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Electrical Safety on Multi-Employer Worksites

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Introduction

This paper will address the electrical hazards analysis; the hazards of electricity; the OSHA Act and electrical safety regulations; ANSI/IEEE C2 *National Electrical Safety Code*; and NFPA 70E *Standard for Electrical Safety in the Workplace* for the electrical safety requirements, procedures, and responsibilities that pertain to all multi-employer worksites which include the "host" and all "contract" and outside service personnel working within or on an industrial or utility facility or complex. The requirements for safe work practices and personal protective equipment (PPE) for all "contract" employers' employees performing work on a "host" site will be addressed. The multi-employer relationship requirements between the "contract" and "host" employers will be discussed in detail. In order to protect all of the "host" and "contract" employer's employees, a series of events must take place, as follows:

- **Electrical Hazards Analysis** – required for identifying the electrical hazards, establishing the hazard protection boundaries, providing the basic elements for the electrical safety program and multi-employer relationship, and the required PPE.

- **Electrical Hazards** – all employers and employees must have at least a fundamental knowledge and understanding of the electrical hazards of shock, arc flash, and arc blast, along with the physiological effects of each hazard.

- **Electrical Safety Program** – once the hazards have been identified an electrical safety program, along with safe work procedures, must be developed. The multi-employer relationship or worksite policy must be a component of the electrical safety program. All affected employees must be trained to thoroughly understand the electrical safety program.

- **Personal Protective Equipment** – Performing the electrical hazards analysis, understanding the effects of the electrical hazards, and developing an electrical safety program will logically lead up to the employer providing and the employee using the appropriate PPE. All affected employees must be trained on the proper selection and use of the PPE.

- **Multi-Employer Relationship (working with contractors)** – All of the above topics must be addressed when developing the multi-employer relationship program.

Contractors working within or on a "host" site are exposed to the same hazards as the host's employees and therefore must be subject to the same requirements and protection as the "host" employer and their employees.

Electrical Hazards Analysis

An Electrical Hazards Analysis must be performed in order to identify the types and levels of electrical hazards in the workplace, establish hazard and protection boundaries (identified below), and identify the required PPE. The information obtained in the electrical hazards analysis is vital for the development of an electrical safety program and safe work procedures, as well as a multi-employer relationship or worksite policy. This information must be known by the "host" employer before any "contractor" or outside service personnel are permitted to work on the host's facility, whether it is an industrial facility or an electric utility.

This analysis must be done in order to comply with the most fundamental requirements of The OSH Act, December 29, 1970. OSHA states: "*An Act: To assure safe and healthful working conditions for working men and women…*" OSHA provides additional direction in Section 5, *Duties*, which is referred to as The General Duty Clause. Section 5(a) & (b), of The OSH Act states the responsibilities of both the employer and the employee as follows:

"*5. Duties*
(a) Each Employer
(1) Shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees;
(2) Shall comply with occupational safety and health standards promulgated under this Act.
(b) Each employee shall comply with occupational safety and health standards and all rules, regulations, and orders issued pursuant to this Act which are applicable to his own actions and conduct."

Note that The OSH Act does not differentiate between the "host" employer and the "contract" employer because the hazards and protection are the same for both.

OSHA 29 CFR 1910.132 is also necessary in order to establish the requirement for a hazard assessment. Paragraph (d) contains very specific requirements: "*The employer shall assess the workplace to determine if hazards are present, or are likely to be present, which necessitates the use of Personal Protective Equipment (PPE).*" If such hazards are present, or likely to be present, the employer must: "*Select, and have each employee use, the type of PPE that will protect the affected employee from the hazards identified in the hazard assessment.*" Paragraph (f)(1) goes on to require: "*The employer shall provide training to each employee who is required by this section to use PPE.*"

The ANSI/IEEE C2, National Electrical Safety Code (NESC), 2007 edition, added a new requirement in 410.A.3 that states: "*Effective January 1, 2009, the employer shall ensure that an assessment is performed to determine potential exposure to an electric arc for employees who work on or near energized parts of equipment. If the assessment determines a potential employee exposure greater than 2 cal/cm^2 exists, the employer shall require employees to wear clothing or*

a clothing system that has an effective arc rating not less than the anticipated level of arc energy."

Note that ANSI/IEEE C2 does not differentiate between the "host" employer and the "contract" employer because the hazards and protection are the same for both.

On June 15, 2005 OSHA issued a Proposed Rule to revise 29 CFR 1910.269 and 1926 Subpart V that is scheduled for Final Rule in April 2011. One major proposed revision is the addition of requirements to perform a hazard assessment. OSHA's proposed 1910.269(f)(11)(i) states: "*The employer shall assess the workplace to determine if each employee is exposed to hazards from flames or from electric arcs.*
(ii) For each employee exposed to hazards from electric arcs, the employer shall make a reasonable estimate of the maximum available heat energy to which the employee would be exposed.
Note 1. *Appendix F to this section provides guidance on the estimation of available heat energy.*
(iii) The employer shall ensure that each employee who is exposed to hazards from electric arcs does not wear clothing that could melt onto his or her skin or that could ignite and continue to burn when exposed to the heat energy estimated under paragraph (l)(11)(ii) of this section."
(iv) The employer shall ensure that an employee wears clothing that is flame resistant…
(v) The employer shall ensure that each employee who is exposed to hazards from electric arcs wears clothing with an arc rating greater than or equal to the heat energy estimated under paragraph (l)(11)(ii) of this section.
Note *to paragraph (l)(11) of this section: See Appendix F to this section for further information on the selection of appropriate clothing."*

These proposed revisions, addressed in a single Federal Register, address construction under 1926 Subpart V and general industry under 1910.269. Also included in this Federal Register is the proposed revision of 1910.137, *Electrical Protective Equipment* and a proposal for a new construction standard 1926.97, *Electrical Protective Equipment*, which is essentially the same as 1910.137.

As can be seen by the above quotes, performing an electrical hazards assessment or analysis is not an option. However, whether or not the analysis is required by standards and regulations is not the issue; identifying electrical hazards and providing an electrical safety program and PPE is the issue and is the right thing to do in order to protect industry's most valuable assets, their employees; this is the real and most important issue. The results of an electrical hazards analysis should be used in the development of the electrical safety program, as well as the multi-employer worksite policy.

Due to the seriousness of electrical hazards and to provide direction for compliance with OSHA when dealing with these hazards, NFPA 70E developed specific requirements for performing the Electrical Hazards Analysis, which includes the Shock Hazard Analysis and the Arc Flash Hazard Analysis.

The Electrical Hazards Analysis will assist in identifying the electrical shock protection boundaries which are identified as the "Limited Approach Boundary", "Restricted Approach Boundary", and "Prohibited Approach Boundary". The electrical arc flash boundary is also identified as the "Arc Flash Protection Boundary" (See Figure 1 for hazard boundaries). Understanding these boundary terms is important to understanding electrical shock and electrical

arc flash hazard protection. Below are the definitions of these terms as found in NFPA 70E, Article 100:

Limited Approach Boundary: "An approach limit at a distance from an exposed live part within which a shock hazard exists."

Restricted Approach Boundary: "An approach limit at a distance from an exposed live part within which there is an increased risk of shock, due to electric arc over combined with inadvertent movement, for personnel working in close proximity to the live part."

Prohibited Approach Boundary: "An approach limit at a distance from an exposed live part within which work is considered the same as making contact with the live parts."

Flash Protection Boundary: "An approach limit at a distance from exposed live parts within which a person could receive a second degree burn if an electrical arc flash were to occur."

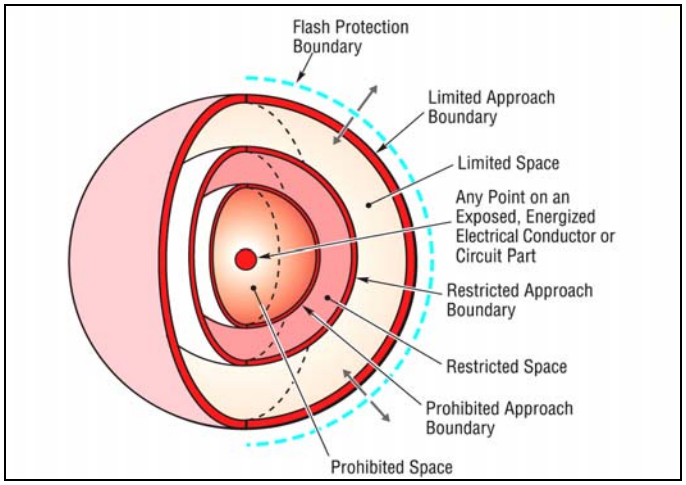

Figure 1. Illustration of Boundaries.

Electrical Hazards

In order to fully understand the electrical safety issues associated with the multi-employer relationship and the work practices required, there must also be an understanding of the hazards of electricity, identified with the completion of the electrical hazards analysis described above. One very important point is that the physics of electricity are the same for everyone; they do not different and do not change from the "host" to the "contract" employer or their employees.

The three main hazards of electricity; electrical shock, electrical arc flash, and electrical arc blast, along with the physiological effects on the human body, must be understood by everyone working on or near electrical circuits and equipment. Contractors and service personnel are often exposed to the same electrical hazards as the "host" employer's maintenance and operations employees and therefore require this same knowledge and understanding.

The National Institute for Occupational Safety and Health (NIOSH), along with the U.S. Bureau of Labor Statistics (BLS), report that electrical contacts result in over 4,700 non-fatal

electrical injuries annually, plus an average of at least ONE death (electrocution) in the workplace every day in the United States alone. NIOSH states that there is an average of 411 deaths per year due to electrocution. NIOSH also indicates that 5 to 10 arc flash incidents occur daily resulting in 10 to 15 employees being hospitalized with arc flash related burns. Figure 2, provided by the U.S. Bureau of Labor Statistics, provides statistical information for non-fatal electrical incidents involving burns and shocks in various sectors of industry.

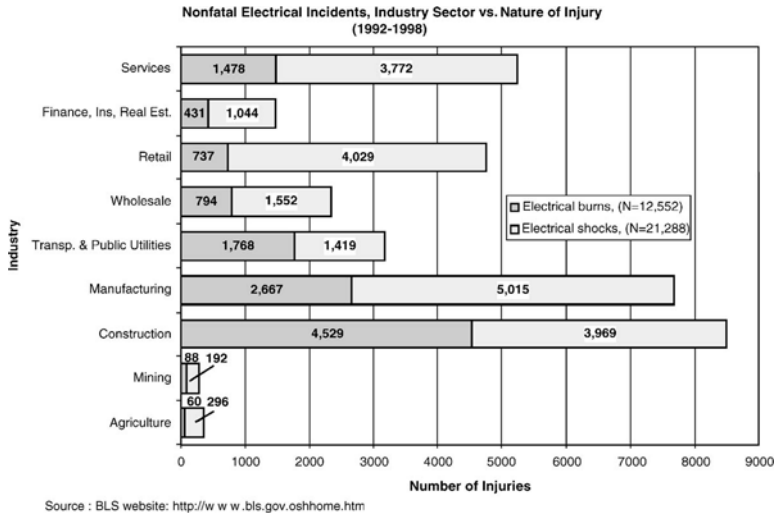

Figure 2. Non-Fatal Electrical Incidents (Bureau of Labor Statistics).

Electricity is no respecter of persons; it will injure or kill a contractor, custodian, manager, or office worker just as fast as it will injure or kill an electrician. The laws of physics for electricity apply to everyone. Some employees work with electricity directly as part of their everyday jobs while others work with it indirectly, primarily by the use of cord- and plug-connected equipment and portable tools. Surprisingly over half of those killed in electrical accidents are not in traditional electrical fields but are from fields such as contractors, outside service personnel, painters, laborers, and drivers. [Detailed surveillance data and investigative reports of fatal incidents involving workers who contacted energized electrical conductors or equipment are derived from the National Traumatic Occupational Fatalities surveillance system maintained by the National Institute for Occupational Safety and Health (NIOSH)].

Electrical Shock

Electrical shock occurs when a person's body completes the current path between two energized conductors of an electrical circuit or between an energized conductor and a grounded surface or object. Essentially, when there is a difference in potential from one part of the body to another, current will flow. The effects of an electrical shock can vary from a slight tingle to immediate cardiac arrest. The severity depends on several factors:

- Body resistance (wet or dry skin are major factors of resistance)
- Circuit voltage (50 volts to ground or more is considered by OSHA, IEEE, and NFPA as being hazardous voltage)
- Amount of current flowing through the body [determined by the circuit voltage divided by the body resistance I (current) = E (voltage) / R (resistance)]
- Current path through the body (if it passes through an vital organ it can be fatal)

- Area of contact
- Duration of contact

The "Shock Hazard Analysis" required by NFPA 70E provides the guidance needed to determine the level of shock hazard (voltage). This analysis also determines the shock protection boundaries, as well as the approach limits for qualified and unqualified employees, along with the required shock protection PPE, i.e., rubber insulating gloves, sleeves, blankets, etc. This shock hazard information is vital for the establishment of the multi-employer worksite policy for contractors and outside service personnel working on a "host" facility.

Electrical Arc Flash

There are various studies on the causes of electrical injuries that show a large number of serious electrical injuries that involve burns from electrical arcs, as noted above.

There are actually three different issues with the arc flash hazard; the arc temperature; the incident energy; and the pressure developed by the arc. The main concern with the arc temperature, which can be as high as $36{,}000^0$F, is the flash flame and ignition of clothing. At approximately 203^0F (96^0C) for one-tenth of a second (6 cycles), the skin is rendered incurable or in other words a third-degree burn and at approximately 172^0F (78^0C) for one-tenth of a second (6 cycles) a person could receive a second degree burn. The incident energy threshold for the onset of a third degree burn is approximately 10.7 cal/cm^2 and the incident energy threshold for a second-degree burn is approximately 1.2 cal/cm^2. As can be seen by this, it does not take a very high temperature or very much incident energy to cause severe injury, which can result in extreme pain and discomfort or even death to the worker. The American Burn Association provides statistics concerning the survivability of electrical burns based on the age of the worker and the percentage of body burn (Figure 3).

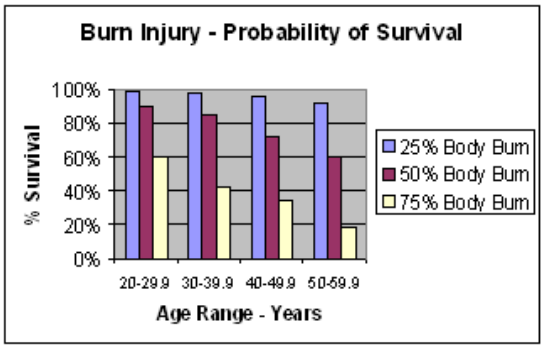

Figure 3. American Burn Association.

The "Arc Flash Hazard Analysis" required by NFPA 70E is used to determine the incident energy of an electrical arc, establish the Arc Flash Protection Boundary, and for determining the level of arc flash PPE required to protect employees. PPE would include, but not be limited to, arc rated FR shirts, pants, coveralls, balaclava, face shield, full arc flash suit, etc. This arc flash hazard information is vital for the establishment of the multi-employer worksite policy for contractors and outside service personnel working on a "host" facility. NFPA 70E also states that an arc flash hazard analysis must be performed "*in order to protect personnel from the possibility of being injured by an arc flash*." The best way to avoid this hazard is to stay away from

energized electrical equipment, especially when disconnecting devices are being operated, i.e., opened, closed, racked-in, or racked-out. Never use electrical equipment rooms for storage, break rooms, offices, shops, etc. If a failure of the equipment was to occur and the room was occupied, injuries or fatalities could occur. Figure 4 illustrates what can happen if an electrical equipment failure occurs that results in an arc flash and arc blast incident. Fortunately this room was not occupied at the time of the incident.

Figure 4. Switchgear Room Post-Arc Flash and Fire.

Electrical Arc Blast

Another major hazard of electricity is the rapid expansion of the air caused by an electrical arc. This occurrence is referred to as an electrical arc blast or in other words an explosion.

According to studies on the subject, the pressures from an electric arc are developed from two sources; the expansion of the metal in boiling and vaporizing, and the heating of the air by passage of the arc through it. Copper, when vaporized, expands by a factor of approximately 67,000 times; therefore one $inch^3$ of copper converts to 1.44 $yards^3$ of vapor instantly, which causes this rapid expansion and the resulting blast or explosion.

The arc flash coupled with the arc blast presents a very serious and dangerous situation for anyone working on or near electrical equipment. While there is PPE for protecting employees from the arc flash hazard there is no PPE for the arc blast hazard. The only thing that can be done for protection from the arc blast is to incorporate safe work practices that include correct body positioning when operating or otherwise interacting with the electrical equipment. A good practice is to never stand where the body would be in the direct "line-of-fire" should an arc flash/blast occur.

In addition to the above discussion, OSHA states: "*The pressures developed by high-energy arcs can damage equipment causing fragmented metal to fly in all directions. In atmospheres which contain explosive gases or vapors or combustible dusts, even low-energy arcs can cause violent explosions.*"

Ralph Lee's paper, entitled "Pressures Developed by Arcs" (IEEE 1987), discusses methods that can be used to determine the amount of damage that a short circuit can cause in switchgear and the buildings where the switchgear is located.

Electrical Safety Program

Now that the electrical hazards analysis has been completed, the information collected must be used to develop an Electrical Safety Program. This program must include the multi-employer worksite policy by taking into consideration the work activities of "contract" and outside service personnel working on the "host" facility.

All employees performing work on electrical equipment or operating the electrical equipment have a potential exposure to the hazards of electricity as part of their every day work. Because of this potential exposure the regulations and standards require a written and enforced electrical safety program along with safe work procedures. OSHA 1910.333(a)(2) and the NFPA 70E offers excellent guidelines for an electrical safety program that can be used by all industries, as well as contractors. OSHA 1910.333(a)(2) states: "*If the exposed live parts are not deenergized (i.e., for reasons of increased or additional hazards or infeasibility), other safety-related work practices shall be used to protect employees who may be exposed to the electrical hazards involved. Such work practices shall protect employees against contact with energized circuit parts directly with any part of their body or indirectly through some other conductive object. The work practices that are used shall be suitable for the conditions under which the work is to be performed and for the voltage level of the exposed electric conductors or circuit parts.*" OSHA STD 1-16.7 Electrical Safety-Related Work Practices – Inspection Procedures and Interpretation Guidelines" goes on to explain: "*Under 1910.333(a)(2) if the employer does not deenergize (under the conditions permitted in 1910.333(a)(1)), then suitable safe work practices for the conditions under which the work is to be performed shall be included in the written procedures and strictly enforced. These work practices are given in 1910.333(c) and 1910.335.*"

NFPA 70E, Section 110.7, *Electrical Safety Program*, provides seven topics that should be included in the electrical safety program. References will be made to the three sections of Annex E, as well as Annex F, J, and I, each of which provide excellent guidance for developing the electrical safety program. These Annexes will only be referenced and not quoted in this paper. [3]

1) Awareness and Self-Discipline

2) Electrical Safety Program Principles – also see Annex E, Section E.1, *Typical Electrical Safety Program Principles*.

3) Electrical Safety Program Controls – also see Annex E, Section E.2, *Typical Electrical Safety Program Controls*.

4) Electrical Safety Program Procedures – also see Annex E, E.3, *Typical Electrical Safety Procedures*.

5) Hazard/Risk Evaluation Procedure – also see Annex F, *Hazard/Risk Evaluation Procedure*.

6) Job Briefings – The job briefing should cover such things as:

- The hazards associated with the job
- Work procedures involved
- Special precautions
- Energy source controls, and
- Personal protective equipment
- Other work in the immediate area, as well as

- Other work associated with the same electrical circuits and equipment.

If a task is routine and will be repeated several times during the day, a single job briefing would be required before the task is performed the first time. However, if significant changes occur that may affect the safety of employees, then a new job briefing would be required before employees are exposed to any additional hazards. A job briefing should be as extensive as necessary to ensure employees understand their exposure to electrical hazards. If the job is routine and the employees are well trained and experienced, and can recognize and avoid the hazards involved, then only a brief discussion would be required. If the tasks are unfamiliar to the employee, or complex, a more complete briefing would be required. This would also apply for outside employees and those who are new to the area where the work is to be performed.

Job briefings are required for electric utilities by OSHA 29 CFR 1910.269(c). In addition to the OSHA requirement NFPA 70E Annex I, *Job Briefing and Planning Checklist*, illustrate considerations for a Job Briefing, as well as a Planning Checklist, that can be very helpful in conducting Job Briefings.

7) Electrical Safety Auditing – The electrical safety program must be audited to ensure compliance.

Personal Protective Equipment

Most employers ("host" and "contract"), operators, and electricians are knowledgeable in the selection and inspection requirements for electrical PPE used for the prevention of electrical shock, as well as PPE used for head, eyes and face, hands, and foot protection. All of these requirements are readily found in OSHA 1910, Subpart I, *Personal Protective Equipment*. Foe electrical work and protection specifically, OSHA Subpart I, 1910.137, *Electrical Protective Equipment*, provides the requirements for the in-service care and use of electrical protective equipment. Although not addressed in OSHA 1910 Subpart I, arc flash full body protection is required by NFPA 70E, ANSI/IEEE C2, and the proposed revision to OSHA 1910.269 and 1926 Subpart V. Unfortunately there are still many employers, operators, electricians, and engineers have limited knowledge or experience with regard to the arc flash and arc blast hazards that may be associated with the maintenance and operation of energized electrical equipment and the necessary PPE that is required.

The OSHA requirements for the hazards analysis and selection of protective clothing was addressed in the section above titled Electrical Hazards Analysis where it referenced OSHA 1910.132, *General Requirements for Personal Protective Equipment*, paragraph (d) which states "*The employer shall assess the workplace to determine if hazards are present, or are likely to be present, which necessitates the use of Personal Protective Equipment (PPE).*" If such hazards are present, or likely to be present, the employer shall "*Select, and have each employee use, the type of PPE that will protect the affected employee from the hazards identified in the hazard assessment.*"

OSHA 1910.132 additionally requires in paragraph (f) Training (1) which states that "*The employer shall provide training to each employee who is required by this section to use PPE. Each such employee shall be trained to know at least the following:*

- *When PPE is necessary;*
- *What PPE is necessary;*
- *How to properly don, doff, adjust, and wear PPE;*
- *The limitations of the PPE; and*
- *The proper care, maintenance, useful life, and disposal of PPE.*"

OSHA 1910.269(l)(6)(ii) requires that "*The employer shall train each employee who is exposed to the hazards of flames or electric arcs in the hazards involved*." Additionally, 1910.269(l)(6)(iii) states "*The employer shall ensure that each employee who is exposed to the hazards of flames or electric arcs does not wear clothing that, when exposed to flames or electric arcs, could increase the extent of injury that would be sustained by the employee.*"

"***Note:*** *Clothing made from the following types of fabrics, either alone or in blends, is prohibited by this paragraph, unless the employer can demonstrate that the fabric has been treated to withstand the conditions that may be encountered or that the clothing is worn in such a manner as to eliminate the hazard involved: acetate, nylon, polyester, rayon.*"

OSHA does, however, require protection from the hazards of electricity in a more indirect manner as stated in the following quotes from OSHA regulation 1910.335 **Safeguards for personnel protection**. **(a)Use of protective equipment. (1)Personal protective equipment. (i)** "*Employees working in areas where there are potential electrical hazards shall be provided with, and shall use, electrical protective equipment that is appropriate for the specific parts of the body to be protected and for the work to be performed*"; 1910.335(a)(1)(ii) "*Protective equipment shall be maintained in a safe, reliable condition and shall be periodically inspected or tested, as required by 1910.137*"; 1910.335(a)(1)(v) "*Employees shall wear protective equipment for the eyes or face wherever there is danger of injury to the eyes or face from electric arcs or flashes or from flying objects resulting from electrical explosion*"; and 1910.335(a)(2)(ii) which states: "*Protective shields, protective barriers, or insulating materials shall be used to protect each employee from shock, burns, or other electrically related injuries while that employee is working near exposed energized parts which might be accidentally contacted or where dangerous electric heating or arcing might occur.*"

If, during the operation, insertion, or removal of a circuit breaker a fault occurs, the worker may be exposed to an electric arc with high temperatures and incident energy as noted above. Protective clothing, including a complete multi-layered flash suit with hood and face shield, may be required for these activities. Once it has been determined that protective clothing and PPE is necessary to perform the specific task, it must be procured by the employer and the employees trained to wear it properly.

Multi-Employer Relationship (working with contractors)

Electrical hazards present a risk for injuries and fatalities to everyone who may be exposed to them. This would include the "host" employer's employees, as well as contractors and outside service personnel working on the "host" employer's facility. The NFPA 70E Multi-employer Relationship requirements are derived from the OSHA CPL 02-00-124, Multi-Employer Citation Policy, which has been in effect since December 10, 1999, and outlines clearly the responsibilities for safety and health for multiple employers on a worksite. OSHA states that "On multi-employer worksites (in all industry sectors), more than one employer may be citable for a hazardous condition that violates an OSHA standard." Similar multi-employer requirements are

also found in OSHA 1910.146(c)(8) (Jan. 14, 1993) and 1910.147(f)(1)(v)(2), Outside personnel (contractors, etc) (Sept. 1, 1989).

OSHA's recognition of the need for employers on multi-employer worksites to share responsibility for workplace safety and health is reflected in OSHA's Multi-Employer Citation Policy. On multi-employer worksites, citations are normally issued not only to the employer whose employees are exposed to hazards but, depending on the actions that the employer has taken to detect violations and protect employees, also to:

1. The employer who creates the hazard ;
2. The employer who has the authority, by contract or practice, to ensure that the hazardous condition is corrected; and
3. The employer who has the responsibility for correcting the hazard.

In the proposed revision of 29 CFR 1910.269(a)(4), OSHA provides definitions of the "host" and "contract" employers along with the responsibilities of each. Similar language is found in the proposed revision of 1926, Subpart V. NFPA 70E, 110.4, Multi-employer Relationship also provides requirements for each of these employers. The OSHA definitions are as follows:

"Host" employer. *"An employer who operates and maintains an electric power generation, transmission, or distribution installation covered by this section and who hires a "contract" employer to perform work on that installation.*"

"Contract" employer. "*An employer who performs work covered by this section for a "host" employer.*"

The following OSHA proposed requirements are provided for clarity for multi-employer worksites (NFPA 70E, 110.4 provides similar language):

"(4) Contractors. (i) "Host" employer responsibilities. (A) *The "host" employer shall inform "contract" employers of:*

(1) *Known hazards that are covered by this section, that are related to the "contract" employer's work, and that might not be recognized by the "contract" employer or its employees; and*

(2) *Information about the employer's installation that the "contract" employer needs to make the assessments required by this section.*

(B) *The "host" employer shall report observed contract-employer-related violations of this section to the "contract" employer.*

(ii) "Contract" employer responsibilities. (A) *The "contract" employer shall ensure that each of his or her employees is instructed in the hazards communicated to the "contract" employer by the "host" employer.*

Note to paragraph (a)(4)(ii)(A) of this section: *This instruction is in addition to the training required by paragraph (a)(2) of this section.*

(B) *The "contract" employer shall ensure that each of his or her employees follows the work practices required by this section and safety-related work rules required by the "host" employer.*

(C) *The "contract" employer shall advise the "host" employer of:*

(1) *Any unique hazards presented by the "contract" employer's work,*

(2) *Any unanticipated hazards found during the "contract" employer's work that the "host" employer did not mention, and*

(3) *The measures the contractor took to correct any violations reported by the "host" employer under paragraph (a)(4)(i)(B) of this section and to prevent such violations from recurring in the future.*"

NFPA 70E also requires a documented meeting between the on-site ("host") and outside ("contract") employers to coordinate and inform each other of all existing hazardous conditions, safety practices and procedures, personal protective equipment, and emergency procedures.

In Summary

Each of the three hazards of electricity (electrical shock, electrical arc-flash and electrical arc-blast) has its own unique characteristics that require special attention to hazard assessments, electrical safety programs and procedures, personal protective equipment, and an effective multi-employer relationship of worksite policy.

The best way to avoid exposure to electrical hazards is to keep as far away as possible from electrical equipment and systems that have exposed energized parts or where the electrical equipment is being operated or maintained.

Personal protective equipment, clothing, and work practices have been developed by OSHA, ANSI/IEEE C2, and NFPA 70E to protect employees from the three hazards of electricity when working on or near 50-volts or more to ground. Additionally, electrical accidents are largely preventable through safe work practices. Examples of these practices include, but are not limited to, the following:

- Deenergizing electrical equipment for inspection or repair;
- Keeping electrical tools and equipment properly maintained;
- Exercising caution when working near exposed energized lines and equipment; and
- Using appropriate personal protective equipment and insulated tools.

The multi-employer relationship program provides methods for electrical safety where all affected employers can provide protection for their employees from the hazards of electricity that exist or that might be created through the work being performed. Implementing the safe work practices and procedures found in the OSHA regulations, ANSI/IEEE standards, as well as in NFPA 70E, will provide the best protection for everyone, whether they are on-site ("host") or outside ("contract") employees.

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