

## Should you outsource electrical hazard assessments?

By Larry Altmayer, Littelfuse

**W**hether you attempt an electrical hazard assessment in-house or hire an outside firm, there are several qualifications that must be considered in meeting OSHA standards.

OSHA regulations and NFPA standards (OSHA 1910 and NFPA 70E) require employers to identify and evaluate electrical hazards in the workplace, and to establish safe work practices and PPE for workers. This includes not only possible shock hazards, but also an assessment of electrical Arc-Flash hazards, as described in the 2004 edition of NFPA 70E. An Arc-Flash assessment is critical, as such events generate intense heat and arc blast pressures that can cause severe burns, concussions, falls, and associated injuries. These events are a leading cause of death among electrical workers.

However, you don't necessarily have to perform this assessment in-house, and there is always the danger of getting it wrong if you do. Electrical hazard assessments are complex, and unless you understand the special expertise required you risk falling short of OSHA requirements. For instance, the sections of 29CFR1910 relating to Personal Protective Equipment (PPE) selection are based on industry standards such as NFPA 70E and the IEEE1584 guideline. These standards and guidelines are used to calculate heat energy associated with an Arc-Flash event based on fault current, fault clearing time, and other factors.

### Resources and Expertise Needed

Beyond technical qualifications, one of the biggest advantages of using an outside hazard assessment firm is readily available personnel and resources. Often, in-house assessments are something that plant managers have precious little time for, and may never be fully completed. By selecting an engineering services firm with adequate personnel and resources, they can handle the entire assessment project. Obviously, they should have enough people and resources for the size of your plant and scope of work needed, including

employee training and implementation of corrections. The firm should have both electricians and engineers on staff, and their resources should be in close proximity to your facilities to avoid excessive travel costs.

Because your company is liable when anyone works in your plant (employees or third party personnel) the group doing the assessment must be able to gather data safely. This includes a written protection plan for gathering data while all systems are energized, and documented proof of workers' safety training in equipment and tool usage. These plans and work practices must adhere to NFPA 70E guidelines and OSHA rules.

The fact that your plant shares liability in case there is an electrical accident is another reason to use an outside firm. Typically an assessment firm carries general liability insurance and professional liability insurance for errors and omissions. (Don't hire a firm that can't present proof of current liability coverage!)

On the other hand, one reason to use in-house staff to do an assessment is cost savings. Assessments may take months to complete, and the cost can add up. Another reason is that in-house personnel should be thoroughly familiar with your plant and processes.

Hazard labeling is another consideration. This may seem mundane, but the National Electrical Code (NEC) mandates that equipment have warning labels that clearly identify electrical shock and Arc-Flash hazards. These requirements are supported by OSHA. Your company or the outside firm must be able to produce these equipment hazard labels in substantial volume. Furthermore, the labels must be correctly installed to correctly identify hazards and avoid possible liabilities.

### The Cost of Getting it Wrong

OSHA publication 29 CFR 1910 clearly spells out employer responsibilities in assessing the workplace to identify potential electrical hazards, and protecting workers from them with appropriate work practices and personal protective equipment (PPE). Hazard assessment and work

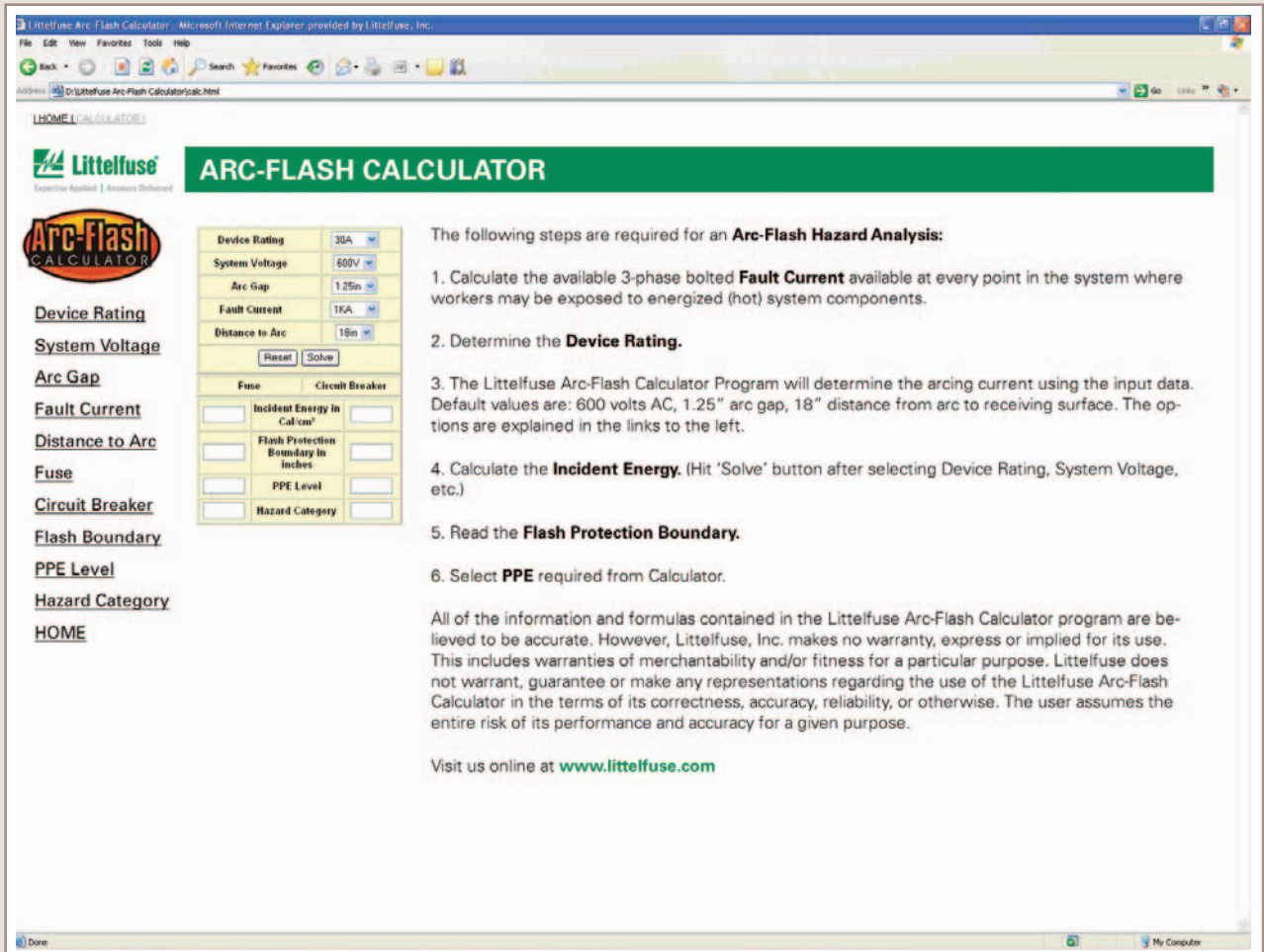


Fig. 1. Basic Arc-Flash calculation software is freely available at <http://www.littelfuse.com/arccalc> and other websites, but it is less sophisticated than the software used by professional engineering firms.

practice errors are costly. Failure to fully comply with OSHA requirements puts workers at risk and can result in fines and exposure to multi-million dollar lawsuits. In 2005, OSHA assessed employers over \$34 million in fines, 44% of which were due to electrical hazards.

With the stakes so high, it is imperative that companies accurately assess their electrical infrastructure and configuration, including the equipment and work practices for all actual and potential electrical hazards, especially shock and Arc-Flash hazards. Because of such complexities, most companies seek an engineering services firm to perform a comprehensive electrical hazard assessment of their facilities. In any event, before attempting an in-house assessment, or selecting a third party for the job, consider the requirements described below.

### Technical Qualifications

1. Ask yourself, do you understand the common pitfalls of doing an electrical hazard assessment and how to avoid

them. If you (or an outside engineering firm) can't list them, then the required expertise is lacking. Whether the assessment is done in-house or by an outside firm, personnel doing the assessment must be able to demonstrate knowledge of your type of plant, its safety needs, and industry specific requirements. (Even if an outside firm is used, most plant managers will assign one employee familiar with the electrical infrastructure to work with the assessors, help them locate circuits, open locks, and give them any one-line drawings that are available.)

2. As the assessors move through the plant, they will encounter energized equipment that may increase their exposure to electrical hazards. The assessors need to follow all OSHA and NFPA safety protocols, and default to wearing the PPE for the worst-case hazard scenario whenever opening panels and the hazards are not known. Furthermore, the inspections should be performed by qualified workers. Plant electricians or maintenance personnel may say they are qualified, but unless they have

received specific work task, hazard identification, safe work practices, PPE and equipment required training and it is documented, then OSHA does not consider them qualified. Allowing unqualified workers to perform electrical hazard inspections could leave the company liable if there is an accident.

3. An outside firm that specializes in electrical hazard assessments will understand the intricacies of all electrical safety standards and their requirements — OSHA's and others. The firm you select should be able to articulate the pros and cons of the different methods required to do the assessment. These standards would include 29 CFR Part 1910 Electrical "Subpart" S, NFPA 70, NFPA 70E, IEEE 1584, ANSI, ASTM, and various state and local standards (e.g., CAL/OSHA et al).
4. Whoever does the shock and Arc-Flash analysis portion of the assessment must meet the full requirements of OSHA and NFPA 70E. This includes an analysis of all electrical equipment down to 50 V. This means that the lead engineer must know the differences between IEEE 1584 and NFPA 70E calculations for short circuit currents and why it is often wise to calculate using both methods to account for worst case possibilities and avoid having to re-do a study in the future. Many companies do only 240 V and above analyses, or an "open-book" analysis using NFPA 70E tables only, with disregard for the table usage requirements and qualifications. Furthermore, the responsible engineer should know the limitations of each standard; for example, IEEE 1584 cannot be used when available fault current exceeds 106 kA, or when voltages exceed 15 kV.

Arc-Flash calculations can be performed by an engineer or a plant electrician – free software is available from many companies for this purpose. However, as with most free software, many assumptions are made in the calculations, which may not result in an accurate determination of incident energy levels or boundaries. The information that is required for the calculations includes knowledge of cable length, diameter, metal type, overcurrent protection, and utility service into the plant.

5. Make sure your company or the firm you select fully understands OSHA requirements for documentation and record keeping. As far as OSHA is concerned, if it wasn't documented, then it didn't happen. Failure to keep proper records can lead to violations and fines.
6. Another requirement is having the commercial software tools and capability to build a computer model, create and conduct short circuit and coordination studies, and to create electrical one-line drawings. To do so effectively the company must not only have the technical library with which to model short circuit and coordination characteristics of existing equipment, but also the knowledge and ability to evaluate available short circuit currents for equipment not included in such a library.

7. To perform the work efficiently requires one or more of the widely used electrical data management and analysis software packages. Most outside firms in this business have a library of such software, and there is a good chance they will have one that your company can use, or may already be using.
8. A typical advantage of an outside engineering firm is a broad range of experience and knowledge of electrical utilities that feed industrial plants. These firms understand the impact of electric utility feeds coming into a plant. Arc-Flash calculations start with available short circuit current, which can increase or decrease depending on actions by the utility. Ideally, analysis includes calculations with multiple assumed values of available short circuit current, so that future actions by the utility will not be a factor. In any case, the company doing the assessment should have the wherewithal to keep the plant in compliance as inevitable changes are made to the electrical system.
9. The work does not end with the electrical hazard assessment. The group doing the assessment must create recommendations and concrete action plans to lower hazards and correct deficiencies. Typically, these recommendations would include changes to fuse types, breaker settings, equipment repairs, adjustments to correct improper interrupting capacity of protective devices, and suggestions to improve overcurrent coordination problems, and any other recommendations that could reduce or eliminate hazards or the need for PPE and fire retardant clothing.
10. Another important qualification is that assessment results be reviewed and signed by a Professional Engineer, and this P.E. should be licensed in the state where your plant is located. This is required by law in some states, and is a moral imperative because of the life safety issues involved.

## Employee Training

Few plants are staffed with training personnel for comprehensive electrical hazard education programs.

Therefore, it's best to use an engineering services firm that can follow up an electrical hazard assessment with employee safety training and continuing audits, using their dedicated, experienced trainers on staff. Topics covered during training should include:

- Standards that govern electrical work and their requirements, including NFPA 70E and others
- Electrical safety work practices, including lockout/tagout procedures per 29 CFR 1910
- Applicability of other OSHA or state rules and penalties for noncompliance
- The difference between "qualified" and "unqualified" workers, and work limitations for unqualified workers
- Comprehensive examples of acceptable and unacceptable work practices, including those in wet or damp locations



WHEN IT  
COMES TO  
ELECTRICAL  
SAFETY...

As the worldwide leader in circuit protection, Littelfuse is the company that engineers and plant managers trust to answer their most critical circuit protection questions.

Littelfuse POWR-GARD Services can help you every step of the way towards OSHA compliance and electrical safety: from identifying Arc-Flash hazards to developing a complete electrical safety system for your facilities. Our services include:

- Short Circuit and Coordination Studies
- Arc-Flash Hazard Assessment
- NEC 110.16 Warning Label Service
- On Site Electrical Safety Training

Don't take chances when it comes to Arc-Flash and electrical safety. Contact the experts today! Visit [www.littelfuse.com/safety](http://www.littelfuse.com/safety)



## DON'T TAKE ANY CHANCES

- Use of key interlocking systems
- Identification of type and level of hazards, including electrical shock and Arc-Flash
- Identifying energized components and conductors
- Determining nominal circuit and equipment voltages
- The use of voltage sensors and meters
- Interpreting hazard warning labels
- Safe approach distances to exposed electrical conductors
- Rules for authorized "Hot Work" and use of Live Work Permits and Job Briefings
- The consequences of poor electrical safety practices to people and equipment
- Personal Protective Equipment (PPE) requirements, including selection, proper use, and maintenance
- Required and recommended maintenance and safety inspections
- Grounds and Grounding

All of this training should include appropriate job aides. Furthermore, it should be integrated with the employer's standard operating procedures and policies of enforcement.

### About the Author

Larry Altmayer has been teaching and training electrical maintenance supervisors, safety managers, electricians, safety engineers, and consultants for over 10 years. He has co-authored or contributed to the Littelfuse Electrical Safety Handbook and has published articles on electrical safety, protection, and controls. Larry Altmayer has given hundreds of presentations to engineers, managers, and electrical workers on electrical safety, NFPA and OSHA regulations. He has worked closely with the OSHA National Training Institute.

Reprinted with permission from Plant Services, September 2007.  
© PUTMAN. All Rights Reserved. On the Web at [www.plantservices.com](http://www.plantservices.com).