education courses [DOE Order 414.1]).

4. Qualified Electrical Workers shall be familiar with the proper use of the special precautionary techniques, PPE (including arc-flash, insulating, and shielding materials), and insulated tools and test equipment. A person may be considered qualified with respect to certain equipment and methods but unqualified for others.

5. Qualified Electrical Workers who are permitted to work within the 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.
    a. The skills and techniques necessary to distinguish exposed energized electrical conductors and circuit parts from other parts of electrical equipment

b. The skills and techniques necessary to determine the nominal voltage of exposed energized electrical conductors and circuit parts
c. The approach distances specified in Appendix A, *Limited Approach Boundary for Overhead Electrical Lines*, NFPA 70E Table 130.2(C), and the corresponding voltages to which the Qualified Electrical Worker will be exposed
d. The decision-making process necessary to determine the degree and extent of the hazard, PPE, and job planning necessary to perform the task safely
e. Selecting an appropriate voltage detector, verifying the absence of voltage, interpreting the indications provided by the device, and understanding the limitations of each specific voltage detector that may be used

6. 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.

4.7 Qualified Electrical Supervisor

1. Qualified Electrical Supervisor includes, but is not limited to, first-line electrical managers, electrical fieldwork supervisors, and electrical persons in charge (PIC); they shall have at least the same level of electrical safety training as the workers they supervise.

2. Qualified Electrical Supervisors shall have First Aid/CPR/AED training, at intervals not to exceed two years (See *Hanford Site Electrical Safety Program [HSESP] Course Descriptions, Objectives, and Training Requirements*, Number 4, *First Aid/CPR/AED*). Evidence of First Aid/CPR/AED training shall be certified annually by a review of training records.

3. A Qualified Electrical Supervisor supervises/directs Qualified Electrical Workers conducting the technical aspects of electrical work. They shall have skills and knowledge related to the construction and operation of electrical equipment and installations.

4. Qualified Electrical Supervisors shall receive safety training to recognize and avoid the hazards involved. This includes:
   a. The skills and techniques necessary to distinguish exposed energized electrical conductors and/or circuit parts from other parts of electric equipment
   b. The skills and techniques necessary to recognize electrical shock hazards, arc flash hazards, and appropriate controls
   c. Familiarity with the proper use of the special precautionary techniques, PPE (including arc-flash, insulating, and shielding materials), and insulated tools and test equipment

d. The approach distances specified in NFPA 70E, Table 130.2(C) and the corresponding voltages to which the Qualified Electrical Worker will be exposed

5. Qualified Electrical Supervisors are not Qualified Electrical Workers unless they meet the requirements of Section 4.6, *Qualified Electrical Worker*.

6. Qualified Electrical Supervisors shall meet company specific qualification requirements (e.g.. Field Work Supervisor, PIC).

4.8 NEC Inspectors

1. NEC inspections shall be performed by designated NEC Inspectors who have been authorized by the AHJ to perform such inspections.

2. NEC Inspectors shall pass a nationally recognized test for general electrical inspectors and plan review inspectors. The International Association of Electrical Inspectors (IAEI) or the International Code Council (ICC) shall certify these tests.

3. NEC Inspectors shall have at least one of the following.
   a. No less than four years experience as a journeyman electrician installing and maintaining electrical equipment
   b. Two years electrical training in a college of electrical engineering of recognized standing and four years continuous practical electrical experience in installation work
   c. 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
   d. Approval and designation from the AHJ based upon years of experience in the electrical field

4. NEC Inspectors shall complete NFPA-70E, *Standards for Electrical Safety*, with refresher training at intervals not to exceed 36 months (See *Hanford Site Electrical Safety Program [HSESP] Course Descriptions, Objectives, and Training Requirements*, Number 5, *NFPA 70E Standards for Electrical Safety*).

5. NEC Inspectors shall remain cognizant of the latest status of the NEC via continued training and education.

4.9 Spotters

1. A spotter is an assigned person(s) whose sole responsibility is to provide a warning or stop signal during vehicle or equipment operation prior to violation of proximity restrictions or predetermined distance limitations to structures or hazards such as power and communication lines, overhead obstructions, buildings, telephone poles, or ground penetrations. (Some operations require the use of a qualified signalman/flagman as a spotter).

2. Spotters shall attend training courses that are appropriate for the hazards involved in equipment operations near power lines and energized electrical equipment.

4.10 Mobile Crane Operators and Crew Members

Training for crane operators and crew members should be followed as designated in DOE-RL-92-36, the *Hanford Site Hoisting and Rigging Manual (HSHRM)*.

4.11 Battery Training

Personnel, who install, maintain, or otherwise work directly with batteries that present a chemical or electrical hazard (battery or battery banks operating over 50 volts) shall complete Battery Safety Training (See *Hanford Site Electrical Safety Program [HSESP] Course Descriptions, Objectives, and Training Requirements*, Number 7, *Battery Safety*).

4.12 Capacitor Training

Personnel who install, maintain, remove, or dispose of capacitors (rated greater than 200µF in circuits greater than 100V) shall complete Capacitor Safety Training (See *Hanford Site Electrical Safety Program [HSESP] Course Descriptions, Objectives, and Training Requirements*, Number 8, *Capacitor Safety*).

5.0 Standard

5.1 Electrical Equipment Listing, Labeling, and Approval Requirements

1. All electrical equipment installed or used on the Hanford Site shall be approved by the contractor specific NFPA 70 AHJ.
    a. Electrical equipment shall be approved and acceptable for use if it has been accepted, certified, listed, labeled, or otherwise determined to be safe by an OSHA Nationally Recognized Testing Laboratory (NRTL) (as indicated by an NRTL label applied by the manufacturer).
    b. If 5.1.1.a is not met, and there is an Underwriters Laboratories (UL) standard for the piece of equipment, it shall be field evaluated and labeled by an OSHA recognized NRTL representative.
    c. For equipment that does not comply with 5.1.1.a or 5.1.1.b inspection and testing shall be completed using the Non-NRTL Electrical Equipment AHJ Approval Form/Instructions (Form A-6005-705) and labeled using the AHJ Approval for Non-NRTL Equipment (BL-6004-154). For an image of the required tag, see Appendix B, *Authority Having Jurisdiction (AHJ) Approval for Non-Nationally Recognized Testing Laboratory (NRTL) Equipment Label*.

EXCEPTION 1: Equipment connected to the load side of a class 2 or 3 power supply when it has been determined that listed equipment for the intended use is not available does not require AHJ approval prior to use

NOTE 1: *NRTL listed equipment operating at less than 50 volts, such as cable assemblies, instruments, security systems, low voltage lighting, communication*

systems, etc., is readily available, and is required to be listed. If it is determined during the procurement process that the specified listed product is not available, the AHJ may approve the product using an informal method.

NOTE 2: *Condition 5.1.1.c is reserved for use in unique situations or special needs that do not satisfy NRTL requirements.*

NOTE 3: *Legacy equipment and Non-NRTL equipment approved prior to the 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.*

NOTE 4: *See the OSHA website* (http://www.osha.gov/dts/otpca/nrtl/index.html) *for a list of OSHA recognized NRTLs.*

2. Equipment shall be suitable for its intended purpose and used in accordance with the manufacturer's instructions and any instructions or requirements of the NRTL listing or labeling.

3. All electrical multi-meters, including the external test leads, used on electrical equipment that operates over 50 volts shall be approved per paragraph 5.1.1. The standard multi-meter will be rated Category III or higher. Category II or less rated test instruments shall be permitted only when no instrument with a higher rating is available for the purpose and it can be assured the instrument will not be used outside the limits of its category rating.

5.2 Electrical Safe Work Practices

1. A hazard/risk evaluation, including both an arc flash and a shock hazard analysis shall be performed and documented for all electrical work in accordance with NFPA 70E and this Program.

2. All electrical equipment, circuit conductors, and circuit parts shall be considered energized until placed in an electrically safe work condition in accordance with DOE-0336, *Hanford Site Lockout/Tagout*.

3. Where there is not an accessible exposed point to take contact voltage measurements to determine the absence of voltage at work locations, planning considerations shall include approval of alternate methods of verification (e.g., proximity probes, non-contact probes, circuit tracers, current sensing probes).

4. Personnel may perform electrical work only to the level for which they have been trained and qualified in accordance with Section 4.0, *Electrical Safety Training and Qualifications*.

5. Appropriate signs, tags, barricades, or an attendant shall be used to warn and protect employees from hazards that may cause injury due to electric shock or arc

flash. If the attendant is required to be within the LAB, they shall be a Qualified Electrical Worker or a Qualified Instrument Specialist with appropriate PPE. If the attendant is required to be within the Arc Flash Protection Boundary, they shall be a Qualified Electrical Worker with appropriate PPE.

6. Where work performed on equipment that is de-energized and placed in an electrically safe condition exists in a work area with look-alike equipment (other energized equipment that is similar in size, shape, and construction), one of the alerting methods listed below (NFPA 70E 130.7[E], [1], [2], or [3]) shall be employed to prevent the employee from entering look-alike equipment.
    a. Safety signs and tags
    b. Barricades (used to establish a safe work boundary)
    c. Attendant(s)

7. Insulated tools and equipment shall be used, stored, maintained, and tested according to the manufacturer's instructions.

8. Electrical PPE and other protective equipment shall meet the requirements of Section 5.17, *Electrical PPE*.

9. All test instruments shall be designed, rated, and approved for their intended use, and visually inspected for external damage before being used on any shift. Damaged or defective equipment shall not be used (See NFPA 70E-2009, Article 110.9).

5.3 Ground Fault Circuit Interrupters (GFCIs)

1. GFCIs are for personnel protection to limit the severity of a shock to a non-injury level (less than 4 to 6 milliamps to ground). GFCIs do not eliminate shock.

2. GFCI protection for personnel shall be used when portable electric tools and equipment are used with temporary wiring methods or extension cord sets. This applies to portable tools and equipment connected to 125-volt single-phase 15, 20, or 30 amp receptacle outlets (NFPA 70-2008, Article 590.6).

3. All 125-volt single-phase 15, 20, or 30 amp receptacle outlets not part of the permanent wiring shall be provided with GFCI protection (NFPA 70-2008, Article 590.6.A).

4. Receptacles other than 125-volt, single-phase, 15, 20, and 30 amp receptacles not part of the permanent wiring shall have either GFCI protection or the Assured Equipment Grounding Conductor Program (AEGCP), Section 5.4, *Assured Equipment Grounding* (NFPA 70-2008, Article 590.6.B).

5. GFCI protection devices are not required where GFCI operation could interrupt power to critical systems (e.g., air monitoring equipment, egress lighting) and the requirements of Section 5.4, *Assured Equipment Grounding*, shall be met.

6. Portable electric equipment used in highly conductive work locations (such as those inundated with water or other conductive liquids) or in job locations where employees are likely to contact water or conductive liquids shall be approved for those locations. In job locations where employees are likely to contact or be drenched with water or conductive liquids, GFCI protection for personnel shall also be used (NFPA 70E 110.9[B][3][d]).

7. Permanently installed GFCI protection devices shall be tested in accordance with the manufacturer's instructions (NFPA 70E 110.9[C]).

8. GFCI receptacles shall not be used unless they have been tested within the past month.

9. GFCI receptacles located in areas that are not accessible, unoccupied facilities under long-term surveillance or undergoing deactivation/demolition, or that would create a greater hazard, shall be tested prior to use.

10. Portable GFCIs shall be tested prior to use.

11. Portable GFCIs should be located closest to the source, although equipment configuration may require locating the GFCI device closer to the worker.

12. 120-volt GFCI receptacles/in-line GFCI devices that trip during use may be reset one time. If the GFCI trips a second time, do not reset it. Contact management.

    NOTE: *For the purposes of this program a portable GFCI is a factory assembled, listed, inline device with a cord and attachment plug*.

5.4 Assured Equipment Grounding

1. All cord sets and receptacles not part of the permanent wiring and equipment connected by cord and plug shall be provided GFCI protection or maintained through the AEGCP.

   EXCEPTION: *This requirement does not apply to re-locatable power taps (RPTs) or surge protection devices (SPDs) when they are used in accordance with Section 5.6, Use of Extension Cords and Multiple Outlet Power Strips.*

2. Where a GFCI cannot be used (due to design or a power interruption[s] creating a greater hazard) for temporary wiring methods or extension cord sets providing power to supply portable electric tools and equipment that are used for construction, repair, maintenance, remodeling, and similar activities a documented AEGCP shall be maintained and implemented through a work control document. The following requirements shall be met.
   a. All equipment grounding conductors shall be tested for continuity and shall be electrically continuous.

b. 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.
c. Testing shall be performed:
   i. Before first use on site or if the inspection is not current
   ii. When there is evidence of damage
   iii. Before equipment is returned to service following any repairs
   iv. Before equipment is used after any incident which may be reasonably suspected to have caused damage (e.g., when a cord set is run over)
   v. Quarterly; cords shall not be used unless they have been inspected for the current quarter; inspections for the next quarter should occur during the last month of each quarter
      1. Quarterly inspection tags (G605911) (See Appendix C, *Quarterly Inspection Tag*, for an image of the required tag) shall be applied to the cord near the attachment plug in a visible location.

Quarter	Months
First	January, February, March
Second	April, May, June
Third	July, August, September
Fourth	October, November, December

d. Quarterly testing may be exempted if testing will present a greater hazard to personnel and the NFPA 70 AHJ approves the exemption.

5.5 Cord-and-Plug-Connected Equipment and Flexible Cord Sets for Maintenance, Construction, and Demolition Activities

1. General Use
   a. Cord-and-plug-connected equipment and flexible cord sets shall be maintained in a safe working condition.
   b. The attachment cord connected to the equipment shall be protected from accidental damage at all times.
   c. Damaged or defective equipment shall be immediately removed from service, marked as out-of-service, and not used until a qualified worker performs repairs and necessary tests to render the equipment safe, or the equipment is discarded. Management shall be notified when equipment is removed from service.

2. User Inspection
   Cord-and-plug-connected equipment and flexible cord sets used for maintenance, construction, and demolition activities shall be visually inspected prior to each use for external damage to ensure there are no:
   a. Breaks or cracks exposing energized conductors and circuit parts
   b. Missing cover plates

c. Missing, loose, altered, or damaged cord, blades, or pins/prongs, etc.

EXCEPTION: *Cord-and-plug-connected equipment and flexible cord sets (extension cords) that remain connected once put in place and are not exposed to damage are not required to be visually inspected until they are relocated (NFPA 70E 110.9[B][3]).*

5.6 Use of Extension Cords and Multiple Outlet Power Strips

1. To meet the requirements for use, manufactured extension cords and multi-tap adapters (splitters) shall:
    a. Be inspected for damage prior to use. Damaged equipment shall not be used
    b. Be listed or labeled by an OSHA-recognized NRTL
    c. Be used in accordance with manufacturer listing and labeling. If the manufacturer listing and labeling is unavailable or the total cord capacity is unknown, consult a Qualified Electrical Worker or an electrical engineer
    d. Not be used as a substitute for the fixed wiring of a structure
    e. Have a current rating that is greater than the connected load. The minimum size shall be 14/3 American Wire Gauge (AWG). It is recommended for longer cords (100 feet or greater) that a minimum size of 12/3 AWG be used
    f. Not be connected in series (daisy-chained), unless specifically designed and approved for this use (See Appendix D, *Acceptable and Unacceptable Combinations of Extension Cords and Power Strips*)
    g. Be unplugged and properly stored when not in use
    h. Not create a trip hazard
    i. Be protected from damage; sharp corners and projections shall be avoided. Where passing through doorways or other pinch points, there shall be substantial protection provided to avoid damage. Fire doors shall not be blocked open without the Fire Marshal's approval

2. Extension cords may be field-assembled by a Qualified Electrical Worker provided that:
    a. Each component is compatible with the other components and is NRTL-listed for the purpose
    b. A Qualified Electrical Worker verifies correct wiring of the extension cord and continuity of the grounding conductor before it is used
    c. The extension cord is durably marked to indicate the organization responsible for its assembly, the maximum allowable load in amps and watts, and whether or not it is suitable for outdoor use

3. Extension cords shall contain an equipment grounding conductor.

4. Extension cords may not be fastened in place in a manner that may damage the cords or restrict their movement.

5. Extension cords used outdoors shall be rated and labeled as suitable for outdoor use.

6. Extension cords may be plugged into portable GFCI protective devices if the permanently attached cord on the GFCI protective device is less than six feet in length.

7. Multi-tap adapters and portable GFCI protective devices are allowed to be used with extension cord sets, if allowed by company policy, as long as they are used within their rating and listed by an OSHA recognized NRTL.

8. Multiple outlet power strips, such as SPDs (surge protection devices) and RPTs (re-locatable power taps) may not be used outdoors or at construction sites or similar locations unless specifically listed and labeled for such use.

   NOTE: *If there is any uncertainty about the proper use or application of SPDs or RPTs, contact a Qualified Electrical Worker or an Electrical Subject Matter Expert (SME).*

9. Multiple outlet power strips shall be connected only to permanently installed branch circuit receptacles. They shall not be connected (daisy-chained) to other power taps, surge suppressors, or to extension cords. Multiple outlet power strips are intended only for indoor dry use.

   EXCEPTION: *Multiple outlet power strips may be connected to a single extension cord temporarily for testing, training, demonstrations, and similar purposes. This temporary configuration may not extend beyond one shift.*

10. Large electrical loads such as space heaters, heat generating devices (e.g., coffee pots), and appliances shall not be connected to an RPT, unless the RPT has been listed and rated for such use.

11. SPDs shall only be used for electronic equipment such as computers and telecommunication devices.

5.7 Work Involving Electrical Hazards

1. Electrical equipment (e.g., electrical enclosure panels, facility electrical overhead lines) that has exposed energized parts ≥50V may only be accessed when one or more of the following conditions exist.
   a. De-energize and Lockout/Tagout
      All energized electrical conductors and circuit parts to which an employee may be exposed shall be put into an electrically safe work condition in accordance with DOE-0336, *Hanford Site Lockout/Tagout* (NFPA 70E-2009 Article 130.1[A], 1910.333[a][1], and 1910.333[b][2]).
   b. Perform the Work with a Written Permit

When working within the LAB of energized electrical conductors or circuit parts that are not placed in an electrically safe work condition (e.g. for the reasons of increased or additional hazards or infeasibility, per NFPA 70E), justification and authorization shall be documented on an approved Energized Electrical Work Permit (EEWP) (Form A-6005-704) and shall require senior management authorization. The EEWP shall be included in the controlled work document (e.g., work package, technical procedure) and the job hazard analysis. Copies of completed EEWPs shall be forwarded to the NFPA 70E AHJ (NFPA 70E-2009 Article 130.1[B], 1910.333[b][1], 1910.333[a][2], 1910.333[a][1] and 1910.333[c][6]).

2. Exemptions to an EEWP
   The following tasks have been evaluated and require at a minimum, shock and arc flash hazard analyses to be completed and documented prior to starting work.
   a. An EEWP shall not be required when a Qualified Electrical Worker or Qualified Instrument Specialist working within the LAB of energized electrical conductors or circuit parts performs the following tasks where the employer can demonstrate that the task presents a greater hazard or is infeasible in a de-energized state due to equipment design or operational limitations.
      i. Testing
      ii. Troubleshooting
      iii. Calibration/adjustment
      iv. Voltage and current measurement
      v. Safe condition/safe-to-work checks
      vi. Working on class 2 circuits
      vii. Removing/replacing electrical device covers and enclosure covers
      viii. Lockout/tagout activities, re-setting overload devices, removing/installing fuses, and similar activities in electrical enclosures with multiple power sources that cannot be de-energized and when the restricted approach boundary will not be crossed. A task based hazard analysis shall identify additional protective measures (such as installing insulating barriers) to minimize/eliminate inadvertent contact.
   b. An EEWP shall not be required when a Qualified Electrical Worker is installing temporary protective measures outside of the restricted approach boundary such as protective shields/barriers, rubber insulating equipment, voltage rated plastic guard equipment, and physical or mechanical barriers.
   c. An EEWP shall not be required when Qualified Electrical Workers or Qualified Instrument Specialists are performing work where there is no arc flash hazard (less than 1.2 cal/cm^2 at the working distance) in an energized cabinet where exposed live parts have been guarded and all energized conductors or circuit parts ≥50V are not exposed. (This exemption is not applicable to voltages greater than 750V).

i. A documented hazard evaluation shall determine whether energized conductors or circuit parts are adequately isolated, insulated, or guarded to prevent inadvertent contact.
ii. If the requirements in paragraph 5.7.2.c.i are met, then work may be performed within the electrical enclosure/panel by a Qualified Electrical Worker, a Qualified Instrument Specialist, or an unqualified person escorted by a Qualified Electrical Worker or Qualified Instrument Specialist.
iii. Use of temporary protective measures shall have documentation of installation and removal.
iv. It is acceptable to allow temporary barriers to remain in place for the duration of the task with verification of adequacy by a Qualified Electrical Worker.

d. An EEWP shall not be required when crossing the LAB only for visual inspection by a Qualified Electrical Worker, a Qualified Instrument Specialist, or an unqualified person escorted by a Qualified Electrical Worker or a Qualified Instrument Specialist, and the Restricted Approach Boundary will not be crossed. If there is the potential for conductors to be damaged or penetrated by the act of reinstalling the cover, stop. Do not reinstall the cover until the hazard is evaluated and the proper precautions are implemented.

5.8 Working within the Limited Approach Boundary (LAB) or Flash Protection Boundary

1. Work performed within the LAB or the Flash Protection Boundary shall be performed by a Qualified Electrical Worker or Qualified Instrument Specialist using appropriate PPE.

   EXCEPTION: *The contractor AHJ may provide exceptions for Hanford Patrol, Hanford Fire Department, and Security Technicians/Specialists to enter the LAB, for systems under their exclusive control, based on specialized training and a hazard analysis that identifies the hazards involved and the associated controls.*

2. A shock hazard analysis shall be completed and documented on the Electrical Hazard Evaluation Form (A-6005-738) to determine the voltage (AC and DC) to which personnel will be exposed, boundary requirements, and the PPE necessary in order to minimize the possibility of electric shock to personnel.

3. For all three-phase equipment under the jurisdiction of the NEC, an arc flash hazard analysis shall be completed and documented to determine the Arc Flash Protection Boundary and the PPE that personnel within the Arc Flash Protection Boundary shall use. Three approved methods for performing an arc flash hazard analysis are described below. This analysis shall be documented on the Electrical Hazard Evaluation Form (A-6005-738).
   a. Incident Energy Analysis (preferred method)

This analysis involves a specific calculation where power system parameters, including utility system, cable, and transformer impedance are used to determine available three-phase fault currents on portions of the power system. From this data, arcing fault currents can be calculated, and based on clearing times of protective devices, incident energy (in cal/cm^2) is calculated at the working distance. PPE shall be selected based on the incident energy calculations.

b. If an Incident Energy Analysis has not been performed, NFPA 70E, Table 130.7(C)(9), "Hazard/Risk Category Classifications and Use of Rubber Insulation Gloves and Insulated and Insulating Hand Tools" may be used to determine the Hazard/Risk category based on the specific task. When using Table 130.7(C)(9), ensure the following limiting conditions are met. If any of the conditions listed below cannot be met, a detailed incident energy analysis is required.
    i. The specific task associated with the work scope shall be listed in Table 130.7(C)(9).
    ii. The available fault current at the specific work location does not exceed the values indicated in the notes following Table 130.7(C)(9).
    iii. The clearing time for the protective device that isolates the fault does not exceed the values indicated in the notes following Table 130.7(C)(9).

c. If clearing times and/or available fault current cannot be determined, the arc flash hazard analysis may be prepared under engineering supervision based on assumed values.

EXCEPTION: *An arc flash hazard analysis shall not be required where all of the following conditions exist.*

1. *The circuit is rated 240 volts or less.*
2. *One transformer or generator supplies the circuit.*
3. *The transformer or generator supplying the circuit is rated less than 125kVA.*

If an incident energy analysis has not been performed, and an arc flash hazard exists, the equipment to be worked on shall be field marked with a label containing a reference to NFPA 70E, Table 130.7(C)(9) for PPE determination prior to work being performed.

If an incident energy analysis has been performed, and an arc flash hazard exists, the equipment to be worked on shall be field marked with a label containing the available incident energy prior to work being performed. The equipment marking shall contain, as a minimum, the following information.

- Flash Protection Boundary
- Working distance
- Incident energy at working distance

- Calculation number and date
- Fault location (bus name)
- Protective device name that clears fault

Where the calculated incident energy is 40 cal/cm^2 or below, the label shall be an orange "WARNING" label; where the calculated incident energy exceeds 40 cal/cm^2, the label shall be a red "DANGER" label. See Appendix E, *Incident Energy Labels*, for sample labels.

When calculated incident energy exceeds 40 cal/cm^2, and de-energizing is not feasible, alternate work methods and controls shall be documented and have senior management authorizations.

4. Unqualified persons who are not escorted by a Qualified Electrical Worker or a Qualified Instrument Specialist shall not be permitted to enter areas that are required to be accessible to Qualified Electrical Workers or Qualified Instrument Specialists only, unless the electric conductors and equipment involved are in an electrically safe work condition.

5. Where there is a specific need for an unqualified person(s) to cross the LAB, a Qualified Electrical Worker or a Qualified Instrument Specialist shall advise the unqualified person of the possible hazards, and continuously escort the unqualified person(s) while inside the LAB. Under no circumstance shall the escorted unqualified person(s) be permitted to cross the Restricted Approach Boundary.

6. Under no circumstances shall an unqualified person(s) be permitted to cross the Arc Flash Protection Boundary.

7. At least two Qualified Electrical Workers shall be assigned to any work inside the Flash Protection Boundary or the Restricted Approach Boundary of exposed parts operating at more than 300 volts phase-to-phase or phase-to-ground. A Qualified Electrical Supervisor and a Qualified Electrical Worker shall evaluate work (independent of voltage) that presents a shock hazard or arc flash hazard to determine the minimum number of workers needed to ensure employee protection.

8. 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 where they present an electrical contact hazard with exposed energized conductors or circuit parts.

5.9 Over Current Protective Devices

5.9.1 Operating Circuit Breakers

1. An employee who operates a circuit breaker shall have knowledge in the safe operation of the equipment and the hazards involved (See paragraph 4.3.3 for required training and paragraph 5.17.10 for required PPE).

2. Protective device operation shall be simulated for emergency preparedness drills.

5.9.2 Reclosing (Re-Energizing) Circuits After Protective Device Operation

After a circuit is de-energized by an over current protective device (e.g., tripped circuit breaker, blown fuse), the circuit shall not be manually re-energized until it has been determined by a Qualified Electrical Worker(s) that the equipment and circuit may be re-energized safely (NFPA 70 E 130.6[k]).

NOTE 1: *Over current protective devices may be, but are not limited to, fuses, circuit breakers, and overloads.*

NOTE 2: *See Section 5.3, Ground Fault Circuit Interrupters (GFCIs), for resetting tripped GFCI receptacles.*

5.10 Planning Work that has the Potential to be within 20 feet of Overhead Lines

1. Work shall be considered to have the potential to come within the limited approach boundary (LAB) if the area 360 degrees around the equipment, up to the equipment's maximum working radius, intersects the LAB or the No Work Zone (as shown in Appendix F, *Operating Cranes near Energized Overhead Lines*, Figure A).

2. When planning work that has the potential to be within 20 feet of overhead lines contact Electrical Utilities (EU) or the owner of the line to determine line voltage. Use Appendix A, *Limited Approach Boundaries for Overhead Lines*, to determine the limited approach boundaries once line voltage has been verified.

3. Overhead lines shall be de-energized when work is planned to be performed in the LAB or when work activities/equipment have 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.

4. If de-energizing overhead lines introduces additional/increased hazards, or is infeasible, the responsible senior manager shall provide documented justification for performing the work energized considering probability, consequence, and risk for each phase/activity of the work scope.

5. If movement of vehicular or mechanical equipment over 14 feet high is planned, the use of a Hanford Site Oversize/Overweight Permit (Form A-6003-609) is required.

6. Work that has the potential to come within the LAB of overhead lines shall implement the following controls.
    a. The facility electrical maintenance, engineering organization, equipment operators, spotters, and supervisors directly involved in the work, and EU (for systems under EU jurisdiction), shall be involved in planning work.
    b. The work location and all paths of travel shall be walked down to identify potential electrical hazards.
    c. Involvement of EU shall include, but is not limited to, the following requirements.
        i. Consultation to determine effective controls, standby support, and outage support when planning work that may affect EU equipment or facilities, preferably a minimum of 48 hours prior to the start of work.
        ii. Consultation when planning work that may affect facility owned overhead electrical lines over 600 volts, as necessary.
        iii. When any combination of equipment, ladders, tools, personnel, etc. may come within the LAB of an energized overhead line.
        iv. When any combination of the equipment, load line, load, or fully extended boom length may come within a crane's prohibited zone or No Work Zone (as shown in Appendix F, *Operating Cranes near Energized Overhead Lines*, Figure A).
    d. The following activities require completion of an Electrical Utilities Site Visit Form (BC-6003-941) to determine line voltage and safe working distance.
        i. Crane operation (use of Electrical Utilities Mobile Crane Site Visit Form)
        ii. Equipment operation (e.g., back/track hoes, aerial lifts, dump trucks, vacuum excavators, forklifts)
        iii. Other work activities that may encroach upon the LAB (e.g., ladders, scaffolds, painting equipment)

        EXCEPTION: *For information on vehicle transit, see Section 5.11.1, Equipment in Transit.*

    e. In the event that the LAB cannot be maintained, then there shall be special planning to establish control measures for the protection of personnel, in accordance with Section 5.11.2.3, *Mobile Equipment Working Outside the Limited Approach Boundary (LAB) of Energized Overhead Lines with the Potential to Enter the LAB* and Section 5.11.2.4, *Mobile Equipment Working inside the Limited Approach Boundary (LAB) of Energized Overhead Lines*.
    f. If energized overhead lines are to be de-energized, arrangements shall be made with the person or organization that operates or controls the overhead lines to de-energize them and implement appropriate hazardous energy control measures. Where overhead lines are uninsulated, or the

insulation integrity has been determined inadequate, they shall be grounded within visual range of the point of work. If arrangements are made to use protective measures, such as guarding, isolating, or insulating, these precautions shall prevent each employee from contacting such overhead lines directly with any part of his or her body, or indirectly through conductive materials, tools, or equipment (NFPA 70E, 130.5 [B]).

g. If work will be performed within the LAB of energized overhead lines under the exclusive control of EU, it is the responsibility of the organization performing the work to follow Section 5.11.2.4, *Mobile Equipment Working Inside the Limited Approach Boundary (LAB) of Energized Overhead Lines* and contact EU to:
    i. De-energize and tag (hold off) the overhead lines
    ii. Over lock the utility's hold off tag (or equivalent) in accordance with DOE-0336, *Hanford Site Lockout/Tagout*.
    iii. Install personal protective grounds within visual range of the point of work
h. If equipment/tool operations have the potential to enter the LAB of energized overhead lines under the exclusive control of EU it is the responsibility of the organization performing the work to follow Section 5.11.2.3, *Mobile Equipment Working Outside the Limited Approach Boundary (LAB) of Energized Overhead Lines with the Potential to Enter the LAB* or contact EU to:
    i. De-energize and tag (hold off) the overhead lines
    ii. Work with the Controlling Organization to lock out the overhead lines
i. If the insulation of facility controlled overhead wiring, 600 volts or less, is damaged or may be damaged by work activities, a lockout/tagout per DOE-0336, *Hanford Site Lockout/Tagout*, shall meet the requirements for worker protection and grounding is not required.
j. The work package shall include direction to contact 373-0911 (the Hanford Emergency Number) and 373-2321 (Electrical Dispatch) in an overhead power-line emergency.
k. Daily pre-jobs briefings shall be held with equipment operators, spotters, and supervisors for continuing work to discuss potential overhead hazards and possible changes in working conditions or circumstances that may be expected to be encountered that day.
l. For work that is performed within the vicinity of high voltage power lines (115kV and higher), workers shall be advised of potential shock hazards where an electrostatic charge or induced voltage may build up on conductive and nonconductive equipment and personnel. The associated job planning for this work shall ensure adequate controls are in place to protect workers from secondary injury (e.g., falls, contusions) should primary controls fail.

5.11 Performing Work within 20 feet of Overhead Lines

5.11.1 Equipment in Transit

1. In this section the term "transit" refers to equipment (e.g., fork trucks, excavators, aerial lifts, back hoes) that is moving under its own power or being transported by trailer, without load and the structure lowered to its lowest practical stowed position prior to movement. Any equipment not in this configuration is considered to be performing work. Controls shall be implemented to ensure the equipment is configured in the lowest practical stowed position prior to movement.

2. Trucks (e.g., dump trucks, garbage trucks, Environmental Restoration Disposal Facility [ERDF] trucks) are considered in transit when moving under its own power with the structure lowered to its lowest stowed position. If the truck is carrying a load, the combined height of the equipment and load shall be less than 14 feet. When loading and unloading trucks an audible alarm or a spotter shall be used to verify that the bed is fully lowered prior to movement.

3. If the vehicle is in transit with its structure lowered to its lowest practical stowed position, the LAB to energized overhead lines may be found in Appendix A, *Limited Approach Boundaries for Overhead Lines*. If insulated barriers, rated for the voltages involved, are installed and they are not part of an attachment to the vehicle, the clearance shall be permitted to be reduced to the design working dimensions of the insulating barrier.

4. If the vehicle in transit will encroach upon the LAB found in Appendix A, *Limited Approach Boundaries for Overhead Lines*, one of the following controls shall be met.
    a. If de-energizing overhead lines introduces additional/increased hazards, or is infeasible, the responsible senior manager shall provide documented justification for performing the work energized, considering probability, consequence, and risk for each phase/activity of the work scope.
    b. The clearances may be reduced from Appendix A, *Limited Approach Boundaries for Overhead Lines*, to the design working dimensions of an insulating barrier.
    c. In addition to the primary and secondary barrier controls listed in Sections 5.11.2.3.2, *Mandatory Barrier Control*, and 5.11.2.3.3, *Secondary Barrier Controls*, an EU representative shall be on site. EU may require the following.
        i. Block or disengage electrical system protective devices that automatically re-energize the circuit after a fault
        ii. Install nonconductive barricades to restrict access to the work area

iii. Only allow essential personnel within the work area; all ground personnel are discouraged from touching the equipment

5.11.2 Mobile Equipment Operations near Energized Overhead Lines

This section is applicable to all outdoor work involving track hoes, forklift trucks, excavators, dump trucks, elevating work platforms, and all other mobile equipment; this excludes cranes (See Section 5.12, *Mobile Cranes Operating near Energized Overhead Lines*). If the work being performed presents a hazard of contact with power lines, outdoor premise wiring, overhead communication lines, or crossing the LAB of energized overhead lines see Appendix A, *Limited Approach Boundaries for Overhead Lines*.

5.11.2.1 Working near Communication Lines

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

5.11.2.2 Overhead Lines De-Energized and Grounded

This is the preferred condition under which mobile equipment operation should be performed because the hazard of injury or death due to electrocution has been removed. The following steps shall be taken to ensure overhead lines are de-energized.

1. EU, or the owner of the overhead lines, shall de-energize the lines.

2. The overhead lines shall be grounded within visual range of the work.

3. The necessity for grounding of wiring that has a manufacturer's applied coating of insulation, and is a 600-V service or less, shall be determined by EU or the owner of the overhead line.

4. The owner of the overhead lines or a designated representative of EU shall be on the site to verify that paragraphs 5.11.2.2.1 and 5.11.2.2.2 have been completed and that the overhead lines are no longer energized.

5. If overhead lines are de-energized and grounded, sections 5.11.2.3, *Mobile Equipment Working Outside the Limited Approach Boundary (LAB) of Energized Overhead Lines with the Potential to Enter the LAB*, and 5.11.2.4, *Mobile Equipment Working Inside the Limited Approach Boundary (LAB) of Energized Overhead Lines*, do not apply.

5.11.2.3 Mobile Equipment Working Outside the Limited Approach Boundary (LAB) of Energized Overhead Lines with the Potential to Enter the LAB

5.11.2.3.1 General

1. Where any mobile equipment structure will be elevated near energized overhead lines, they shall be operated so that the LAB distance of Appendix A, *Limited Approach Boundaries for Overhead Lines*, is maintained.

2. Contractors are required to utilize the mandatory barrier control below and at least one of the secondary barrier controls listed below.

5.11.2.3.2 Mandatory Barrier Control

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

1. The spotter shall be in place prior to movement of the equipment and be positioned to effectively gauge the clearance distance.

2. Operators of equipment and spotters who work near energized overhead lines shall be trained to visually determine when equipment is nearing the LAB for overhead lines and to establish and maintain effective communications between the operator and spotter.

3. The spotter shall have no duties other than being a spotter for a single specific operation.

4. 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.

5. Spotters shall be easily identifiable by the equipment operators.

5.11.2.3.3 Secondary Barrier Controls

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

1. Install physical barriers to prevent encroachment into the LAB.

2. Use stakes/cones or painted lines to provide constant reminders to operators and spotters of the proximity to energized overhead lines.

3. Use materials to enhance visibility of energized overhead lines for spotters.

4. Have EU personnel measure line height. Signs shall be posted to indicate overhead line height to warn of energized overhead lines and enable the spotter to accurately determine the clearance distance.

5. Have EU personnel raise or relocate energized overhead lines to reduce the possibility of an inadvertent contact.

6. Other control(s) may be permitted following review and approval by the contractor's AHJ. This review shall verify that the alternate controls are as effective as the controls listed above.

5.11.2.4 Mobile Equipment Working Inside the Limited Approach Boundary (LAB) of Energized Overhead Lines

1. If de-energizing overhead lines introduces additional/increased hazards, or is infeasible, the responsible senior manager shall provide documented justification for performing the work energized, considering probability, consequence, and risk for each phase/activity of the work scope.

2. The clearances may be reduced from Appendix A, *Limited Approach Boundaries for Overhead Lines*, to the design working dimensions of an insulating barrier.

3. In addition to the primary and secondary barrier controls listed in Sections 5.11.2.3.2, *Mandatory Barrier Control*, and 5.11.2.3.3, *Secondary Barrier Controls*, an EU representative shall be on site. EU may require the following.
   a. Block or disengage electrical system protective devices that automatically re-energize the circuit after a fault
   b. Install nonconductive barricades to restrict access to the work area
   c. Only allow essential personnel within the work area; all ground personnel are discouraged from touching the equipment

5.11.3 Personnel Working Outside the Limited Approach Boundary (LAB) of Energized Overhead Lines with the Physical Capability to Enter the Limited Approach Boundary

1. If the work being performed presents a hazard of contact with energized overhead lines, outdoor premise wiring, overhead communication lines, or crossing the LAB of energized overhead lines, follow the requirements of Section 5.7, *Work Involving Electrical Hazards*, and Section 5.8, *Working within the Limited Approach Boundary (LAB) or Flash Protection Boundary* (See NFPA 70E, Table 130.2[C]). Examples include, but are not limited to, work involving ladders, scaffolds, painting equipment, irrigation pipe, poles, or tools.

2. After an inspection of the overhead lines (600-V service or less) to evaluate insulation integrity of the conductors and terminations, EU or a Qualified Electrical Worker may determine that the insulation is intact and no further precautions are necessary as long as the work scope does not involve contact with the line. As an additional precaution, protective sleeves may be installed to protect the insulation from damage due to inadvertent contact.

5.12 Mobile Cranes Operating near Energized Overhead Lines

5.12.1 General

1. If de-energizing overhead lines introduces additional/increased hazards, or is infeasible, the responsible senior manager shall provide documented justification for performing the work energized.

2. Work shall be performed to prevent the possibility of the crane, load line, or load becoming a conductive path (See Appendix A, *Limited Approach Boundaries for Overhead Lines*).

3. Cranes shall not be used to handle materials under energized overhead lines if any combination of boom, load, load line, or machine component can enter the prohibited zone or the No Work Zone (see Appendix F, *Operating Cranes near Energized Overhead Lines*, Figure B). The prohibited zone for cranes is the LAB as defined in Appendix A, *Limited Approach Boundaries for Overhead Lines*.

4. Durable signs shall be installed at the operator's station and on the outside of the crane to warn that electrocution or serious bodily injury may occur unless minimum clearances, as specified in Appendix A, *Limited Approach Boundaries for Overhead Lines*, are maintained between the crane or the load being handled and energized overhead lines.

5. If cage-type boom guards, insulating links, or proximity warning devices are used on cranes, such devices shall not be a substitute for the requirements of paragraphs 5.12.2.1 and 5.12.2.2, even if such devices are

required by law or regulation. In view of the complex, invisible, and lethal nature of the electrical hazard involved, and to lessen the potential of false security, instructions on the electrical hazard involved, operating conditions for the devices, limitations of such devices, and testing requirements prescribed by the device manufacturer, if used, shall be understood by the crane operator, crew, and load-handling personnel. The required clearances to energized overhead lines, established in Appendix A, *Limited Approach Boundaries for Overhead Lines*, shall be maintained regardless of any devices used on the crane.

6. For cranes operating within 20 feet of the prohibited zone of high voltage power lines (115kV and higher), EU or the utility owner shall determine, during the site visit, the grounding requirements necessary to eliminate the potential hazards associated with electrostatic charge or induced voltage. Workers shall be advised of potential shock hazards.

7. In the event that the crane becomes electrified, the operator shall make an attempt to immediately move the equipment away, if possible, without compromising the safety of the operator.

8. All personnel involved in the work activity have Stop Work Authority in accordance with DOE-0343, *Stop Work*.

9. Devices originally designed by the manufacturer for use as a safety device, operational aid, or a means to prevent power line contact or electrocution, when used to comply with this section, must comply with the manufacturer's procedures for use and conditions of use.

10. Crane operators shall not rely on conductor insulation for their protection.

11. All overhead lines shall be considered energized until appropriate hazardous energy control measures are implemented.

12. Operation of a mobile crane within 20 feet of overhead lines shall be conducted in accordance with one of the following conditions.
    a. Overhead lines de-energized and grounded (See Section 5.12.2)
    b. Overhead lines energized, crane operating less than the erected/fully extended boom length away (See Section 5.12.3 and Appendix F, *Operating Cranes near Energized Overhead Lines*)
    c. Overhead lines energized, crane within prohibited zone (See Section 5.12.4)
    d. Crane in transit, no load, and boom lowered (See Section 5.12.5)

5.12.2 Overhead Lines De-energized and Grounded

This is the preferred condition under which mobile crane operation should be performed because the hazard of injury or death due to electrocution has been removed. The following steps shall be taken to ensure overhead lines are de-energized.

1. EU or the owner of the overhead lines shall de-energize the lines.

2. The overhead lines shall be grounded within visual range of the work.

3. The necessity for grounding of wiring that has a manufacturer's applied coating of insulation, and is a 600-V service or less, shall be determined by EU or the owner of the overhead line.

4. The owner of the overhead lines or a designated representative of EU shall be on the site to verify that paragraphs 5.12.2.1 and 5.12.2.2 have been completed and that the overhead lines are no longer energized.

5.12.3 Overhead Lines Energized, Crane Operating Less than the Erected/Fully Extended Boom Length Away (with the Physical Capability to Enter the Prohibited Zone or No Work Zone)

The following steps shall be taken to minimize the hazard of electrocution or serious injury as a result of contact between the energized overhead lines and the crane, load line, or load (see Appendix A, *Limited Approach Boundaries for Overhead Lines)*.

1. Representatives of the facility, the organization operating the crane, and EU or the owner of the overhead lines shall hold an on-site meeting to establish the procedures to safely complete the operations.

2. The specified clearance between the overhead lines and the crane, load line, and load shall be maintained at all times (see Appendix A, *Limited Approach Boundaries for Overhead Lines*).

3. Load control, when required, shall use non-conductive tag lines.

4. A spotter, who is a qualified signalperson per DOE-RL-92-36, *Hanford Hoisting and Rigging Manual*, shall be used. The spotter shall be in constant contact with the crane operator and shall have the sole responsibility of verifying that the required clearance is maintained and be positioned to effectively gauge the clearance distance.

5. No one shall be permitted to approach or touch the crane or the load unless the signalperson indicates it is safe to do so.

6. Operation of a boom and/or load above energized overhead lines is prohibited.

7. The horizontal and vertical conductor movement due to wind and temperature shall be added to the minimum clearance distance as specified in Appendix A, *Limited Approach Boundaries for Overhead Lines*. A qualified representative of the owner of the lines or a designated representative of EU shall be consulted for specific distances.

8. Durable signs shall be installed at the operator's station and on the outside of the crane to warn that electrocution or serious injury may occur unless minimum clearances, as specified in Appendix A, *Limited Approach Boundaries for Overhead Lines*, are maintained between the crane or load being handled and the energized overhead lines.

9. Erect and maintain an elevated warning line, barricade, or line of signs, in view of the operator, equipped with flags or similar high-visibility markings, at 20 feet from the power line or at the minimum approach distance under Appendix A, *Limited Approach Boundaries for Overhead Lines*. Other control(s) may be permitted following review and approval by the contractor's AHJ. This review shall verify that the alternate controls are as effective as the controls listed above.

5.12.4 Overhead Lines Energized, Crane within the Prohibited Zone or No Work Zone

1. Before operating a mobile crane within the prohibited zone, a qualified person together with a qualified representative of EU shall visit the site to determine if this is the most feasible way to complete the operation and set new minimum required clearances. The factors that must be considered in making this determination include, but are not limited to: conditions affecting atmospheric conductivity; time necessary to bring the equipment, load line, and load (including rigging and lifting accessories) to a complete stop; wind conditions; degree of sway in the power line; lighting conditions, and other conditions affecting the ability to prevent electrical contact. These operations shall be under their supervision. The clearances may be reduced from Appendix A, *Limited Approach Boundaries for Overhead Lines*, provided that insulated barriers are used and are rated for the voltage of the overhead line that it will be used on. The following controls shall be required in addition to the mandatory control listed in Section 5.11.2.3.2, *Mandatory Barrier Control*.
    a. Insulated barriers shall not be a part of, or an attachment to, the crane and shall not allow contact between the energized overhead lines and the crane, load lines, or load
    b. The crane/load shall be grounded by EU or the utility owner
    c. Automatic re-closers shall be blocked or disabled

d. Nonconductive barricades to restrict access to the crane work area shall be used
e. Erect and maintain an elevated warning line, barricade, or line of signs, in view of the operator, equipped with flags or similar high-visibility markings, at 20 feet from the power line or at the minimum approach distance under Appendix A, *Limited Approach Boundaries for Overhead Lines*
f. An insulating link/device installed at a point between the end of the load line (or below) and the load
g. Nonconductive rigging if the rigging may be within the approach boundary (see Appendix A, *Limited Approach Boundaries for Overhead Lines*) during the operation
h. If the crane is equipped with a device that automatically limits range of movement, it must be used and set to prevent any part of the equipment, load line, or load (including rigging and lifting accessories) from breaching the minimum approach distance
i. If a tag line is used, it must be of the nonconductive type
j. Barricades forming a perimeter at least 10 feet away from the crane to prevent unauthorized personnel from entering the work area. In areas where obstacles prevent the barricade from being at least 10 feet away, the barricade must be as far from the crane as feasible
k. Workers other than the operator shall be prohibited from touching the load line above the insulating link/device and crane. Operators remotely operating the crane from the ground shall use either wireless controls that isolate the operator from the crane or insulating mats that insulate the operator from the ground
l. Only personnel essential to the operation are permitted to be in the area of the crane and load
m. The crane shall be properly grounded
n. Insulating line hose or cover-up shall be installed by the utility owner/operator except where such devices are unavailable for the line voltages involved
o. The utility owner/operator (or registered professional engineer) and all employers of employees involved in the work must identify one person who will direct the implementation of the procedures. The person identified in accordance with this paragraph must direct the implementation of the procedures and must have the authority to stop work at any time to ensure safety. In most cases this person will be the Designated Lead (DL/Lift Director) as defined in the DOE-RL-92-36, *Hanford Hoisting and Rigging Manual*.

2. Load control, when required, shall use nonconductive tag lines.

3. A spotter, who is a qualified signalperson per DOE-RL-92-36, *Hanford Hoisting and Rigging Manual*, shall be used. The spotters shall be in constant contact with the crane operator and shall have the sole

responsibility of verifying that the new minimum required clearance is maintained and be positioned to effectively gauge the clearance distance. The spotter shall also be equipped with a visual aid to assist in identifying the minimum clearance distance. Examples of a visual aid include, but are not limited to: a line painted on the ground; a clearly visible line of stanchions; a set of clearly visible line-of-sight landmarks (such as a fence post behind the dedicated spotter and a building corner ahead of the dedicated spotter). This visual aid may be the same as that referred to in 5.12.4.1.e.

4. The person(s) responsible for the operation shall alert and warn the crane operator and all persons working around or near the crane about the hazard of electrocution or serious injury and instruct them on how to avoid the hazard.

5. All nonessential personnel shall be removed from the crane work area.

6. No one shall be permitted to approach or touch the crane or the load unless the spotter/signalperson indicates it is safe to do so.

5.12.5 Working near Transmitter/Communication Towers

1. When working near transmitter/communication towers where the equipment is close enough for an electrical charge to be induced in the equipment or materials being handled, the transmitter must be de-energized or the following precautions must be taken:
    a. The equipment must be provided with an electrical ground.
    b. If tag lines are used, they must be non-conductive.

5.12.6 Crane in Transit, No Load, Boom Lowered

1. This section establishes procedures and criteria that must be met for equipment traveling under or near a power line on a construction site without load. While in transit without load and boom and boom-support system lowered, the clearance shall be as specified in Appendix A, *Limited Approach Boundaries for Overhead Lines*.

2. When planning transit of the crane, the effect of speed and terrain on boom and crane movement shall be considered.

3. If any part of the equipment, while in transit on a construction worksite, will get closer than 20 feet to the power line, a dedicated spotter who is in continuous contact with the driver/operator shall be used. A construction worksite, as defined by 10 CFR 851.3, *Definitions*, is the area within the limits necessary to perform the work described in the construction, procurement, or authorization document. It includes the facility being

constructed or renovated along with all necessary staging and storage areas as well as adjacent areas subject to project hazards.

4. When traveling at night, or in conditions of poor visibility, the following additional requirements shall be met.
    a. The power lines are illuminated or another means of identifying the location of the lines is used.
    b. A safe path of travel is identified and used.

5.12.7 Crane Assembly and Disassembly near Overhead Lines

Assembly or disassembly near overhead lines is considered to be an operating crane, see Section 5.12, *Mobile Cranes Operating Near Energized Overhead Lines*, for applicable controls. For additional assembly and disassembly requirements see DOE-RL-92-36, the *Hanford Site Hoisting and Rigging Manual*.

5.13 Core Drilling, Excavations, and Blind Penetrations

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

2. Excavations shall be performed per the requirements of DOE-0344, *Hanford Site Excavating, Trenching and Shoring*.

3. If the presence and location of electrical circuits or conductors cannot be accurately identified and completely de-energized, appropriate mitigating controls shall be used. At a minimum:
    a. 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
    b. A scan shall be performed if penetrating deeper than 1 ½ inches into concrete or masonry surfaces
    c. Circuits or conductors shall be de-energized to the maximum extent possible and placed in an electrically safe work condition
    d. A hazard analysis (e.g., Job Hazard Analysis [JHA], Automated Job Hazard Analysis [AJHA]) 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
    e. Workers performing blind penetrations shall use appropriate voltage rated gloves with protective outer leather gloves and nonconductive safety glasses with side shields

4. When required, a drill stop box shall be used to ensure that the power is interrupted if metal embedments are 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 hazard evaluation shall be used.

5. When using water during drilling operations a GFCI shall be used (See Section 5.3, *Ground Fault Circuit Interrupters [GFCIs])*.

5.14 Generators

5.14.1 Electric Generators

1. When portable or vehicle-mounted generators are used to supply electrical loads from a generator-supplied feeder, a grounding electrode conductor connection to an electrode in accordance with NFPA 70 Article 250 is required.

2. Portable and vehicle mounted generators shall be listed and labeled, or approved in accordance with Section 5.1, *Electrical Equipment Listing, Labeling, and Approval Requirements*. Non-NRTL listed and labeled portable and vehicle-mounted generators shall be approved by the AHJ.

3. When manufacturer's instructions or equipment labeling require supplemental grounding, those instructions shall be followed.

4. Any connection or disconnection of cables/cord sets at the generator output terminals, load side terminals of the generator output circuit breaker, or connections at the load end of the feeder require lockout/tagout in accordance with DOE-0336, *Hanford Site Lockout/Tagout*.

5. Cables/cord sets shall be disconnected from the generator source output circuit breaker or output terminals when they are not terminated at the load end.

5.14.2 Portable Generators

1. Portable describes equipment that is easily carried by personnel from one location to another.

2. The frame of a portable generator shall not be required to be connected to a grounding electrode for a system supplied by the generator under the following conditions.
    a. The generator supplies only equipment mounted on the generator, and/or GFCI protected cord-and-plug-connected equipment through receptacles mounted on the generator
    b. The normally non-current-carrying metal parts of equipment and the equipment grounding conductor terminals of the receptacles are connected to the generator frame (NFPA 70 Article 250.34 [A])

5.14.3 Vehicle-Mounted Generators

1. The frame of a vehicle shall be connected to a grounding electrode for a system supplied by a generator located on the vehicle unless all of the following conditions are met.
    a. The frame of the generator is bonded to the vehicle frame
    b. The generator supplies only equipment located on the vehicle and/or GFCI protected cord-and plug-connected equipment through receptacles mounted on the vehicle
    c. The normally non-current-carrying metal parts of equipment and the equipment grounding conductor terminals of the receptacles are connected to the generator frame (NFPA 70 Article 250.34[B])

2. Initial energization of generators shall be accomplished via the Generator Initial Start-Up Checklist (Form A-6005-436). Subsequent generator startups shall be accomplished via the Generator Re-Start-Up Checklist (Form A-6005-437).

    EXCEPTION: *This does not apply to single-phase 120/240 volt generators that supply only cord-and plug-connected equipment that is connected to the generator's mounted receptacles.*

5.15 Batteries or Battery Banks Operating over 50 Volts

1. For the purpose of shock hazard analysis, DC voltages shall be considered equivalent to AC voltages referenced in NFPA 70E and appropriate voltage rated PPE shall be worn.

    NOTE: *DC sources are not considered an arc flash hazard and an arc flash hazard analysis is not required.*

2. When performing work on batteries where chemical exposures may exist, the following chemical resistant PPE shall be worn, as required by the hazard analysis.
    a. Goggle and face shields
    b. Gloves
    c. Protective aprons
    d. Protective footwear

3. Portable or stationary water facilities shall be available for rinsing eyes and skin in case of electrolyte spillage, in accordance with American National Standards Institute (ANSI) Z358.1.

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

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

5.16 Capacitors

This section applies to circuits greater than 100V with the associated capacitor rating greater than 200µF.

1. For the purpose of shock hazard analysis, DC voltages shall be considered equivalent to AC voltages referenced in NFPA 70E and appropriate voltage rated PPE shall be worn.

2. Only Qualified Electrical Workers or Qualified Instrument Specialists trained in the proper handling and storage of power capacitors and hazard recognition shall be assigned the task of removing/servicing/installing such units.

3. Access to capacitor areas shall be restricted until all capacitors have been discharged, shorted, and grounded.

4. Any residual charge from capacitors shall be removed by shorting the terminals before servicing or removing.

5. Capacitors shall be discharged using an appropriately voltage rated shorting probe. If capacitors have been removed from the circuit or are being transported, the terminals shall be continuously short circuited using no smaller than #14 AWG.

6. Automatic discharge and grounding devices should not be relied upon.

7. Shorting probes shall be inspected before each use.

8. Capacitor terminals should be considered “charged”" until the terminals are shorted.

5.17 Electrical Personal Protective Equipment (PPE)

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.

   NOTE: *PPE for non-electrical hazards (e.g., battery acid) shall also be considered.*

2. Electrical PPE and other protective equipment that has an expired testing date or fails visual or functional inspection shall be removed from service.

3. PPE shall be:
   a. Maintained in a safe, reliable condition
   b. Stored in a manner that protects against physical damage, moisture, dust, or other deteriorating agents

c. Visually inspected before each use
d. Periodically inspected or tested in accordance with manufacturer's instructions and/or the applicable ANSI or American Society for Testing and Materials (ASTM) standard(s)

4. All personnel are to be provided, and shall use, PPE appropriate for potential shock or arc flash hazards to which they may be exposed. All parts of the body inside the arc flash protection boundary shall be protected.

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

   NOTE: *Requirements for PPE are provided in NFPA 70E, Chapter 1, "Safety Related Work Practices."*

6. Voltage rated rubber-insulating equipment shall be marked with the issue date and shall expire after the testing interval listed.

7. Electrical PPE shall be subject to periodic electrical tests with the maximum test intervals as identified below.

Rubber Insulating Equipment	**Testing Interval**
Blankets	Before first issue; every 12 months thereafter
Covers	If insulating value is suspect
Gloves	Before first issue; every 6 months thereafter
Line hose	If insulating value is suspect
Sleeves	Before first issue; every 12 months thereafter

8. Voltage rated gloves, preferably with leather protectors, shall be used when there is a danger of injury from electric shock due to contact with energized electrical conductors or circuit parts.
   a. An inspection shall be performed prior to using gloves and immediately following any incident that is suspected of having caused damage
      i. Check date on gloves to verify it is within periodicity
      ii. Visually inspect for cracks, holes, tears, foreign substances, and other visible defects
      iii. Perform air leakage test on gloves
      iv. Gloves found with any defects that may affect its insulating properties shall be removed from service

b. 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
c. Gloves exposed to chemicals, damaged, or requiring periodic testing, cleaning and sanitizing shall be returned to EU

9. Personnel who operate circuit breakers, electrical disconnect switches, and similar switchgear equipment, up to 600 volts, with doors closed and all covers in place shall wear, as a minimum:
   - Hearing protection
   - Non-melting (untreated natural fiber) pants and long-sleeve shirt
   - Safety glasses
   - Leather or insulating gloves

   EXCEPTION: *If either of the following conditions is met, the above minimum PPE is not required.*
   a. The circuit is rated 240 volts or less, is supplied by one transformer, and the transformer supplying the circuit is rated less than 125kVa
   b. The incident energy is less than 1.2 cal/cm^2 at the working distance

10. Personnel shall wear appropriate layers of Flame-Resistant (FR) clothing wherever there is potential exposure to an arc flash above the threshold incident-energy level for a second-degree burn (1.2 cal/cm^2).

    EXCEPTION: *Where the work to be performed inside the arc flash protection boundary exposes the worker to multiple hazards, non-FR PPE shall be permitted under special permission by the AHJ.*

5.18 National Electric Code (NEC) Inspections

1. NEC Inspections are required for new electrical installations and modification of existing electrical installations to ensure compliance with the NEC.

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.

3. Electrical equipment that is listed and labeled by an NRTL is not required to be individually NEC inspected when it is being installed as a component of a system or facility that is subject to NEC inspection.

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

5. EIPs (Electrical Installation Permit) (Form A-6005-707) are required prior to performing any electrical installations or modifications. NEC Inspectors prepare EIPs to document the scope of the inspection, any corrections of deficiencies that were performed, and whether the work inspected is approved or not approved. EIPs shall be available at the job site.

6. Block EIPs may be used to cover a specified boundary such as a managed building, facility, or area. Block EIPs shall be valid for no more than 12 months. The NEC Inspector shall evaluate the scope of work, and reserves the right to deny the use of a Block Permit and require an individual Permit to cover the scope of work. Block EIPs shall be available at the job site.

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

8. NEC Inspectors shall approve corrections of deficiencies.

9. An NEC inspection is required to energize an electrical service. The NEC Inspector shall document the inspection and approval of the electrical service on the NEC Service Inspection Label (BL-6002-745) (See Appendix G, *National Electric Code [NEC] Inspection Labels*) and shall attach the inspection label to the electrical equipment.

10. Code compliance issues that the requestor and the NEC Inspector cannot resolve satisfactorily shall be referred to the company AHJ.

5.19 Program Assessments

The HSESP shall be assessed to help ensure that the principles and procedures of the Program are being followed. The first assessment of the Program shall occur 12 months after implementation. Subsequent program evaluations shall be conducted every 2 years thereafter, at a minimum. Where the assessment determines that the principles and procedures of the Program are not being followed, contractors shall take actions to correct any observations or findings. Deficiencies and findings shall be documented in accordance with the contractors' corrective action system.

Issues concerning the HSESP that are identified through assessments and surveillance reports shall be forwarded to the HSESP Committee.

6.0 Recordkeeping

Records and documentation generated by the Program shall be processed and maintained in accordance with appropriate contractor policies.

7.0 References

1. 10 CFR 851, "Worker Safety and Health Program."
2. 29 CFR 1910, Subpart I, "Personal Protective Equipment."
    a. 1910.137, "Electrical Protective Equipment."

3. 29 CFR 1910, Subpart S, “Electrical.”
4. 29 CFR 1926, Subpart K, “Electrical.”
5. 29 CFR 1926, Subpart CC, “Cranes & Derricks in Contruction.”
6. 29 CFR 1926, Subpart O, “Motor Vehicles, Motorized Equipment, and Marine Operations.”
7. 29 CFR 1910.268, Subpart R, “Telecommunications.”
8. 29 CFR 1910.269, Subpart R, “Electrical Power Generation, Transmission, and Distribution.”
9. 29 CFR 1926, Subpart V, “Power Transmission and Distribution”
10. NFPA 70-2008, “National Electrical Code (NEC).”
11. NFPA 70E-2009, “Standard for Electrical Safety in the Workplace.”
12. DOE-0336, “Hanford Site Lockout/Tagout.”
13. DOE-HDBK-1092, DOE Handbook, “Electrical Safety.”
14. DOE-RL-92-36, “Hanford Site Hoisting and Rigging Manual.”
15. DOE-0344, “Hanford Site Excavating, Trenching, and Shoring.”
16. DOE O 414.1, “Quality Assurance,”as amended.
17. American Society of Mechanical Engineers B30.5, “Mobile and Locomotive Cranes.”

Appendix A: Limited Approach Boundaries for Overhead Lines

	Equipment in Transit	Equipment Performing Work	Cranes in Transit	Cranes Performing Work[1]
Communication Wire	Avoid contact	Avoid contact	Avoid contact	Avoid contact
50-750 V	4 feet	10 feet	4 feet	10 feet (See Section 5.12)
2.4-13.8 kV	4 feet	10 feet	6 feet	10 feet (See Section 5.12)
115 kV	6 feet, 2 inches	12 feet, 2 inches	10 feet	15 feet (See Section 5.12)
230 kV	10 feet	16 feet	10 feet	20 feet (See Section 5.12)
500 kV[2]	19 feet	25 feet	19 feet	50 feet (See Section 5.12)

1. The limited approach boundary for cranes is the "prohibited zone" as defined in American Society of Mechanical Engineers (ASME) B30.5 and OSHA 1926.1400 Subpart CC, *Cranes and Derricks*.
2. The 500kV lines on the Hanford Site are owned by the Bonneville Power Administration (BPA). Any work near these lines requires prior contact with BPA.

NOTE: *All numbers are based on the most conservative requirements from the National Fire Protection Association (NFPA) 70E, Code of Federal Regulations, Title 29, Occupational Safety and Health Administration 29 CFR 1910.333 (c)(3)(iii)(A), and ASME B30.5 (for cranes).*

Appendix B: Authority Having Jurisdiction (AHJ) Approval for Non-Nationally Recognized Testing Laboratory (NRTL) Equipment Label

AHJ Approval for Non-NRTL Equipment

AHJ Report No _____

Manufacturer _____

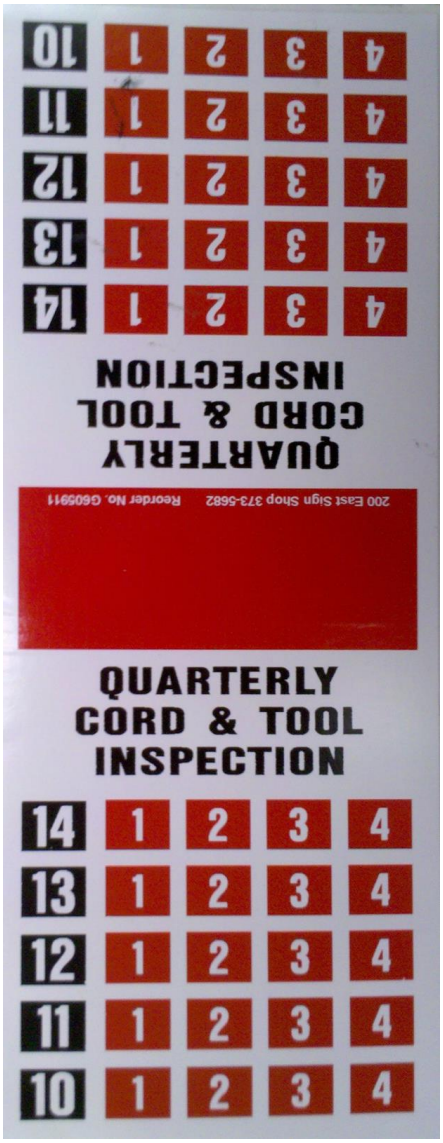
Serial No _____

Evaluated by (Print/sign) Date

_____

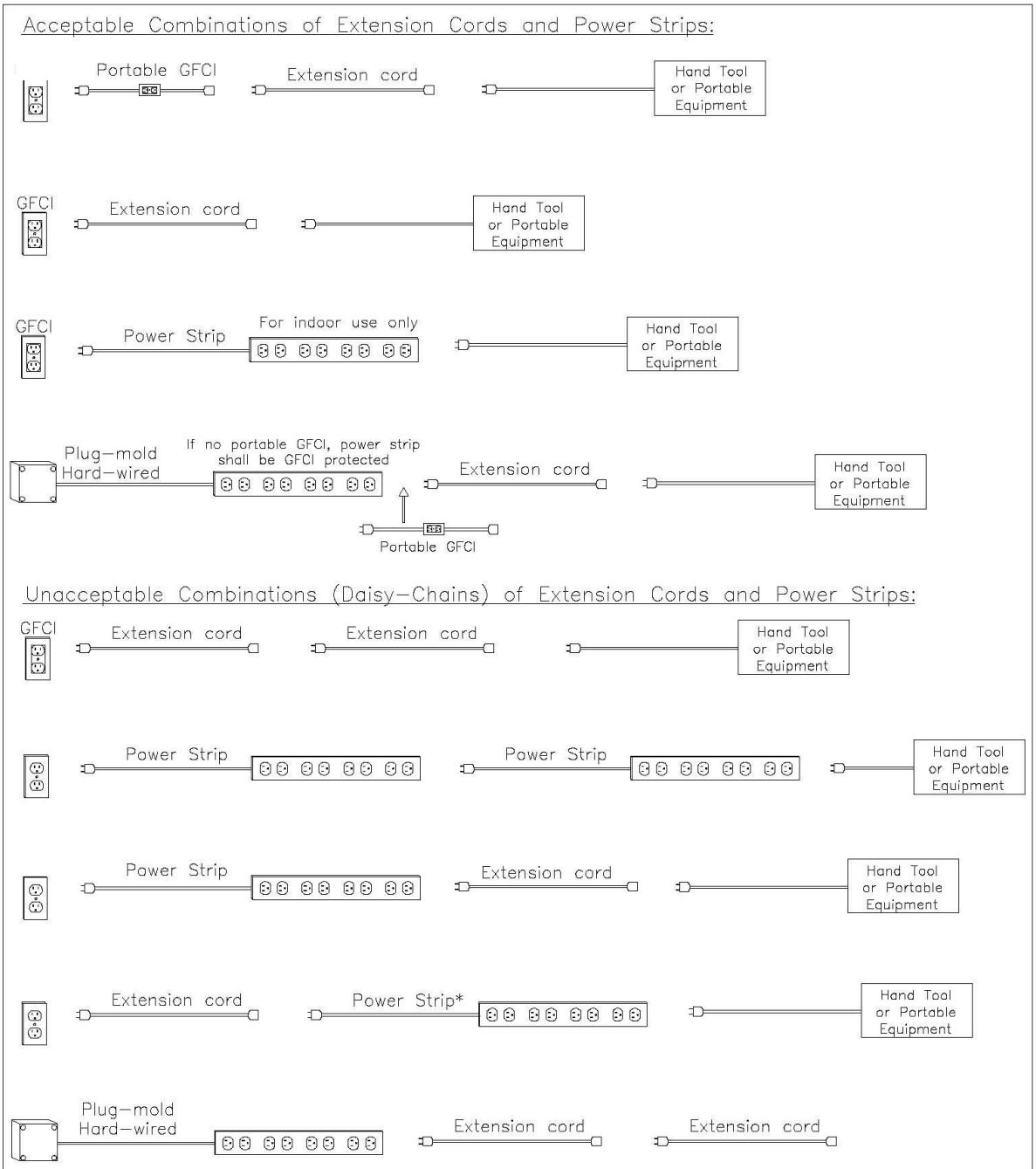
BL-6004-154

Appendix C: Quarterly Inspection Tag



Quarterly Inspection Tag G605911

Appendix D: Acceptable and Unacceptable Combinations of Extension Cords and Power Strips



***EXCEPTIONS**: A power strip may be connected to a single extension cord temporarily for testing, training, and similar purposes. This temporary configuration may not extend beyond one shift.*

***NOTE**: GFCI devices are not required where GFCI operation could interrupt power to critical systems (i.e. air monitoring equipment, egress lighting).*

Appendix E: Incident Energy Labels

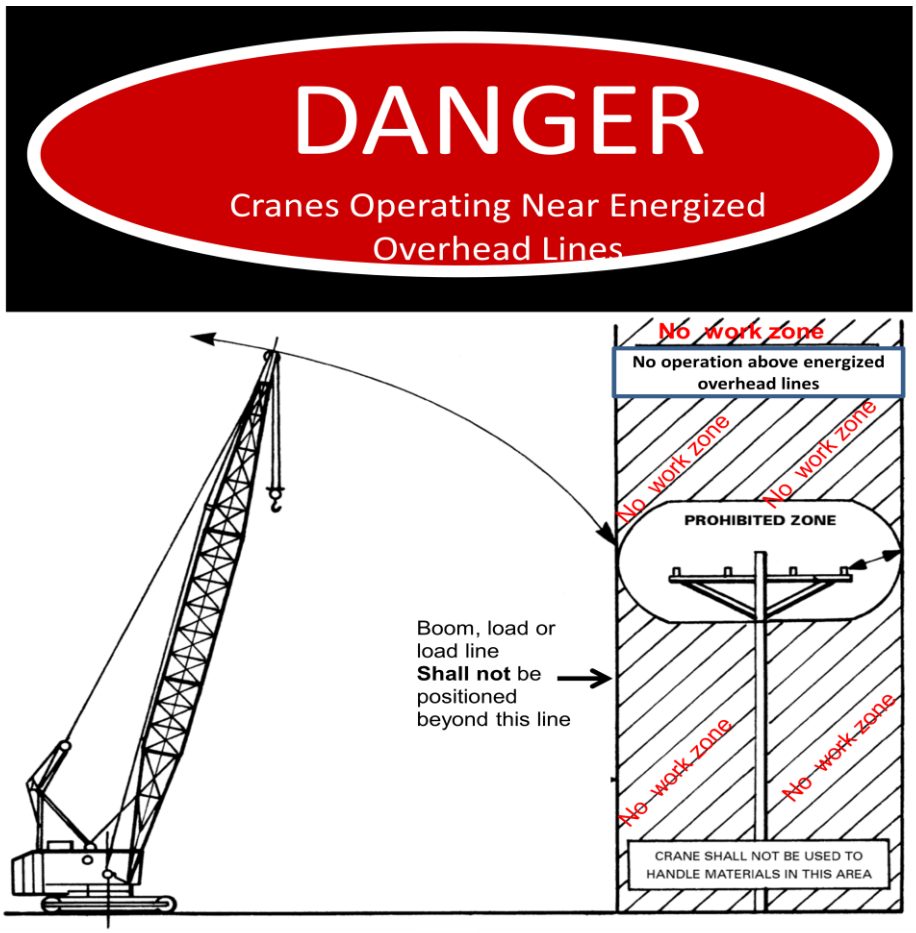
WARNING			
ARC FLASH HAZARD			
APPROPRIATE PPE REQUIRED			
BUS FAULT	**Flash Protection Boundary:**	**(inches)**	**inches**
	Working Distance:	**18**	**inches**
	Incident Energy:	**(incident energy)**	**cal/cm^2**
Calc No.	(calculation number, rev, date)		
Bus:	**(bus name)**		
Prot Device:	**(protective device name)**		

DANGER			
ARC FLASH HAZARD			
ABOVE 40 cal/cm^2			
BUS FAULT	**Flash Protection Boundary:**	**(inches)**	**inches**
	Working Distance:	**18**	**inches**
	Incident Energy:	**(incident energy)**	**cal/cm^2**
Calc No.	(calculation number, rev, date)		
Bus:	**(bus name)**		
Prot Device:	**(protective device name)**		

Reissue

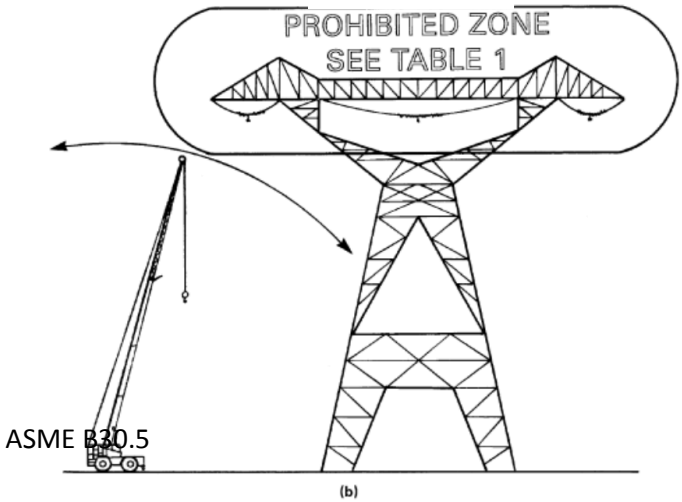
Appendix F: Operating Cranes near Energized Overhead Lines

Figure A



ASME B30.5

Figure B



ASME B30.5

Appendix G: National Electric Code (NEC) Inspection Labels

Attachment 1: Hanford Site Electrical Safety Program (HSESP) Committee Charter

The Hanford Site Electrical Safety Program (HSESP) Committee is established to serve as the group providing consensus direction for the consistent administration and implementation of the HSESP, herein called the Program. The participating contractors and organizations are responsible for appointing representatives to the committee.

The Department of Energy (DOE) Richland Operations Office (RL), DOE Office of River Protection (ORP), and affected Contractors acknowledge that a joint committee provides the best approach for implementing a consistent, effective, and compliant interpretation of requirements for the Program. The parties agree to cooperate in a teambuilding manner to ensure that the full intent of the Program is met and will be responsibly carried out by their respective organizations.

1.0 Mission

The mission of the HSESP Committee is to ensure consistent and standard application of the Program to promote and maintain a safe work environment. The Committee will achieve this consistent approach through sharing best practices, lessons learned, and taking advice and receiving input from the Hanford Workplace Electrical Safety Board (HWESB) and the Hanford Electrical Codes Board (HECB).

2.0 Committee Structure/Membership/Qualification

The Committee shall be comprised of two primary representatives each from the following prime contractors to the DOE at Hanford:

- Mission Support Contract (MSC)
- Plateau Remediation Contract (PRC)
- River Corridor Contract (RCC)
- Tank Operations Contract (TOC)

One representative shall be the contractor's Technical Representative for the HSESP Program as determined by their contractor; the second representative shall be a Hanford Atomic Metal Trades Council (HAMTC) representative (as appointed by the HAMTC President or delegate).

In addition, one representative each from the following organizations shall be appointed to serve on the Committee:

- Central Washington Building and Construction Trades Council (CWB & CTC) (as approved by the Union President or delegate)
- HAMTC
- Electrical Utilities (EU)

These representatives comprise the consensus decision-making membership. An alternate member shall be identified to serve during any absence of a primary representative. The alternate shall have the same authority as the primary representative in their absence.

A representative from Volpentest HAMMER Training and Education Center, Training Department (HAMMER) shall attend meetings as an advisory member to address matters

pertaining to training. A representative of the Hanford Hoisting and Rigging Committee shall be invited to participate at each meeting as an advisory member.

A Committee member's length of duty may be indeterminate.

A chair and co-chair shall be elected by a simple majority of the voting membership of the Committee every two years. The chair and co-chair may be re-elected to their respective positions.

Meetings shall be open to others to observe and to give their organizations' impact, perspectives, and technical advice for consideration of the Committee; however, participation in consensus decisions resides solely with the Committee members described herein. The Committee has the authority to develop sub-committees and invite ad hoc participants as needed.

Representatives of RL and ORP shall be invited to participate at each meeting as advisory members.

The MSC shall provide a recording secretary for the Committee. The recording secretary is a position that provides administrative support to the chairperson. A facilitator shall be provided by the MSC as requested by the Committee.

3.0 Functions of the HSESP Committee

The functions of the Committee shall be:

- Elect a chair and co-chair
- Assist the MSC with the maintenance of the written Program
- Communicate and submit Program changes to RL and ORP through the MSC
- Maintain the Committee charter and review annually
- Review and verify that training is consistent and appropriately covers the content of the Program
- Develop lines of inquiry for contractor use during independent assessments
- Evaluate trends in performance and recommend actions for improvement
- Review electrical safety related events, issues, and lessons learned as appropriate
- Share electrical events or trends across the DOE Complex; compare Hanford to other sites in the DOE Complex
- Ensure distribution of lessons learned as necessary
- Maintain communication with the contractor working level committees and collaborate to resolve worker level issues, concerns, or events in a way that maintains site-wide consistency
    - Since the core function of a Site-Wide Safety Program is "worker protection," it is imperative to have a structure that fosters and encourages input and feedback from the working level. Affected contractors will convene/attend a working level committee to discuss issues, concerns, or events that occur in the area of electrical safety within their organizations. These working level committees shall include equal representation of bargaining unit (as appointed by the bargaining unit president or delegate) and non-bargaining unit

employees and ensure good communication up through each group's representative(s) on the HSESP Committee.

- Evaluate and recommend resolution for issues/disputes pertaining to the Program
  - Issues shall not include any actions regarding applicable Collective Bargaining Agreements
- Recommend topics/information for communication to the workforce
- Provide Program status to the Senior Management Team (SMT) and DOE management when requested
- Maintain a current website on electrical safety for site-wide use
- Review and approve compliance guides developed by the HWESB and HECB

4.0 Roles and Responsibilities

4.1. Chair Roles and Responsibilities

- Schedule and conduct meetings
- Facilitate meetings in an orderly fashion
- Limit disruptions
- Ensure meeting agendas are prepared
- Ensure meeting summaries are documented
- Function as a point of contact and spokesperson for the Committee
- Interface with other site-wide safety program committees as necessary
- Ensure an action item list is maintained and members complete their assignments in a timely manner
- Coordinate assignments of sub-committee(s)
- Communicate with the SMT as needed

4.2.Co-Chair Roles and Responsibilities

- Act as the Chair when the Chair is absent
- Perform roles and responsibilities as delegated by the Chair

4.3. Member Roles and Responsibilities

- Provide the chairperson with the identity of an alternate Committee member who is designated as the organizational representative
- Attend and participate in meetings when scheduled or notify their alternate when unable to attend
  - Alternates are responsible to attend and participate in meetings when the primary cannot attend
  - If the primary and alternate are both unable to attend, the Chair shall be notified
- Foster communication between the Committee and affected organizations relative to issue identification, interpretations, and consensus resolution
- Maintain lines of communications between management, workers, and the HSESP Committee
- Assist management and safety personnel with electrical safety questions, assessments, incident investigations, critiques, fact finding meetings, and other electrical safety issues

- Distribute meeting summaries and other electrical safety information throughout represented project or contractor facilities. Provide printed copies to personnel who may not routinely use e-mail
- Communicate regularly with craft workers, supervisors, safety professionals, and management regarding electrical safety issues, concerns, and lessons learned
- Ensure that electrical safety questions, concerns, and requests for interpretations are brought to the appropriate technical board for discussion and resolution
- Promotes and coordinates electrical safety initiatives within the company
- Maintain a safety and requirements focus when addressing issues; avoid facility, craft, job function, or contractor biases when participating in discussions.
- Maintain current knowledge of the requirements of the Program
- Maintain working knowledge of appropriate electrical safety codes, standards, and procedures
- Attend periodic meetings of the Hanford Electrical Code Board (HECB) and/or Hanford Workplace Electrical Safety Board (HWESB)
- Research agenda topics in preparation for HECB and HWESB meeting discussions
- Participate in issue discussions representing respective organization
- Bring up issues or speak in discussions only after being recognized by the chairperson
- Listen respectfully and refrain from interrupting others
- Refrain from disruptive side conversations

5.0 Meetings

The Committee shall:

- Meet regularly as necessary, but no less than quarterly, via scheduled meetings
- Hold special meetings to address urgent or emerging issues
- Record and retain meeting minutes and action items, and distribute to the membership, alternates, and DOE
- Document and maintain record copies of decisions

6.0 Meeting Agenda

- The chairperson shall ensure an agenda is prepared for each meeting, using input from the membership, and forward a copy to all members, alternates, and DOE in advance of the meeting time and date
- Action items shall be assigned and tracked

7.0 Quorum

The Committee shall be considered to have a quorum when all Committee members, or their alternates, are present. Failure to reach consensus will be cause for an issue to elevate into a secondary phase of discussion and comment.

8.0 Secondary Phase of Discussion and Issue Resolution

Matters not agreed upon by the Committee through the initial consensus process shall be elevated to the secondary phase of discussion. If consensus cannot be reached by the

Committee, the issue may be elevated to the SMT and/or DOE. The SMT shall provide a status of their resolution process to the Committee at scheduled meetings.

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