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Electrical Safety for Your "Other" Employees

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Abstract

This paper discusses an approach to apply electrical injury and fatality prevention and protection measures to workers who may not be considered the target workforce for the electrical safety requirements in NFPA70E-2009, *Standard for Electrical Safety in the Workplace.*

For some organizations, the focus and improvement in electrical safety programs have largely addressed electrical workers whose primary work tasks involve construction, operation and or maintenance of electrical equipment. However, nearly 50% of those who suffer workplace electrical injuries and fatalities are not electrical workers. These are the "other" employees. An organization intent on improving its electrical safety program, whether it be based on minimum compliance or aimed at zero injury performance, will likely find opportunities to better address electrical safety for this group.

Guidance is offered to safety professionals to aid planning, design and implementation of a comprehensive and effective electrical safety program for employees whose job responsibilities are not defined as routinely working on or near exposed hazardous voltages. Included is the following information which may be useful in design and implementation of electrical safety program enhancements to cover all workers:

- Injury statistics
- Common limitations in applying NFPA70E
- Work scenarios having unintentional exposure to electrical hazards
- A risk-based approach for applying hazard control measures in NFPA70E

Introduction

Exposure to electrical hazards remains a leading cause of occupational fatality. Cawley and Homce reported it was the 6th highest cause of U.S. workplace fatality in a study spanning 1992 – 2002. Their study also reported 46,598 workers were nonfatally injured from electrical hazards during the same period[1]. Since the passage of the OSHA Act in 1970, workplace injuries and fatalities, including those from electrical hazards have trended downward. The emergence of more robust prescriptive industry standards, such as NFPA70E, *Standard for Electrical Safety in the Workplace,* has been instrumental in accelerating the downward trend in injuries and fatalities from electrical hazards. However, misperception of who may be at risk for electrical injuries may

be limiting achievement of the potential for injury prevention and the application of best practices for preventing these injuries.

Article 90.1 of NFPA70E-2009 states, *"The purpose of this standard is to provide a practical safe working area for employees relative to the hazards arising from the use of electricity."* The scope description in Article 90.2 further narrows application of the standard with this statement: *This standard addresses electrical safety requirements…for the practical safeguarding of employees during activities such as the installation, operation, maintenance, and demolition of electric conductors, electric equipment, signaling and communications conductors and equipment, and raceways…*[2]

For many organizations, the focus and improvement in electrical safety programs have largely addressed electrical workers whose primary work tasks involve construction, operation and or maintenance of electrical equipment. However, nearly 50% of workplace electrical injuries and fatalities are not electrical workers. For these non-electrical workers, the exposure to electrical hazards ranges from use of common portable tools and appliances to unintentional contact with overhead power lines in the course of routine work activities.

Limited Application of Industry Standards

It is the author's experience that workplace electrical safety programs tend to focus on safe-guarding electrical workers whose job activities involve working on or near electrical equipment and circuits that either are or potentially could be energized above 50V AC. Workers whose exposure to electrical hazards is generally limited to normal operation and routine interaction with electrical equipment and systems may not be specifically addressed or covered by the program. Literal interpretation of the scope statement in NFPA70E Article 90.2 could help explain limited application of the useful information in this standard.

The reality is that we live in an electrical world, with nearly every aspect of modern business and commerce dependent on electrical technologies and interactions with tools, appliances, equipment and systems having inherently hazardous electrical energy. Although the degree of risks ranges from little to great, it is the norm today that all people in the workplace have some risk of injury from electrical energy. Equipment, appliance and tool designs, and installations requirements such as those found in NFPA70, *National Electrical Code*[3], and IEEE/ANSI C2, *National Electrical Safety Code*[4] have continually evolved to reduce the risk of electrical injury from normal interaction by all workers. When the inherent safety features of electrical equipment or systems are not as intended due to damage, wear, improper installation, misapplication, misuse, or the hazard is unrecognized, the risk of electrical injury to the unsuspecting worker can significantly increase. Examples include a mobile television news crew that parks their vehicle underneath a power line and raises an antenna mast into the line, a carpenter who uses a power tool plugged into an extension cord with a damaged ground wire, a roofer handling a section of aluminum gutter near an overhead electric line or a cover on an electric powered appliance is missing or unsecured.

Identifying Work Scenarios with Risks

Recent data from Taylor et. al. and Cawley and Homce show that while electricians, electrical apprentices, and electrical power installers are the highest at risk groups, more than 50% of

electrical fatalities fall outside these electrical trades. Construction laborers, groundskeepers and gardeners, truck drivers, carpenters, managers and administrators, and painters are among the top ten occupations sustaining the most fatal electrical injuries.[5] Lombardi et. al. have provided insight on work activities contributing to no fatal electrical injuries. Manual tasks characterized as plugging/unplugging, loading/unloading, cleaning/dusting and other tasks other than testing/checking power and turning on/off comprise 33.5% of activities contributing to nonfatal electrical injuries.[6] The study by Taylor et al of fatal electrical injuries show that vehicular and transportation operations, use of tools and machinery and materials handling operations accounted for 31.3% of fatal electrical injuries during the period 1992-1999.[5].

Overhead electric line contact is of particular concern, accounting for 41.4% of electrical fatalities[1] and 4.3%[5] of non-fatal electrical injuries. Contact with overhead lines during activity other than electrical system installation and maintenance is the largest category of workplace electrocutions in the U.S. Within this group, contact with a handheld object accounted for 22%, and contact indirectly through a piece of high reaching mobile equipment, such as cranes, drilling rigs, mobile work platforms, antennas, irrigation rigs, and raised truck beds, accounted for 17%.[1] Anything that can go up in the air has the potential for making unintentional contact with an overhead power line. This includes antenna masts on mobile equipment, water drilling rigs, crane booms, elevated work platforms, ladders, pipes, roof gutters, building siding etc., etc. Literally any conductive object, material, or equipment that can be held or in contact with a person has the potential for extending the individual's reach to unintentionally contact an overhead electric line.

The use of ground fault circuit interrupters (GFCIs) has proven effective in significantly reducing fatalities associated with portable tools and appliances. The statistics noted in the referenced papers suggest there is much room to expand the use of these devices. Wells reported more than 70% decrease in electrocutions involving portable tools and appliances in the 32 year period from 1970-2002.[7] Requirements for GFCIs installation were introduced in the 1968 National Electrical Code. Each edition since then has expanded the requirements for GFCI installation, and there was an estimated 33 million units installed by 2002. The expanded application of GFCIs was likely a major contributor to the significant reduction in electrocution fatalities. An organization intent on reducing risk of electrical injury in its operations should consider actions to expand use of GFCI protection.

Tailoring Application of Electrical Safety Standards

For individuals and organizations that may have perceived themselves as not being at risk to electrical injuries, electrical safety codes and standards may be a bit intimidating. With the major emphasis of most electrical safety codes and regulations being directed to subject matter experts or to workers routinely working on or near energized electrical conductors, tailoring electrical craft specific requirements to apply to non-electrical work environments may take some effort. Safety professionals can play key roles in facilitating this work. Safety professionals, with expertise in hazard assessment methodology, can help create a collaboration including workers in non-electrical crafts and experts in electrical hazards and safe work practices to define awareness and education needs, job planning aides targeting identification of electrical hazards, and safe work practices, such as the use of ground fault circuit interrupters (GFCIs) on portable tools and appliances. Examples of questions this collaboration could address include:

- Do we have a documented electrical safety program?

- Is it best characterized as an electrical safety program for workers in electrical crafts, or does it address risk of electrical injury for all workers?
- Do workers use mobile equipment or handle material that could come in contact with overhead electric lines?
- Do workers use portable tools, appliance and extension cords?
- Do workers use portable tools and appliances in potentially damp or wet environments?
- Do we have portable tools or appliances operating above 120V which do not have GFCI protection?[8]
- How disciplined is the organizations in maintaining integrity of enclosures and covers on electrical equipment, tools and appliances?
- Are non-electrical personnel included in arc flash protection programs?

These are a few examples of questions that could help identify opportunities to reduce risk of electrical injuries to all workers. The questions could differ based on the industry, work environment or maturity of the organization's electrical safety program.

One Company's Experience

For the past 25 years, the author has worked with colleagues to continuously improve electrical safety management in a global Fortune 100 company. Over a twenty year period 1979-1999, employees and contractors in its global operations incurred 9 fatalities from electrical hazards. Combined employee and contractor workforce during this period ranged from ~80,000 to ~120,000. Of the nine fatalities, two were carpenters who rolled a scaffold into an overhead electric line, one was a painter who contacted an overhead power line while positioning a ladder against a building, one was a welder who attempted to troubleshoot a welding machine, one was a painter who came in contact with a high voltage terminal on top of a substation transformer, one was a supervisor providing troubleshooting assistance, one was an engineering consultant performing a visual inspection of electrical switchgear, one was a sales representative who came in contact with an energized conductor in a customer's facility, and one was an electrician performing work on energized switchgear. One out of nine fatalities was an electrician, and only three of the nine could be characterized as workers whose job responsibilities would place them near exposed electrical hazards. The rest were "other" workers.

In 1990, the company launched an electrical safety awareness campaign designed to shift perception from electrical safety was an issue just for electrical crafts to awareness that all people are exposed to electrical hazards. In order to engage all employees and all levels of supervision and management, the campaign focused on electrical safety hazards common to everyone – electrical safety at home. One aspect of the campaign was designating May as Electrical Safety Month throughout the company. After more than 20 years, this annual emphasis is an institution within the safety culture in the company. Since 1994, Electrical Safety Foundation International (ESFI) has proclaimed May as National Electrical Safety Month and has provided resource kits with planning tips, awareness tools and educational materials. In 2000, the company overhauled its global electrical safety management standard, with additional emphasis directed toward broadening coverage to include all personnel. The work to engage all personnel in electrical safety appears to be proving effective. OSHA recordable injuries from electrical hazards over the past 5 years reflect more than 50% reduction compared to the previous 10 years.

Resources

There are numerous resources that target electrical safety training and education to workers whose job responsibilities involve working on or near energized or potentially energized electrical equipment and circuits. Applying these resources to workers not in the electrical crafts has limitations, unless instructional delivery is tailored specifically to those without an electrical background. Brenner recently reported on efforts of Electrical Safety Foundation International (ESFI) to addresses the electrical safety risks to all workers. Electrical Safety Foundation International is a non-profit foundation with the sole mission of providing electrical safety awareness and education materials.[9] ESFI provides these materials free or at low cost. Most materials are available as downloads from its website at www.esfi.org.[10]

Conclusion

Electrical hazards are a leading cause of occupational fatalities. Consensus standards relevant to electrical safety have evolved in content and application to more effectively reduce risks from electrical injury. There are opportunities to extend application of concepts and practices in these standards to workers outside of the electrical crafts. This is essential in order to reduce the total number of occupational fatalities and injuries from electrical hazards, since workers outside the electrical crafts comprise a large number of electrical fatalities and injuries. Safety professionals are uniquely positioned to influence the application of best practices for protecting all workers from the risks of electrical injury. Although most safety professionals may not be expert in electrical safety, the concepts of risk assessment and risk management are core safety management competencies. Safety professionals can help assure all workers potentially exposed to electrical hazards are included in an organization's electrical safety program.

References

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