

Is Your Electric Utility Prepared for the New Arc Flash Safety Regulation?

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Issued on April 11, 2014, the U.S. Occupational Safety and Health Administration (OSHA) 1910.269 revised regulation now mandates that by January 1, 2015 electrical power generation, transmission, and distribution companies “must make a reasonable estimate of the incident heat energy to which the employee would be exposed.” The regulation also stipulates that beginning April 1, 2015, electric utility companies “must ensure that employees with exposure to electric-arc hazards wear protective clothing and other protective equipment with an arc rating greater than or equal to the estimated heat energy whenever that estimate exceeds 2.0 cal/cm².”

Protecting Employees from Arc Flash Hazards

With the regulation OSHA anticipates that, “these new provisions, if followed, will prevent virtually all fatalities, and significantly reduce the incidence of serious burns from arc-flash accidents.” Arc flash hazards can occur when an employee is opening or closing doors and/or removing covers; operating switches or circuit breakers; racking circuit breakers; or using tools or testing equipment, etc. When an arc flash/blast incident occurs, the arc current propels the arc and shrapnel away from the power source. Arcs in enclosures such as Motor Control Centers (MCCs), can magnify the blast—the energy from which is forced to the open side of the enclosure and thus toward the employee. When the power of an arc blast combines with arc flash temperatures that can reach as high as 35,000 °F at the arc terminals, the outcome of an arc flash/blast can be devastating.

Over the years, many non-utility facilities have adopted the National Fire Protection Association (NFPA) standard, *NFPA 70E, Standard for Electrical Safety in the Workplace*®. This standard, which addresses many of the same concerns as the

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OSHA regulation, has proven to lower the number of injuries and fatalities due to electrical incidents, like arc flashes, at these locations. An Electrical Safety Foundation International report found that the number of electrical fatalities dropped from over 300 a year to less than 200 a year (between 1992 and 2010).¹ Within the electric utility community according to the OSHA ruling, “an estimated 74 fatalities and 444 serious injuries occur annually among employees involved in the electric power generation, transmission, and distribution work addressed by the provisions” of the revised 1910.269 regulation. The Administration estimates that the final regulation will “prevent approximately 19.75 additional fatalities and 118.5 additional serious injuries annually.”

With a clear objective to reduce injuries and to save lives of electrical utility employees, this paper offers advice on performing an arc flash assessment and the list of criteria in selecting an outside contractor to ensure your electrical operations are in compliance with the arc flash safety components of the revised OSHA regulation.

As a reminder, electric companies that fail to comply with the new regulation could face stiff penalties including fines, civil litigation, and even jail time. There is also the potential for negative media coverage, and the associated fallout with the company’s government, regulatory, and community relations efforts if a death occurs at the job site. When it comes to arc flash safety, the old Benjamin Franklin quote is particularly appropriate: “An ounce of prevention is worth a pound of cure.”

Thermal Impacts of Arc Flash Temperatures
145 °F Curable burn
205 °F Cell death
700 °F Clothing ignition
1,400 °F Clothing burns
1,800 °F Metal droplets
9,000 °F Surface of the Sun
35,000 °F Temperature at arc

Performing an Arc Flash Assessment

In order to determine the arc flash incident energy levels throughout the electrical distribution system, electric companies must perform an assessment of these levels and then institute the necessary personal protective equipment (PPE) plan to protect employees from the effects of arc flash incidents. More proactive companies may use the assessment process to identify then mitigate

incident levels, to such a low level that additional PPE is not necessary. Appendix E (starting on page 1388 of the ruling) of the OSHA regulation outlines elements of the assessment.

Scope of Assessment: The entire electrical distribution system within a facility must be examined in detail. This includes identification of sources of electric arcs, exposure to flames, and determination of the probability that an electric arc will occur. Electric utilities are also required to review protection against burn injury and protection against ignition and to select protective clothing and other PPE for use in arc flash incident areas.

Calculating Methods: To determine protection against burn injury, the electric utility must estimate available heat energy at arc flash incident locations. Appendix E of the OSHA regulation lists various methods for calculating values from an electric circuit, over multiple system areas, and from single-phase-to-ground exposures. Each method requires data including fault current, expected length of the electric arc, distance from the arc to employee, and clearing time for the fault. The Appendix also offers guidance in estimating these parameters.

The assessment should result in a report of arc flash energy levels and recommendations for enhanced PPE requirements at specific locations. These requirements are very specific, right down to the finish surface of the hardware for fall protection (must be corrosion-resistant), for example. Additional examples from the regulation: “Work-positioning equipment shall be inspected before use each day;” and “Protective grounding equipment shall have an ampacity greater than or equal to that of No. 2 AWG copper.” The assessment should also include recommendations for enhanced warning labels at potential arc flash incident locations and recommendations for additional safety training.

Industrial companies who have completed similar arc flash incident assessments have discovered several benefits from the assessment process and the results. These include, but are not limited to, the following:

- Bringing the company into compliance
- Minimizing the possibility of fines and other penalties for being non-compliant
- Identifying areas where arc flash incidents can be mitigated
- Improving the company’s electrical system reliability
- Creating a safer work environment for employees

Criteria for Selecting an Outside Contractor

The revised OSHA regulation gives electric utilities the option to perform the assessment internally or to outsource the responsibility. As a result, a myriad of firms are now offering arc flash assessment services. Selecting

the outside resource best suited to your company's needs is an important step in achieving compliance with the new regulation. Below is a list of the key criteria to consider should your utility seek the services of an outside resource for arc flash assessment and recommendations.

1. Past Experience. The new OSHA regulation is lengthy (1,607 pages) and comprehensive. It covers a wide range of locations within electrical operations and a broad range of training requirements. Just reading through the ruling can be daunting. Ensuring that your outside resource is familiar with the particular ruling is certainly a must.

Ask if your outside resource has experience in performing assessments and compliance implementation for NFPA 70E standard. There are firms who have performed similar services for the industrial customers covered under the National Fire Protection Association standard. There is a cross pollination between the NFPA 70E standard and the revised OSHA regulation. Engineering firms who assist customers in their compliance needs for the former are in the best position to apply their knowledge and expertise to the latter.

Keep in mind, very few engineering firms will have *direct* experience in performing arc flash compliance consulting for electrical utilities simply because this aspect of the regulation is new. There are some firms who may have provided similar consulting services for electrical utilities who were seeking to elevate their safety standards in advance of the OSHA decision. But it is more likely that engineering firms will have acquired their relevant experience by performing assessments and recommending compliance programs for customers in the industrial arena. Many industrial companies have very sophisticated and complex electrical systems which may be similar to your utility, so the skills and competencies necessary to interpret NFPA 70E certainly apply to the revised OSHA regulation.

2. Licensed Professionals. Your assessment should be overseen by a professional, electrical engineer who is licensed in the state(s) where your operations are located. While the OSHA regulation provides a national framework for safety, your state may have additional requirements. Take care to ensure that the outside resource you select for your arc flash compliance work is familiar with not just the federal, but also the state regulations on this matter.

3. Assessment Method. As the regulation indicates, the heat energy incident levels must be determined for every potential arc flash location. Appendix E provides guidance in performing assessments and

regarding which methods may work best in the various aspects of your system. These levels can be determined by sophisticated computer modeling software that can cost upwards of \$10,000. Because of the cost of the software and the training required to utilize it, some companies choose to outsource this work to consulting firms rather than perform the work themselves. If outsourcing this aspect of your assessment, don't underestimate the importance of collaboration between your utility and your consultant. The accuracy and availability of the input data and drawings will have a significant impact on the quality of the study results, so sharing of information is critical.

Ask your outside resource which computer model they will be using for the heat energy computing. It should be one that meets the requirements set forth in the OSHA regulation. Confirm that your engineering firm has run this modeling for other customers, and for how long. You may also want to ask how many team members are qualified to run the modeling, to ensure that this doesn't pose a potential backlog for the engineering firm. Time is of the essence in bringing your operations into compliance. You don't want any delays to occur because your data is waiting in queue for a single computer operator who is honeymooning for three weeks in Punta Cana.

Before signing the contract with your outside resource, be sure that they will provide you with a copy of the software model used for your heat energy calculations. You may need to run more tests and enter more data down the road. It is good practice to retain this information in-house as well as have a copy with your engineering partner.

4. Mitigation Planning. Although the revised OSHA regulation does not stipulate that electric utilities must find methods to reduce arc flash incidents, there are inherent benefits in doing so. Seek out an engineering resource that can advise you on not only meeting the regulatory requirements, but also on ways to adjust your operations to mitigate arc flash incidents altogether.

Professionals who perform arc flash consulting for industrial customers are more likely to identify opportunities to remove or greatly reduce arc flash incidents. For example, recommending a setting adjustment on a protection device may be the difference between a heat energy level requiring significant safety protection and a level that falls within acceptable measures. Ask your outside resource to provide you with examples of mitigation recommendations they have made for industrial customers to assure you of their abilities in this area.

5. Labeling Support. It may sound simple, but part of the revised OSHA regulation includes more robust warning labels in all areas where arc flash incidents may occur. You will need a resource that can provide these labels. Maybe your operations can print labels in-house. But if you need to have this service performed outside, it may be easiest to have the engineering firm do this as part of your arc flash compliance contract. Labels that meet OSHA requirements are an important way to inform employees of the precautions necessary in specific work areas.

6. Training. Let's take a step back for a moment. OSHA is part of the US Department of Labor, so while the revised OSHA regulations may provide opportunities to better protect your operations, the regulation is primarily intended to protect your *employees*. All the safety precautions in the world will do little to protect your employees if they are not properly trained on the use of the equipment, the messages on warning signs in key work areas, and the first-aid steps to take should an incident occur. This is where training comes in.

The regulation states that "all employees performing work covered by this section shall be trained" in safety-related work practices, safety procedures, applicable emergency procedures, safe minimum approach distances, proper use of PPE and precautionary techniques, and recognition of electrical hazards. The regulation tells employers that the training shall be performed in the classroom or on-the-job. Training is necessary for employees as well as contract workers who may be working in areas where arc flash incidents may occur. First-aid training is necessary for employees performing fieldwork. And the regulation calls for a robust lockout/tagout system along with training for employees using the system. Following the training, "the employer shall ensure that each employee has demonstrated proficiency in the work practices involved before that employee is considered as having completed the training required..."

So training is an important aspect of the regulation. Unless you have a robust training program internally, you may want to have your engineering partner design a training program specific to arc flash incidents. Depending on your internal resources, you may choose to have the outside engineering firm also perform the training and proficiency monitoring for you. Have your consulting engineering firm provide details on similar training programs they have designed for others. Ask the firm to provide references in this area specifically.

7. Long-Term Support. Like most federal regulations, OSHA 1910.269 is not a one and out program. To ensure continued compliance, OSHA stipulates that the employer "shall determine, through regular supervision and through inspections conducted on at least an annual basis, that each employee is complying with the safety-related work practices..." In addition to the annual inspection, additional training shall be performed "if new technology, new types of equipment, or changes in procedures necessitate the use of safety-related work practices that are different from those which the employee would normally use..."

With the need for regular inspections and additional training, you should select an outside resource that will be with you over the long term. Make sure your contractor is accustomed to long-term support with their other customers. Ask how long they have served their key accounts. Look at their team members, are they all a little long in the tooth, or are there some members who may be on the upward trajectory of their career? Get a good idea of the bench strength your outside resource offers so you have the assurance of a long-term partner.

At the on-set, the OSHA 1910.269 revisions pose considerable work for American electric utilities. In the end, these efforts will save lives, reduce injuries, and provide a safer work environment for electrical employees. To bridge the gap, many electric utilities may need assistance from an outside engineering firm. Thankfully, there are many experienced and qualified electrical engineering firms who can provide the heat energy incident assessments, the compliance recommendations, and the required training for arc flash regulations. With a detailed qualification list and a careful review of the candidates, your utility should be able to identify and select the right engineering firm for your arc flash compliance needs now and in the future.

Resources

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For the Final Ruling on OSHA 1910.269, go to <http://www.dol.gov/find/20140401/2013-29579.pdf>

For information on the NFPA Standard 70E, go to <http://www.nfpa.org/codes-and-standards/document-information-pages?mode=code&code=70e>

¹Compiled by the Electrical Safety Foundation International using data from the U.S. Bureau of Labor Statistics, CFOI, 1992-2010.

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