



**Podcast Transcript: Electrical Arc Flash Safety**

Featuring NFPA and Eaton Corporation

**You're listening to Joe Sheehan, NFPA's Principal Electrical Engineer and Larry Stahl, Industry Director of Eaton's Electrical Business discussing electrical arc flash safety. And now...Joe Sheehan.**

**Joe Sheehan:** Let me introduce NFPA 70E. 70E began, had its beginnings from OSHA directly. OSHA asked NFPA to engage themselves in another electrical document, a new electrical document, focused toward worker's safety. And that document was NFPA 70E, the standard for the electrical safety requirements in the work place. The first edition was published in 1979 and included only Part 1, which was basically the previous edition of the national electrical code. And, as it's grown over the years, this edition has four parts within it. Those four parts are Chapter 1: Safety Related Work Practices, Chapter 2: Safety Related Maintenance Requirements, Chapter 3: Safety Requirements for Special Equipment, and then finally, Chapter 4: Installation Safety Requirements. And for this discussion we are going to focus on Chapter 1 of 70E, Safety Related Work Practices.

**Larry Stahl:** Thanks Joe. You know, to help others understand what the arc flash hazard is and the risk. It's like, you know, when you are dealing in the electrical world there are multiple hazards. And those are the abnormal circuits that you deal with, like ground faults, short circuits, overloads. Historically we've been able to apply technology and identify them and eliminate them. And today those are no longer the hazard that they once were. Well, and that's where we are with arc flash. Arc flash is a significant hazard. It has been around for awhile but we really haven't acknowledged its existence enough as an industry. And we have to start looking for new technologies, applying old technologies to help identify the abnormal circuit of an arc flash, which is a partial phase-to-phase, or phase-to-ground, or phase-to-neutral connection that arcs and looks like a normal circuit condition to the overcurrent protective devices that are used in a circuit. The risks are very high. People get hurt. People get killed. That's really what we are trying to eliminate here all together. It's going to take a significant amount of effort on everybody's part. An arc flash hazard is an electrical explosion. It puts out a tremendous amount of heat, shrapnel, toxic fumes, acoustical waves, and bright flashes. It has potential to hurt and kill. Just as a small example, copper expands when it oxidizes in an arc flash hazard, expands at a rate of 63,000 times its normal volume.

One incident will cause the loss of an employee, whether it's days of work out or his death. It will cause moral or ethical questions within the company and it will cost financially. It's millions. No matter how you look at it, the losses are significant. Every single company that deals with electricity in terms of its maintenance and so on needs to really understand this hazard and deal with it.

**Joe Sheehan:** And you know, the arc flashes as we now understand it and know it in the electrical industries is really not new. Neither is electrical shock. Workers have been injured by electrical shock and arc flashes since electricity was first used. However, recently it's been able to be quantified. Recently it's been able to be studied a lot more. There are trauma centers around the United States that deal with this injury that have produced an awful lot of valuable information to help write standards. As we talk about how prevalent are arc flashes. They really aren't more prevalent like I said before. But the data collection is becoming much better and much more accurate, as they relate to electrical. Remember electrical burns as a category or injuries used to be hidden. Hidden with other burn data and sometimes wasn't broken out as electrical. As we look at how serious are the injuries. There are many sides to serious. For example, you know, some statistics; 32,000 non-fatal electrical injuries occurred between 1992 through 1998. Another example in 1999 alone, there were 278 fatalities from contact with current. One other statistic that I don't see too many people talking about is the economic loss from injuries. It is actually ten times greater than the loss from labor strikes. Serious as it relates to injury, recovery time is also extremely important. The recovery from an electrical explosion to an arc flash is a long time. Skin burns, second degree and third degree take mainly forever, if ever possible to recover from. The effect to the family and the loved ones is extremely serious. OSHA counts serious injury a little bit different. OSHA counts it as lost work days. And as far as arc flash is related to lost work days, there are a lot more lost work days due to arc flash is than you would normally think. When we talk about costly electrical injuries and cost, this is a real big one. I saw recent statistics that costs of 23 million dollars per disabling injury. 23 million. That's the first year medical cost plus lifetime disabling medical cost and that can exceed 23 million dollars. So, how do we work together to build a safer work place? We have to eliminate these arc flashes. We have to really just eliminate these electrical hazards. We have to reduce them as best as we can, but elimination, a zero,

should always be the goal.

**Larry Stahl:** Joe, that's a staggering number. And you know, we always look at things in terms of the physical injuries, the impairments, and the financial side of it. You know, you kind of touched on this a bit. One of my co-workers who lives over in Europe... The way he likes to put it is, once one of these electricians deals with an arc flash, and experiences it, he will never plug in a Christmas tree again. What goes on inside that person's head. There is psychological aspect to this too that we don't often talk about. And it's serious because that guy, once he experiences that flash, assuming he lives through it, will never be able to think about things the same way he did in the past. What do companies do from here? I mean, first of all, they have to acknowledge that there is a hazard. They must deal with it. They must acknowledge that. The first move in dealing with that hazard is to comply with NFPA 70E, 2004 edition. This is a guide that will help the customer, help the user or the contractor to analyze the system, calculate the arc flash energies, label the equipment, provide the personal protective equipment, the PPE, put in place procedures, and train. NFPA 70E, is a great guide. It should be utilized and implemented by everyone. They must comply with it. Then, the next step, they should turn to their industry experts, people like Eaton, and our competitors. I mean, we are all in this and working toward solutions to recommend to our customers to take it to the next step. The next step would be, how do you remove people from live equipment when you're changing its state? That's the first thing. The second would be to reduce the duration of the arc flash fault. And, the third, is to reduce the current levels that feed into the energy of that fault. Any combination to those two will also be part of the solutions. There are answers out there to minimize the risk. To your point Joe, we should be shooting toward zero and total elimination of it. People have to get started to acknowledge the fact that there is a hazard to begin with.

**Joe Sheehan:** Absolutely, Larry. You know, that's why OSHA is the law and why it became federal law, was to protect the employees in the workplace from injury, electrical injury. As we look at it, from NFPA's point of view, OSHA is the law. It's the federal law. As you know, it's strictly enforced. OSHA law requires the employer to provide a safe workplace and to protect workers from injury. The OSHA law, however, doesn't provide the necessary detailed information on how to provide a safe workplace. It just simply states the

requirements. NFPA 70E is a standard and it's a solution to those performance requirements that OSHA sets forth. In so following 70E and using the requirements within 70E, an employer can comply with OSHA. So, we look at it as the solution to comply with the federal law as far as protecting the worker from injury. It's not, certainly not, the only solution, but it is a solution. And it is a consensus based standard or a consensus based document that provides that solution.

**Larry Stahl:** And, you know, how does the arc flash accidents happen to begin with? Well, people assume, people take short cuts, you've got overconfidence to deal with, miscommunications, not complying with 70E, not following their standard procedures. You know, they should always test, turn off, and test again, and use a lock out/tag out procedure. It's just so important that they have those as part of their normal routines and they do every single day. Usually it's the experienced craftsman or professional, like myself, that just take it for granted and have lack of respect. I have historically been one of those individuals. As we'd spoke earlier, Joe, my first IEEE electrical safety workshop in 2004, my perspective today is totally different than what it was before. I have respect for what is behind that piece of sheet metal. I don't do a lot of things that I used to historically. Even if it's in a consulting basis and standing in a switchgear room, I step away. I do not get within close proximity because I realize what is behind those pieces of sheet metal.

**Joe Sheehan:** Yes, Larry. Thanks. These are exciting times for electrical safety. We see substantial increase in 70E training. We see engineering studies in the workplace that quantify the degree of hazards and inform the employer as to where the most hazardous situations are in its facility. We see that PPE business is booming with all kinds of new products. We also see that the document NFPA 70E is also again ready to enter the revision cycle. The next edition will be the 2009 edition. Our proposal closing dates will be September 15th. So, if anybody is interested in submitting proposals, we certainly would welcome those proposals from the public. As far as the manufacturers go, you have introduced some very exciting products here, Larry. I'm very excited to see that these innovative solutions can be used to reduce or mitigate some of these terrible hazards that we just talked about. So many things are happening. Exciting times for the electrical worker I believe too. We're confident that through NFPA 70E training, awareness

training, task specific training, such as the lock out/tag out. Using all of these we think that there will be a substantial decrease in the injury rate as it applies to the electrical workers as we go forward. Thank you, Larry.

**Larry Stahl:** Thanks, Joe. And just to add to what you stated. You know, as an action plan for users and electrical contractors. You know, where do you start? Where's the first place? Well, the first place to start is with NFPA 70E. Acknowledge the document, comply with the document, and put it in to place. As part of that document, there is a form in there. It says to de-energize the equipment. And, if you can't de-energize the equipment, why can't you? It asks for a manager's signature on that. I mean that, that in itself will help with the cultural change that we need to go through to turn it off if you're going to work on it. You brought that point up earlier Joe and it's so, so important. Then, there are the next steps. The next steps as we talked about it, is to reduce the energy levels or to move the people out of harm's way. All the manufactures are working toward solutions to that end. Just as one simple example that we offer. One small solution out of the many is what we call an Arcflash Reduction Maintenance Switch™. It can take energized equipment from a 40 calories per centimeter squared, which is a PPE 4, down to under 4 calories per centimeter squared, which is a PPE 1. Depending on the application, could even get you down to zero. That in itself would go a long way to reduce the injuries that take place. People have to move forward and there is no one single answer. They have to start with 70E and then they have to look for additional solutions beyond that. Joe, thank you very much for your time and it's been a great conversation. I've learned a lot from it.

**Joe Sheehan:** Thank you very much, Larry.

**The NFPA and Eaton Corporation offer training and materials on electrical arc flash safety. For more information, log onto [www.NFPA.org](http://www.NFPA.org) or visit Eaton's electrical arc flash safety website at [www.arcflashsafetysolutions.com](http://www.arcflashsafetysolutions.com).**

### LARRY A. STAHL

Larry A. Stahl is Industry Director - Petro/Chem for Eaton's electrical business. His 30-year career with Eaton has included various roles such as sales, marketing and product management. Prior to joining Eaton (formerly Cutler Hammer) in 1976, Larry earned his B.S. degree in Electrical Engineering from the University of New Hampshire and worked for four years as an Industrial Electrician in New Hampshire. Through early practical and current professional experience with the hazards of arc flash, Larry has worked towards solutions of improved safety through product and system designs. Larry is an active member of both IEEE IAS PCIC and the IEEE IAS Electrical Safety Workshop.

### JOSEPH V. SHEEHAN

Joseph V. Sheehan, P.E., is a Principal Electrical Engineer. Prior to joining NFPA in 1993, Joseph was employed for over 28 years in the electrical construction industry as an Electrician, Chief Estimator, and Project Manager in the Boston area. He taught Electrical Engineering for over 15 years in the evening division at Franklin Institute of Boston. Also, he is a licensed Master Electrician in Massachusetts, Rhode Island, and Connecticut. He is a Registered Professional Engineer in Massachusetts.

Staff liaison for:

- NFPA 70E, Electrical Safety in the Workplace
- NFPA 70B, Electrical Equipment Maintenance
- NFPA 79, Electrical Equipment for Industrial Machinery
- Assist with NFPA 70, National Electrical Code®

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