

The Basic Guide to
**Arc Flash Assessments
And Safety**



Table of Contents

Introduction: What is an arc flash?.....	1
Who needs arc flash assessments?.....	2
Why do we need arc flash assessments?.....	3
What causes an arc flash and arc blast?.....	4
What is the goal of an arc flash assessment?.....	6
Simple steps to complete an arc flash assessment.....	7
Arc flash PPE.....	8
Tips and advice.....	9
Conclusion.....	10
Additional resources.....	11

Introduction:

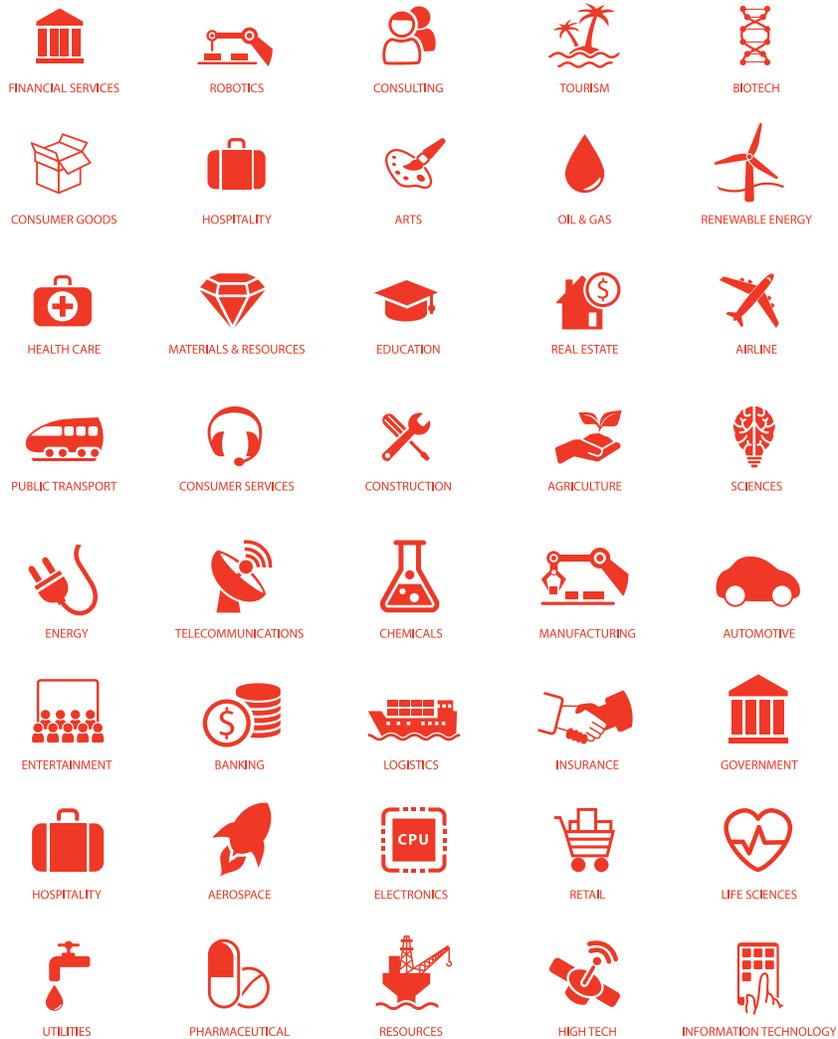
What is an Arc Flash?

The common term 'arc flash' often is discussed in the industry regarding electrical injuries, either in a factory or facility. It's therefore crucial to understand what an 'arc flash' really is, given their commonality. Because of the combination of heat and light emission, an often-fatal electrical explosion may occur, referred to as an 'arc flash'. Following the explosion, hot gasses can be generated and can melt metal and other similar materials causing further damage. In many cases, the damage compounds regarding specific metals such as copper, which tend to vaporize and explode.

Given the extent of the damage potential of an arc flash, it's often a precursor to fatalities and severe injuries which include eye damage and radiation burns. The pressure waves emitted from the explosions can also severely affect brain function and hearing. If by chance there are free tools, other debris, and machinery, more accidents can occur. On top of causing injury or death to employees, another problem is business continuity (often called downtime), causing massive amounts of revenue loss.

Who Needs Arc Flash Assessments?

Nowadays, it seems that everyone understands the need for having an electrical safety program to protect workers from the hazards associated with electrical equipment. What seems to still be missing are adequate arc flash assessments. The answer to who needs to have an arc flash assessment is simple: any facility that has 3-phase electrical equipment must have an arc flash assessment to determine the hazards present and how to protect employees from them. Over the past 15 years, we have seen that the industries needing arc flash have shifted from manufacturing, to aerospace, to facilities, and now to schools and municipals. So who needs an arc flash assessment? Just about everyone.



Why Do We Need Arc Flash Assessments?

1. To protect workers

Those of you reading this who are in the safety profession have likely completed some form of hazard assessment in your tenure, or at least read about them in college. Some hazard assessments are simple. For example, employees who carry heavy objects frequently drop them on their toes. In this situation, a simple hazard assessment may provide simple mitigation techniques such as informing these employees to stop carrying these objects, or requiring these employees to wear steel toed shoes.

2. To comply with NFPA 70E

Electrical hazard assessments are not quite as simple. You can't simply look at an electrical cabinet and know the hazards. Sure, there is always the potential for shock when the cabinet is energized, but what about arc flash hazards? You can't look at a panel and know the arc flash potential. It's not based on how old it is, or how big it is, or even what it's feeding.

3. To avoid downtime in the facility

There are many factors that determine why a panel has a higher hazard than another one. For most of the electrical equipment in your facility, there will not be an arc flash potential. The issue is that you don't know where that may be. We can't predict which panels will be a small spark and which ones would yield a life-altering explosion. This is why we complete arc flash assessments. We want to find the goods and the bads and make sure that we are able to warn the employees about both.



“Every 30 minutes during the work day, a worker suffers an electrically induced injury that requires time off the job for recovery. Over the last ten years, more than 46,000 workers have been injured from on-the-job electrical hazards.” - Electrical Safety Foundation International

What Causes an Arc Flash and Arc Blast?

An arc flash will occur due to an uncontrolled conduction of electrical current, either resulting from a phase-to-neutral, phase-to-phase, or a phase-to-ground situation. Air ionization combines with the resulting scenario, and a 3-phase arcing fault may occur when conductive metal vaporizes.

The easiest way to explain arc flash is to think about welding. Just about all of us can picture a welder or a plasma cutter. The bright light with the potential to fuse steel or cut right through metal almost instantly explains how intense the heat is from arc welding and it's the same with an electrical arc.

The reason why it's so important to know all this? All of this can happen as quickly as 1/1000 of a second.

Personnel need to only be a few feet away from the location of the coming incident and be exposed to potential injury or even death. Other workers may also experience massive burns and injuries, as the energy release can filter through the air as part of the arc fault current, damaging everything in its path.

As mentioned earlier, the presence of copper makes the incident that much more dangerous. Other conductors present more of a problem, but specifically copper, can cause detrimental issues due to expansion. When vaporized, copper expands as much as 67K and causes a pressure wave or an arc blast. The blast is enough to knock over a construction wall or snap the heads of 3/8-inch steel bolts clean off. Hence, the danger.

The incident is so sudden that oftentimes no one would know what physically caused the arc flash. The cause could've been something as simple as opening a door or exercising a device within the facility. A worker could be testing and troubleshooting a piece of equipment, and without preventative measures in place, an arc flash incident can occur. Even dropping materials in cabinets, or simply touching the wrong thing, can cause disaster. The human element is a possibility because carelessness and poor safety practices are the cornerstone of arc flash disasters.



“An arc flash can happen as quickly as 1/1000 of a second.”

Events beyond our control can cause an arc flash incident, which is why it's even more paramount to have an assessment in place:

- Spikes
- Voltage Transients
- Installation Gaps
- Worn Connections
- Improper Equipment Installation
- Corrosion
- Dust
- Exposed Live Components
- High Voltage Cables
- Damaged Equipment
- Poor Circuit Breaker Maintenance
- Broken Conductor Insulation
- Static Electricity
- Blocked Disconnect Panels
- Liquid or Moisture on Electrical Equipment

What Kind of Fatal or Dangerous Injuries Can Occur?

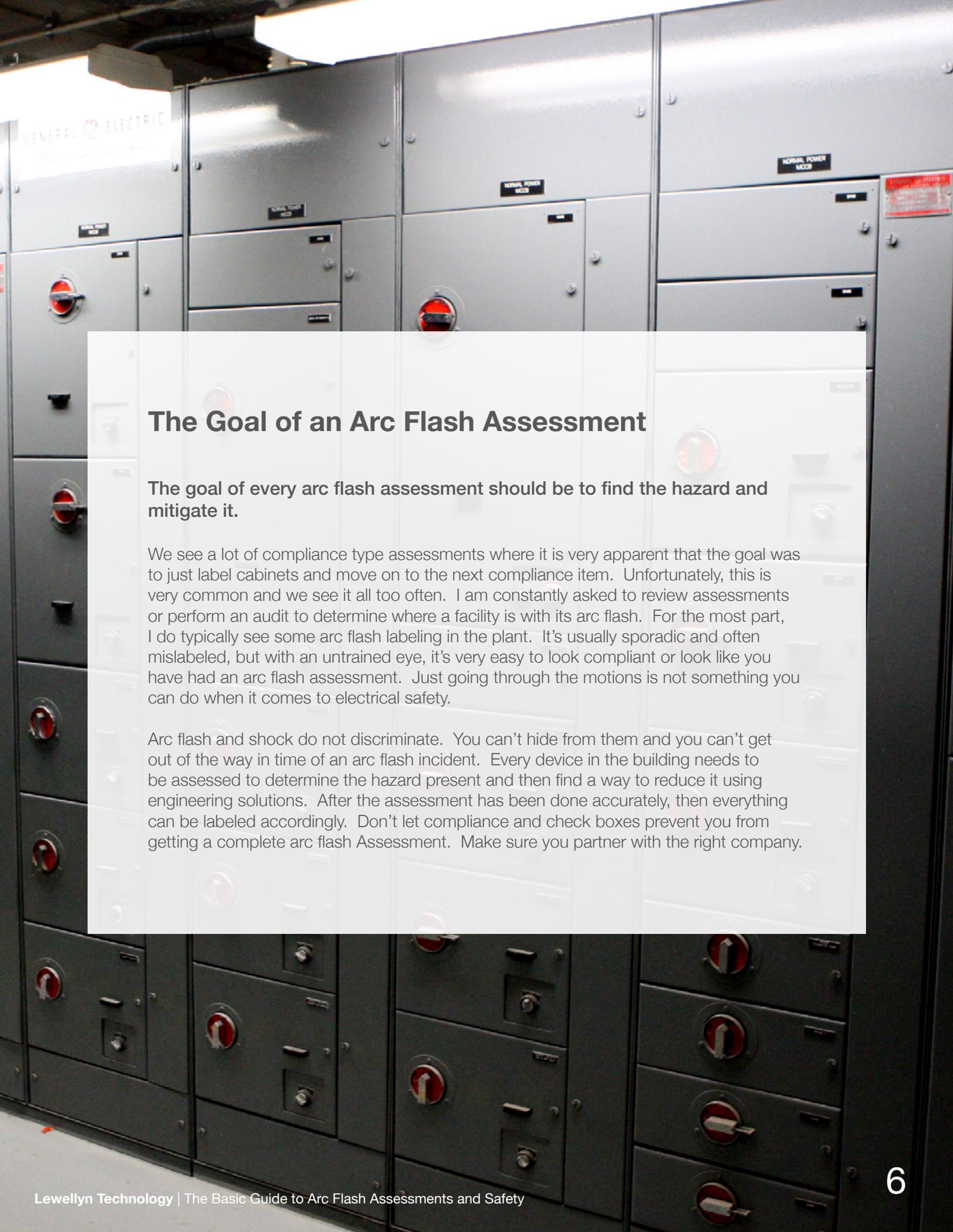
When not wearing the proper Personal Protective Equipment (PPE), the arc flash can ignite clothing and burn it in seconds. The kind of burns on your skin caused by an arc flash could take years to recover from.

The eyes are also a target. Without required protection, molten debris and projectiles can enter the eye and damage the retina. The harsh UV radiation not only physically damage the eye, but can also permanently render a person blind.

An arc flash can affect your lungs given the heated vapors in the air, damaging your internal organs and even suffocating you. Just as a precaution, specialized breathing masks might also be a necessity as part of an electrical safety program.



“An arc flash can cause severe burns, memory loss, hearing loss, respiratory damage and even death.”



The Goal of an Arc Flash Assessment

The goal of every arc flash assessment should be to find the hazard and mitigate it.

We see a lot of compliance type assessments where it is very apparent that the goal was to just label cabinets and move on to the next compliance item. Unfortunately, this is very common and we see it all too often. I am constantly asked to review assessments or perform an audit to determine where a facility is with its arc flash. For the most part, I do typically see some arc flash labeling in the plant. It's usually sporadic and often mislabeled, but with an untrained eye, it's very easy to look compliant or look like you have had an arc flash assessment. Just going through the motions is not something you can do when it comes to electrical safety.

Arc flash and shock do not discriminate. You can't hide from them and you can't get out of the way in time of an arc flash incident. Every device in the building needs to be assessed to determine the hazard present and then find a way to reduce it using engineering solutions. After the assessment has been done accurately, then everything can be labeled accordingly. Don't let compliance and check boxes prevent you from getting a complete arc flash Assessment. Make sure you partner with the right company.

3 Simple Steps to Completing an Arc Flash Assessment

Data Collection, Engineering Solutions, and Labeling are the 3 main steps to getting an arc flash completed.

1.

DATA COLLECTION:

The data collection phase of the project requires that someone come onsite to your facility and inspect your electrical equipment. You can't do an arc flash from the drawings because it is not that simple. Don't let anyone allow you to send them your drawings and a report with labels - it can't happen that way. Someone must break a sweat in your building. There must be a professional technician opening your electrical equipment and writing things down to be used later in the assessment.

2.

ENGINEERING SOLUTIONS:

Moving on from the onsite work is what I call the solutions phase of the project. This requires power engineering knowledge, software, and experienced licensed engineers to devise a solution. There should be a series of 4 total engineering assessments completed during this phase: **Short-Circuit Analysis, Protective Device Coordination Analysis, Interrupt Rating Analysis, and Incident Energy Analysis.** These engineering studies are used to provide us with the ability to determine why the hazard is present, how powerful it is, how it is traveling, and how to eliminate it or reduce it.

3.

LABELING:

During this phase, a report should be written that summarizes the results from these 4 studies and assembled into a comprehensive document. This can be referenced for current and future use designed to protect the employees. The hazard mitigation section should be the focus of the report which offers opportunities to reduce the hazards in the facility.

Expert Tip: Preventative maintenance, such as IR Thermography, can help facilities avoid unexpected downtime due to overheating equipment. Employing a worker with thermography knowledge is helpful but you can always hire a professional Thermographer to inspect your facility."



Arc Flash PPE

When someone mentions arc flash PPE, most of the time they think of space suits and heavy clothing. PPE is the last line of defense in preventing arc flash injuries. However, to many it's the first thing they think of when they hear about NFPA 70E and arc flash. Electricians cringe at the thought of having to wear "hot and heavy clothing" as we often hear; the times have changed. There are many new styles of lightweight arc rated clothing in the market to fit just about any application. Many companies are now manufacturing lighter, more breathable, and simply more fashionable PPE. I often tell everyone I speak with in relation to this that aside from the tag or logo on arc rated clothing, I could likely go to a job interview wearing this type of PPE and you would not be able to tell.

The culture change that comes with implementing NFPA 70E may mean that employees will have to change what they wear to work around electrical equipment. There isn't much we can do about that. However, if the arc flash project is done properly and safety is at the forefront of the project, we would often see a very limited need for PPE as many of the hazards have been mitigated. If you are in a situation where you still need to wear arc rated clothing, my advice is to shop around. Partner with a clothing vendor that will work with you and allow you to test their products, "wear-test" as we call it. Try them out and pick out a style that your employees will actually want to wear.

PPE is not a one-size fits all solution. You may have applications where an everyday wear uniform is the best solution. In many cases, you may want to use a coverall type of system. Bottom line is, PPE has changed and you owe it to yourselves to find a system that works comfortably and effectively.

Download our free Arc Flash PPE Poster to use as a reference when working with electricity.

[Download our PPE Poster](#)

Tips and Advice

1. Know who is doing your assessment

Do your research - do not hire a company because it's your in-house contractor or someone you go bowling with. Know the business you are partnering with to help you achieve your number one goal: SAFETY. I personally spend most of my time consulting clients on what went wrong with their assessment. Questions I ask all the time are why do they not have labels or have hazard mitigation. When clients ask questions, the #1 most requested is, "Can you look over my report and tell me if it looks good?". It is often that those who are responsible for procuring a proper arc flash assessment do not know much about it but that is OK. The important thing is to know the company you are partnering with. Nowadays there are hundreds maybe thousands of companies doing arc flash assessments and believe it or not, they all don't do it the same way. Do your research and ask questions. This brings us to our next point which is also very important.

2. Safety companies vs. engineering firms

Just remember, the main goal is to protect your employees from arc flash. The best way to determine if you are talking to the right firm is to ask what their goal is and ensure that it is aligned with yours. Why should you hire a safety company and not an engineering company? Yes, some engineering work is required to get you a safety solution, but if you only partner with an electrical engineering firm then what are you getting? A safety company ensures safety for your workplace as well as compliance with regulations. Don't hire a plumber to paint your house is the old cliché, right?

3. Implement NFPA 70E in your facility

Safety assessments go far beyond the electrical engineering aspect of the project. Implementing NFPA 70E in your facility is one of the largest initiatives you will complete and it will forever change your electrical maintenance program. The NFPA 70E Standard changes every 3 years and you need a partner who will be there for you to guide you through the changes. Implementing NFPA 70E is not something you do once then move on; you have to keep it updated. Each time something changes in the facility, such as an equipment moved/removed/added, you need to ensure that the arc flash report and labeling gets updated. A company that has your interests in mind will be there for you during these changes.

I'll end this section like I started: Be educated on who you partner with and make sure it's a company that focuses on safety.

Conclusion

Thank you for reading Lewellyn Technology's *Basic Guide to Arc Flash Assessments and Safety!* Now that you understand what an arc flash hazard is and how to mitigate it, the next step is to take action. Contact us on the next page to speak with one of our safety experts and start protecting your facility and your employees.



Download our Electrical Safety Catalog to find out what your facility needs

[Click to download the catalog](#)

Why Partner with Lewellyn Technology?

Lewellyn Technology has been improving workplace safety since 1993. Our core business is preventing electrical and combustible dust hazards in facilities of different industries nationwide. Our team of industry leaders and recognized OSHA experts work to ensure the compliance aspect is part of our solution, keeping safety of your employees as a priority. Lewellyn Technology provides multi-year project support and long-term partnerships; that is why we are there for you after the delivery to ensure excellent service and results.

We have in-house technicians nationwide which makes it easier for our clients to know who they are dealing with. Part of what makes us different from other companies is that we do not subcontract the projects so you will continue to receive consistent quality and deliverables from coast to coast.

About the Author



Jay Smith is the Executive Vice President of Lewellyn Technology and has been with the company for over 15 years. He spends most of his time as a consultant to Fortune 100 and 500 companies on NFPA 70E and electrical safety. Smith also speaks at multiple national trade shows and conferences on the subject of NFPA 70E and arc flash.

Contact Jay Smith at
O: (800) 242-6673 ext 251 | C: (812) 699-2461 | E: jsmithjr@lewellyn.com

Learn about other Lewellyn Technology services by visiting us on our website:

www.Lewellyn.com