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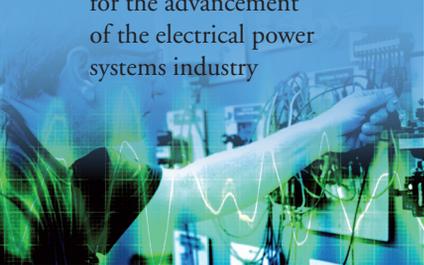
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ADAPTING IN THE FACE OF CHANGE: GEN Z AND TRAINING

BY JACKIE M. PEER,
OMICRON electronics Corp. USA

Since its introduction in the early 1900s, the design and operation of the modern power system has been conducted in a steady-as-she-goes manner. The fundamental protection principles and applications have for the most part remained unchanged; however, with the recent advent and overlay of digital technology along with a more distributed grid, the pace of change has been fast and furious with no signs of slowing down soon.

Electric power, arguably the most critical of all infrastructures, must be generated and delivered in a safe and reliable manner. Society and our way of life depend on it. In recent decades, the electric power industry has faced challenges with the amalgamation of an aging infrastructure with modern technology and systems.

Sometimes described as eclectic, today's grid is controlled, monitored, and protected by a wide-ranging mix of technology — electromechanical, solid state, and digital. New control and communications technologies introduce new capabilities and flexibility, but not without added complexity and vulnerability. The rapidly changing

generation resource mix and the integration of renewables to the grid through inverter-based systems have presented new performance and protection considerations. Increased frequency and severity of natural disasters and cyber- and physical-security threats pushes grid resiliency initiatives as a top priority. All this creates even more demand for personnel equipped with mixed skill sets. At this same time, and for the first time with the incumbent Generation Z workforce, we now have five generations working side-by-side.

In the face of change, this article discusses training considerations for today's evolving grid and multi-generational workforce. Understanding generational differences in the context of workforce development and training can help organizations build richer and more diverse learning experiences to ensure personnel are equipped with mixed skills to design, operate, maintain, and troubleshoot the grid.

TRAINING METHODS

Among the many training methods available to train today's workforce, five types are common.

1 Classroom training. A traditional approach, instructor-led training brings learners (students) together in the same place and at the same time. It provides a dedicated space for instruction and learning that is distraction free from typical day-to-day work and pressures. The classroom experience provides face-to-face personal interaction and an environment where questions are asked and answered and dialog occurs. Students learn from one



Classroom Training from Subject Matter Experts

another as well as from the instructor. Two disadvantages are removal from the job students are being trained for (equipment, technology, processes) and lack of hands-on experience.



Hands-On Training for Testing Primary Apparatus

2 Hands-on training. In this practical approach, trainees dive in and get their hands on what they are learning. This active approach with active participation is typically preferred because the hands-on aspects require focus and help improve retention. This learning-by-doing approach is not always feasible or practical depending on the availability of the technology, apparatus, or system to be trained on, and it lacks instruction on the theory behind the application.



Hands-On Training for Testing Secondary Equipment

3 eLearning. Electronic learning has been around for decades. It has many definitions that sometimes lead to confusion when trying to articulate exactly what it is: training provided

via a digital device or computer, allowing technology to facilitate learning anytime, anywhere. eLearning can easily scale for delivery to one or many and can be tailored and targeted to meet specific learning objectives. The flexibility to learn based on the learner's time and schedule and at their own pace is a strong benefit. Switching from traditional classroom-based instruction with human interaction to self-paced eLearning provides an entirely different learning experience for the students. However, eLearning can be a challenge for those who struggle with time management and self-motivation in self-directed scenarios.

4 Coaching and mentoring. To coach or to mentor are often used interchangeably, even though there are key differences in the two relationships between coach and coachee and mentor and mentee, respectively. A mentor is someone who offers their knowledge, expertise, and advice to someone with less experience, the mentee. A mentor's top priority is to develop skills that are relevant not only for the mentee's present job, but also for future jobs. Coaching tends to be shorter term, more structured and formal, aimed at performance that impacts the present job.



Virtual Reality Training

5 Video and Augmented Reality (AR). The influence of video on our everyday life is undeniable, and it's a powerful medium. It's only natural that it will extend into the workplace education setting. The online nature of videos allows them to easily be shared, and people tend to learn best when concepts are conveyed

visually. Video boosts engagement and helps retention.

AR is a game changer for training field engineers and technicians, especially for those responsible for testing and troubleshooting. As systems become ever more complex, the use of AR training can increase awareness and, in turn, work safety by practicing virtual equipment maintenance, high-risk tasks, troubleshooting, or working in unique situations.

Blended Learning

Traditionally, blended training marries e-learning and instructor-led training to create a hybrid and unique learning experience. Blended training gains popularity because it breaks away from the traditional methods of teaching — methods that don't work for all students. Blended training covers all learning styles and provides a tailored and favorable learning experience. Combining modern technology such as video or AR with traditional training methods appeals to all different learning styles.

UNDERSTANDING FIVE GENERATIONS

Welcome Gen Z! For the first time, five generations are working side by side: Silents, Baby Boomers, Generation X (Gen X), Generation Y (Gen Y), and Generation Z (Gen Z) (Table 1).

Over the past century, a new generation has been formed every 15-20 years, shaped largely by cultural trends and world events. Multiple generations coexisting in the workplace is not new, but it has become a hot topic for human resources, hiring and training managers, and instructional designers as yet another generation joins the workforce at the same time older workers are postponing retirements and working longer.

Why does this matter? Understanding each generation is important because they have different viewpoints and expectations for their work, workplace culture, and learning and knowledge sharing, making each generation unique from the others.

How important are generational differences when it comes to training? It depends. If you want to create relevant learning and development, it is important.

Let's face it: Learning styles vary from individual to individual regardless of generation. People learn in different ways, so providing different options for learning appeals to individual preferences, regardless of generation or rank.

Gen Z, for example, is markedly different than their Gen Y predecessors when it comes to learning using digital technology. They use technology differently and are interactive learners who prefer to learn digitally and visually; video is a favorite media versus learning by listening. Understanding the connection between digital engagement and a learner's experience is key.

This presents an opportunity to enhance training programs and delivery methods, not only to appeal to incumbent Gen Zers, but more so to adapt to a larger range of learner styles and preferences.

To address the topic of learning, LinkedIn conducted a survey comprised of about 400 learning and HR professionals and more than 2,000 Gen Z students.

- 58% indicated they would like to learn a new skill, but don't feel they have the time to do so.
- 43% preferred a fully self-directed and independent approach to learning.

When asked how they preferred to learn new skills, Gen Zers replied:

- Prefer to learn by doing 55%
- Prefer online learning, watching a video, or through an online course 38%
- Prefer to learn by listening 7%

A key takeaway from this survey is that Gen Z students want to learn on their own terms and prefer bite-sized learning. As native internet users, learning and development leaders should consider investing in micro-learning, also referred to as bite-sized learning, known for quickly closing skill and knowledge gaps.

CONCLUSION

The electric power industry depends on the knowledge and expertise of the workforce to support the grid and to ensure the safe and reliable delivery of electric power to society. Today's power system is going through a transformation with new advancements in technology, more connection

Table 1: Understanding the Generations

Silents	Baby Boomers	Generation X	Generation Y	Generation Z
Born 1925–1945	Born 1946–1964	Born 1965–1981	Born 1982–1995	Born 1996–2009
aka Traditionalists Veterans Builders	aka Boomers Me Generation	aka Gen X Latch-Key Kids MTV Generation 13th Generation	aka Gen Y Millennials Echo Boomers	aka iGeneration (iGen) Post-Millennials Centennials
Telephone	TV	PC	Internet	iPhone, Social Media
Largely disengaged from technology	Early IT adopters	Digital immigrants	Digital natives	Technoholics
Face-to-face	Face-to-face; telephone or email if required	Text messaging or email	Online/social media and text messaging	Visual communication using technology
Teach Me Prefer structured command- and control-oriented learning, classroom lectures, books, and on-the-job training	In Person Prefer classroom setting with in-class participation; will use technology, may prefer books to reading online	Learn by Doing Prefer self-directed learning and freedom to figure things out on own; computer before books	Short and Sweet Thrive on flexibility and space to explore; favor on-demand, highly personalized, and interactive training	Get It Now. Do It Now. Learn It Now. Prefer to learn on own terms; prefer visual, interactive, bite-sized, and hands-on learning; use of technology and social media is a given

through communications, and more distributed energy resources. And amid this change, five generations are now working together. All these changes come at the expense of added complexity and vulnerabilities that today’s workforce must understand. This collective change to the grid and the workforce presents an opportunity to understand generational differences, learner styles, and preferences and to create effective

and appealing training programs. The ultimate goal is to provide effective learning and development opportunities to industry personnel to ensure a skilled workforce is in place to support the grid of today and tomorrow. For companies with limited resources and facilities to create and deliver training, outsourcing to trusted and proven training experts is a practical and feasible option.



JACKIE M. PEER currently serves at *OMICRON electronics Corp. USA* as Head of Strategic Business Development in North America. Jackie previously worked for more than two decades at *Schweitzer Engineering Laboratories (SEL)* in a variety of leadership positions in R&D, sales, and technical marketing and as director of *SEL’s Modern Solutions Power Systems Conference* and *SEL University*. An *IEEE Senior Member*, Jackie is a member of the *Society of Women Engineers* and *IEEE Women in Engineering* and is a board member for *IEEE Women in Power* and the *IEEE Foundation*. She participates at the regional and national levels with *IEEE’s Scholarship Plus Initiative*, which is devoted to increasing the supply of well-qualified,

entry-level engineers to the power and energy industry. Jackie is president of the board of directors for *Boys & Girls Clubs of the Lewis Clark Valley*, which serves over 4,000 area youth. In 2014, she received the *Manufacturing Institute’s Women in Manufacturing STEP (Science, Technology, Engineering and Production) Award*, which recognizes women in those disciplines who have made significant achievements in manufacturing.

THE MAKING OF A LEGEND

BY ALAN ROSS, SDMyers

I recently had the opportunity to do a podcast interview with Craig Stiegemeier, who is retiring after 40 years with ABB. Craig is the inspiration behind Legends, the podcast featured on *Energy Central and Transformer Technology*, but he isn't the only legend who inspired me: Pat Ryan, Executive Director of the IEEE Power & Energy Society; Dan Smith of Austin Energy; Wayne Bishop of OMICRON and Vice President of Meetings for IEEE; John McDonald of GE...and I could go on and on; these are the real legends who have set the standard for all of us.

Why did their interviews inspire me? What were the common traits that make up a legend? The first trait I noticed was the humble way they approach success. Humility is “strength under control for the benefit of others.” At least, that’s my definition. But humility is hard to measure given the very fact that legends tend to be the difference-makers in their professions, the ones who are leaving or have left an impact. So at first glance, they appear to be the leaders, the bold ones who stand head and shoulders above the crowd.

But humility simply gets you through the gate. I’ve observed three of the most important traits that make up the criteria for being a legend.

Legends are life-long learners. This means the person is curious about the world around them and never arrives. They delight in learning more — learning new things in their field of expertise, but also learning for the sake of learning. Being a life-long learner is innate, something you are born with, but it is also something that can be honed.

Since I have been writing for NETA’s *Training Talk*, I have come to realize just how important training and education is in this process. Bad training can poison the well and make learning a chore and a bore and worse, a necessary evil. Training should be about learning, and good training should make people want to learn, want to grow their knowledge base, and want to commit to the time, energy, and money good training requires. Training, education, and development for legends are never necessary evils; they are a commitment to the future.

Legends share — openly and willingly — with anyone who wants to learn. You might say that in addition to being life-long learners, they are also life-long teachers. Over ten years ago, a co-worker introduced me to Craig Stiegemeier. Craig turned to me and said, “Alan, if there is anything I can share with you to help you learn about our industry, please don’t hesitate to call on me.” That is a life-long teacher,” and over the course of the next decade, Craig was true to his word.

It’s not enough to learn, you must also want others to learn and grow; you delight in watching someone become more than they were, to become life-long learners themselves. And you must be able to give unconditionally and freely. The legends I mentioned are those kinds of people. Most effective trainers meet both of the first two traits because in order to be an effective teacher, you must also be a learner.

Ultimately, in every situation — personally, in their career, in their avocation, or in their community — legends leave it better than they found it. You know them. You know the difference between retirees who are leaving it better than they found it, those who are just leaving it, and those who think a great legacy is all about taking it with them. The word legacy is closely associated with legends because while engaged in their careers, legends are stewards of the time and talents they

have. But they go beyond stewardship into the realm of legacy.

Stewards are responsible for the here and now, for the resources and opportunities we have today. Legacy is what we leave behind for posterity, and for many legends, that is what they are doing — leaving a lasting legacy. We hear too often about how the next generation is not going to be able to know what the boomers knew, that we are losing legacy knowledge by the bucket-full. That is true, but legends give back; they make sure they don't leave future generations in the lurch. I joke with my sons, telling them that I want my headstone to read, "He left it better than he found it." Wouldn't it be a great epitaph for every generation to say, "We left it better than we found it?"

CALL TO ACTION

When you combine all three attributes, you have a legend. Sadly, we usually think of the entertainment or sports industries as creating legends, not engineering or technical professions. This article is my call to all legends to realize that we might not make an issue of *Sports Illustrated* or a show on ESPN, but we can and should try to be a legend, and it does not matter at what age you start. Life-long learning is just that: learning over an entire lifetime. You can't start at the end of your career and hope to make up for a life of mediocrity, with twenty years of experience, one year at a time. We must build a full twenty or thirty or even forty years of experience while adding experience on top of experience, knowledge on top of knowledge, wisdom piled high upon wisdom.

Learning without wisdom is like honey without sweetness. It's just a sticky mess. Wisdom, the application of learning, and teaching others to apply that knowledge is what leaving it better than we found it is all about. Wisdom is knowledge applied in a way that positively impacts every single person you come into contact with.

When I interviewed John McDonald, of GE, he was the most excited and animated when he talked

about his work with students, with GE but also with IEEE. While you could make a case that it was great for GE to be able to recruit the next generation's best and brightest, that was not John's main motive: It was to share the passion and the purpose he has had his entire life with a future generation that in most, if not all, cases could never do anything to advance his career. He was leaving a legacy. Unselfishness is a hallmark of legends.



Wouldn't it be a great epitaph for every generation to say, "We left it better than we found it?"

Wayne Bishop, a Vice President at OMICRON and Vice President of IEEE Meetings is young enough to be able to have significantly more impact with future generations, but Wayne is already a legend in the making. He is already leaving things better than he finds them and will continue to do so as he grows in his career. Wayne is fortunate to have some pretty strong role models to follow, but more important, he is going to be a role model for others to follow.





*Change is the
wind beneath a
legend's wings.*

There are too many to list here, but they know who they are. Their satisfaction comes from knowing that what they are doing matters for future generations. They are also inquisitive. I was recently quoted as saying, "I wish I was 40 years old again." Why? These are some of the most exciting times for the electrical power industry. Whether industrial, commercial, utility, or government, power is changing.

Technology, robotics, automation, artificial intelligence (AI), machine learning (ML), distributed energy resources (DER), digitalization, micro-grids, smart

cities, smart grid...I could go on and on. There has never been a time with as much change in the power industry as there is today or as much as we will face into the very near future. Change is the wind beneath a legend's wings. They will learn and apply what they have learned to new ways of doing things, new solutions to not only age-old problems, but to new problems we can only imagine facing in the future. These are the environments where legends thrive.

CONCLUSION

If all this sounds rather esoteric and unrealistic, it is not. It is powerful, life affirming, and meaningful. Is what we do important? Is what we do leaving things better? Is what we do something we can teach others, so they might learn from our mistakes or leverage our successes beyond what we have been able to experience? I hope so. I hope this simple Training Talk article spurs someone to desire to become a Legend, to espouse the attributes that make up what it means to be a legend: life-long learning, life-long teaching, and making it better than we found it.



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ELECTRICAL SAFETY TRAINING: WHAT'S MISSING?

BY JAMES R. WHITE, Shermco Industries

A top priority for NETA Member Companies is to continually raise awareness of the hazards of electric shock, arc flash, and arc blast. The concern is warranted due to the frequency these three hazards are faced in electrical work. But with this focus on electrical safety training, are we missing something? What additional types of safety training should we address?

One way to answer this question is to look at your company's loss and incident history for the last 12 to 18 months. What incidents occurred? What caused those incidents? Another good source of information is OSHA (www.osha.gov). What are the most frequent incidents in the industrial environment? Table 1 reflects fatalities by event from 2003–2016.

Table 1: Fatalities by Event, All Ownerships, 2003-2016

Event or Exposure	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
1 Transportation, excluding water, rail, air	2,041	2,118	2,173	2,081	2,057	1,829	1,516	1,600	1,670	1,695	1,628	1,737	1,821	1,855	25,821
2 Assaults and violent acts	902	809	792	788	864	816	837	832	791	803	773	765	703	866	11,341
3 Falls	696	822	770	827	847	700	645	646	681	704	724	818	800	849	10,529
4 Struck by object or equipment	531	602	607	589	504	520	420	404	476	519	509	503	519	533	7,236
5 Exposure to harmful substances or environments, excluding electrical	240	210	250	297	285	247	234	250	245	184	194	236	290	364	3,526
6 Caught in or compressed by equipment or objects	238	269	278	283	296	302	233	228	145	124	131	132	99	117	2,875
7 Contact with / exposure to electric current	246	254	251	250	212	192	170	164	174	156	141	154	134	154	2,652
8 Aircraft	211	231	149	217	174	191	159	152	145	127	136	135	139	130	2,296
9 Caught in or crushed in collapsing materials	126	117	109	108	108	100	80	91	84	73	78	74	90	82	1,320
10 Explosions	75	75	65	99	75	80	60	80	82	88	67	84	75	55	1,060
11 Water vehicle	69	91	88	96	71	76	86	60	72	63	60	55	44	48	979
12 Railway	43	50	83	65	49	34	34	45	50	38	41	57	50	50	689
Other	157	116	119	140	115	127	77	138	78	54	103	71	72	87	1,454
Total Fatalities (all causes)	5,575	5,764	5,734	5,840	5,657	5,214	4,551	4,690	4,693	4,628	4,585	4,821	4,836	5,190	71,778

COMPILED BY THE ELECTRICAL SAFETY FOUNDATION INTERNATIONAL USING DATA FROM THE U.S. BUREAU OF LABOR STATISTICS, CFOI, 2003-2016
 SOURCE: [HTTP://FILES.ESFI.ORG/FILE/2016-ESFI-BLS-WORKPLACE-ELECTRICAL-INJURIES-AND-FATALITIES.PDF](http://files.esfi.org/file/2016-ESFI-BLS-WORKPLACE-ELECTRICAL-INJURIES-AND-FATALITIES.PDF)

#1. Note that transportation is the number one cause of fatalities, and it has been the number one cause of fatalities for far longer than this table goes back. One reason for this is that there are so many people on the road going everywhere at all times of the day or night. This statistic suggests that implementing a safe driving program, which includes associated safety training, should be provided to employees in an effort to reduce accidents and fatalities. Some companies have gone even further and installed a device in each company vehicle that prevents people from texting or performing tasks that would be a distraction while driving. Anything that can be done to reduce the possibility of a traffic incident translates into less opportunity for an injury or fatality.

#2. The number two cause of fatal injuries is workplace violence! Read the paper and it seems every day includes a new story of someone taking out his/her frustrations on others. Maybe your employees would benefit from training on how to recognize people under stress and how to handle a potentially dangerous situation. Many schools have started to offer this type of training for students and teachers. Your employees may not have the same level of risk as a high school student, but can it be said that there is no risk?

#3. Fatalities from falls come in at number three, where it has been for several years. Many people think falls are the leading cause of fatalities in the workplace, but it is only third on the fatalities list. However, falls are the number one cause of non-fatal injuries in the workplace. How much training do your employees have in ladders including when and how to tie off a ladder, what constitutes an unsafe ladder, when guardrails are needed, and what to do if they are not being used? How much training have your field people had in the use of fall-arrest systems? The list goes on, because so much is involved with fall protection training. Don't forget office staff may also need to training in how to change light bulbs or hang signs.

#4. Struck by an object or equipment (number four) is fairly self-explanatory, as being struck implies that the worker may not have been fully aware of the situation or circumstance.

#5. Exposure to harmful substances or environments, excluding electrical, is fifth on the list. Training is primarily needed for those who work around potentially dangerous chemicals, but this could also apply to spray solvents, lubricants, and cleaners. Many workers think approved solvents and cleaners are safe, but reading the cautions on the container makes it clear that the substance is not completely safe — only safer. What is the risk involved in using these items in an enclosed space? Training on the requirement for and use of safety data sheets (SDSs) for all potentially hazardous products should be provided for all workers.

#6. Continuing down the list, “caught in or compressed by equipment or object” sounds especially painful. There are a variety of ways this could happen, but training is typically unique to specific equipment and devices encountered in the workplace.

#7. At the number-seven position is contact with or exposure to electric current — primarily from electric shock. Electrical safety training is typically focused on the areas of electric shock, arc flash, and arc blast hazards. Electrical test and maintenance companies tend to focus their training efforts on electrical safety training. OSHA considers arc flash and arc blast under the heading of explosions.

Thinking electrical equipment or systems are off-line without confirmation can result in catastrophic incidents. Workers should be trained on how to recognize hazards and the risks associated with those hazards. I once observed painters within an outdoor substation preparing to paint a 13.8 kV transformer without confirming that the transformer was de-energized. They refused to heed warnings of the potential hazards present. This resulted in a call to the substation owner. The painters were very upset when the substation owner stopped work to investigate the near-miss incident. This is not an example of being caught in the act of wrongdoing, but it does show that people don't know what they don't know.

A library or collection of causes of injury or fatality data should be maintained so that up-to-date information on actual events and incidents is

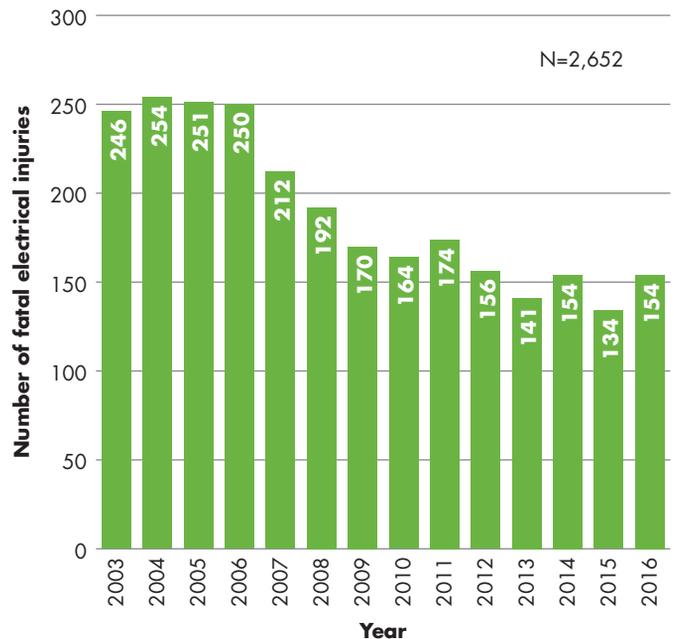
available for training purposes. Examples and case histories are always good, as they bring the topic from arm's length to more personal. Examples within the company will obviously carry the most weight.

Most important, when it comes to safety training, don't be a box-checker — a company that just wants to get the training over and done with.

OSHA has issued a Letter of Interpretation making it clear that jobs that can present a clear and present danger to workers (such as qualified electrical workers and technicians) require an employer to provide hands-on labs for the demonstration of skills, an instructor who is immediately available to answer questions, and a program that meets all the training requirements of OSHA 1910.332. Therefore, don't expect training for qualified persons to take just a half-day. Remember that although electrical shock causes more fatalities than arc flash or arc blast, the injuries from an arc flash or arc blast event can be very severe and life altering. The latest data available from the Electrical Safety Foundation International (ESFi) for shock-related fatalities is shown in Figure 1. Based on this information, the industry is moving in the right direction, even though there was a spike in 2016.

CONCLUSION

Electrical testing and maintenance companies should provide electrical safety training for their



COMPILED BY THE ELECTRICAL SAFETY FOUNDATION INTERNATIONAL USING DATA FROM THE U.S. BUREAU OF LABOR STATISTICS, CFOI, 2003-2016

Figure 1: Electrical Fatalities — ESFi

employees, but safety training should not be limited to just electrical safety. We should strive to provide whatever training is necessary to enable our workers to recognize hazards and the risks associated with those hazards. This means a company should investigate the causes of injury and fatalities in its workplace and provide training to reduce workers' exposure to those specific injuries and fatalities.



JAMES (JIM) R. WHITE, Vice President of Training Services, has worked for Shermco Industries Inc. since 2001. He is a NFPA Certified Electrical Safety Compliance Professional and a NETA Level 4 Senior Technician. Jim is NETA's principal member on NFPA Technical Committee NFPA 70E®, Standard for Electrical Safety in the Workplace®, NETA's principal representative on National Electrical Code® Code-Making Panel (CMP) 13, and represents NETA on ASTM International Technical Committee F18, Electrical Protective Equipment for Workers. Jim is Shermco Industries' principal member on NFPA Technical Committee

for NFPA 70B, Recommended Practice for Electrical Equipment Maintenance and represents AWEA on the ANSI/ISEA Standard 203 Secondary Single-Use Flame Resistant Protective Clothing for Use Over Primary Flame Resistant Protective Clothing. An IEEE Senior Member, Jim received the IEEE/IAS/PCIC Electrical Safety Excellence Award in 2011 and NETA's Outstanding Achievement Award in 2013. Jim was Chairman of the IEEE Electrical Safety Workshop in 2008 and is currently Vice-Chair for the IEEE IAS/PCIC Safety Subcommittee.

HOW TO AVOID PROSECUTION FOR OSHA OR OH&S VIOLATIONS

BY TERRY BECKER, TW Becker
Electrical Safety Consulting, Inc.

Due diligence: Two words that are and will be interpreted differently by employers, supervisors, safety professionals, electrical engineers, electrical technologists, electricians, and other qualified workers when referring to shock and arc flash hazards. OSHA in the USA and Federal, Provincial, and Territorial OH&S legislation in Canada outline the legal requirements for workplace safety. If there is an electrical incident, the onus is on the employer to prove they have met their legal duties under OSHA or OH&S legislation, including doing everything “reasonably practicable” to avoid the incident.

The Provincial Government’s OHS Branch in Alberta, Canada, provides the following explanation of due diligence:

“Due diligence is the ability to demonstrate that a person did what could reasonably be expected under their circumstances, in order to satisfy a legal requirement. A due diligence defence depends on your ability to demonstrate the actions taken before an incident occurs, not after.”

Due diligence is providing reasonable efforts to comply with the legislation; not a perfection standard. Even within the best health and safety systems, non-compliance may occur from time-to-time, and those incidents of non-compliance may result in a serious incident.”

There are many similarities between the concepts of “doing what is reasonably practicable” and “due diligence.” The key difference is that “doing what is reasonably practicable” is a legal obligation that must be performed at all times. “Due diligence” is a defense when the person has failed to comply with an OHS legal requirement, but can prove they did everything reasonable to avoid the non-compliance.”

REASONABLE CARE

One additional element of the due diligence defense is demonstrating reasonable care. In a reasonable-care defense, an employer must demonstrate they have taken all reasonable actions to foresee and prevent an incident. An employer’s actions should include:

- Take the time to review and document actions. Appoint an electrical safety committee. Document meeting minutes to show that OSHA and OH&S legislation has been reviewed; that NFPA 70E, *Standard for Electrical Safety in the Workplace* or CSA Z462, *Workplace electrical safety Standard* will be referenced and applied; and that gap analysis will be completed.
- Proactively identify workplace hazards. Inventory existing energized work tasks that will be performed where a worker may be exposed to shock and/or arc flash hazards and identify what worker role will perform the inventoried work tasks.
- Eliminate the hazards if possible. Ensure that an established and audited lockout/tagout program is in place. Ensure justification is established when energized electrical work must be performed. Follow the requirements outlined in NFPA 70E or CSA Z462.
- Develop and implement a management system (e.g., an electrical safety program) for arc flash and shock hazards to control, mitigate, or manage any hazards that cannot be eliminated.
- Audit the management system to ensure it is working.
- Ensure that work is not done if it is not possible to eliminate, control, or manage the hazards or mitigate their effects to an acceptable level.

DUE DILIGENCE

If an employer provided arc flash and shock training several years ago, isn't that all they were required to do?

As noted under OSHA and OH&S legislation, regulators expect that appropriate due diligence has been implemented and substantiated. Providing training only once several years ago would not be appropriate due diligence.

Due diligence is risk based. Greater oversight is required where there is a greater likelihood of potential injury or damage to health. The employer may also be held accountable to the standard set by other companies in their industry.

To demonstrate due diligence, an employer, safety professional, supervisor, electrician, electrical engineer, electrical technician, and other task-qualified workers should complete these occupational health and safety tasks:

1 The employer recognized shock and/or arc flash hazards with the potential to cause injury or damage to the health of employees or contractors. Risk-based assessments for work tasks were completed to identify whether there is exposure and determine which Hierarchy of Risk Control Methods must be applied to reduce risk. The employer and employee have shared roles and responsibilities. Elimination must be the first priority, and energized electrical work must be documented and justified.

2 The employer developed a management system (e.g., an electrical safety program) to prevent potential injury or damage to health from occurring. NFPA 70E and CSA Z462 provide guidance on the content that should be included in an electrical safety program. Occupational health and safety management system standards (e.g., ANSI Z10 for the USA or CSA Z1000 for Canada) should be consulted to determine the framework or table of contents. Direction on the content of a safety management system is also provided by OSHA in the USA and OH&S regulators in Canada.

3 The employer took reasonable steps to ensure the electrical safety program was working (e.g., audits

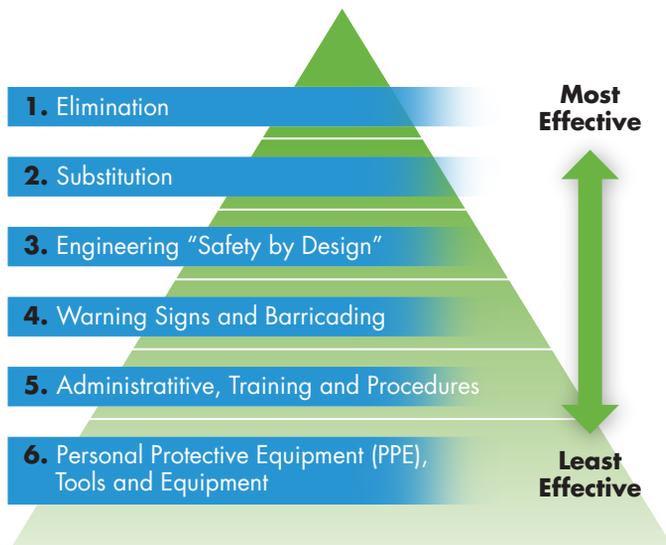


Figure 1: Hierarchy of Risk Control Methods

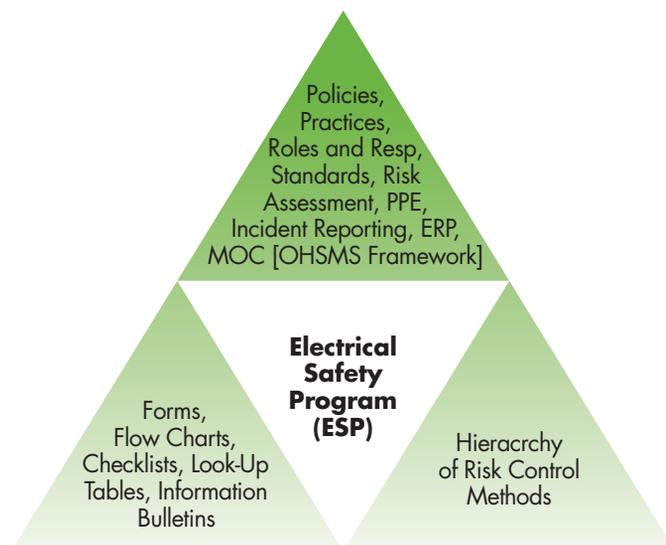


Figure 2: Electrical Safety Program

or assessments were completed internally or by a third-party electrical safety subject matter expert following an OHS audit process). The employer ensured that the findings and recommendations of an audit were implemented.

4 The employer pre-qualified the company or consultant hired to provide training and reviewed the course content to ensure it complied with NFPA 70E or CSA Z462. Exercises focused on field application of the knowledge, and a formal test was administered. Certificates were issued to students, and the employer retained copies.

5 The employer provided specific direction and instructions to employees and contractors who would be exposed to shock and/or arc flash hazards. The employer developed, implemented, and audited an electrical safety program that included policies and practices that would be applied to an assigned Job. A qualified person was assigned to identify a specific work task(s) related to executing the assignment if there were exposed to shock and/or arc flash hazards. A job safety plan was documented by the qualified person and a job briefing was completed before energized electrical work tasks were executed.

6 The employer provided information and training on the specific requirements in the employer's electrical safety program, including policies, practices, procedures, PPE procured, electrical incident reporting requirements, emergency response program requirements, etc. Information was posted in the electrical shop or electrical rooms. Arc flash and shock hazard warning or danger equipment labels were installed on electrical equipment.

7 The employer monitored the effectiveness of the electrical safety program to ensure it was working and sustainable. Expected risk control methods

were actually applied in the field to achieve the expected residual risk level. Occupational health and safety management standards and practices were used to monitor observations by supervisors and follow up on near-miss reports, employee testing, and electrical room inspections (e.g., monthly preventive maintenance tasks). Formal electrical safety audits were conducted internally or by a third-party electrical safety SME, including the number and reason for any energized electrical work permit (EEWP) issued in the last 12 months.

CONCLUSION

Effective due diligence will only really be measured if your company experiences an electrical incident where there is a significant injury and an OSHA or OH&S officer is onsite completing an investigation. This is obviously not the best method to test your company's due diligence for shock and arc flash hazards. Being proactive in electrical safety as outlined in the seven steps listed above will provide the basis for effective due diligence and reasonable care. Implement and audit the performance of a developed electrical safety program and follow a continuous improvement model. PLAN, DO, CHECK, ACT!



TERRY BECKER, PE, CESP, IEEE SENIOR MEMBER, is an independent electrical safety specialist and consultant at TW Becker Electrical Safety Consulting, Inc. As the previous owner and visionary of ESPS Electrical Safety Program Solutions Inc., he spent more than 10 years growing the company into an industry-leading total solutions provider for electrical safety consulting, licensed electrical safety programs, and training solutions, including the e-Learning Electrical Safety Training System (ESTS), Electrical Worker, and Non-Electrical Worker training programs. Terry brings more than 28 years of experience as an Electrical Engineer working in both engineering consulting and for large industrial oil and gas corporations. He is the first

past Vice-Chair of the CSA Z462 Workplace Electrical Safety Standard Technical Committee and is currently a voting member and leader of Working Group 8 Annexes. Terry is also a voting member of the IEEE 1584 Arc Flash Hazard Calculations Standard Committee and a voting member of the CSA Z463, Maintenance of electrical systems Standard Committee. He attends all NFPA 70E technical meetings as a guest, is recognized as an electrical safety subject matter expert, and participates in NFPA 70E Working Groups. Terry is a Professional Engineer in the Provinces of Alberta, British Columbia, Saskatchewan, and Ontario, and has presented on CSA Z462, NFPA 70E, and electrical safety practices at industry conferences and workshops in Canada, the United States, Australia, and India.

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- Cable Fault Location and Tracing, Medium-Voltage
- Cable Testing and Diagnostics, Medium-Voltage

Substation

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- Transformer Maintenance and Testing
- Advanced Transformer Maintenance and Testing
- Substation Maintenance I
- Substation Maintenance II
- Power Factor Testing

Safety

- NFPA 70E 2018 Electrical Safety
- Electrical Safety for Utilities
- Electrical Safety for Mining
- Electrical Safety for Industrial Facilities
- Electrical Safety for Inspectors
- Electrical Safety for Overhead Contact Systems
- 2017 National Electrical Code
- OSHA Electrical Safety Related Work Practices
- Maritime Electrical Safety

Basics

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- Basic Electrical Troubleshooting
- Electronics Troubleshooting
- Electronics for Electricians
- Electrical Print Reading
- Grounding & Bonding

Engineering

- Short Circuit Analysis
- Protective Device Coordination Utilities
- Protective Device Coordination Industry
- Power Quality & Harmonics

Motors/Controls

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Sep 20, 2019 | Presenter: TBD
- **Fundamentals of Generator Protection Testing**
Oct 18, 2019 | Presenter: David Beard
- **Best Field Practices for Testing Instrument Transformers: CTs, VTs, CCVTs**
Nov 15, 2019 | Presenter: Daniel Carreno
- **Overview and Results Interpretation of Tan Delta Testing on Medium- and High-Voltage Cable Systems**
Dec 13, 2019 | Presenter: Steven Spikes



Previous Webinars

- **PD Testing in the Life Management of a Cable**
April 19, 2019 | Presenter: Robert Probst
- **Battery Maintenance Load Testing: Standards, Requirements & Recommended Practices**
May 17, 2019 | Presenter: Volney Naranjo
- **Dielectric Frequency Response & Analysis of IEEE Guide C57.161**
June 21, 2019 | Presenter: Diego Robalino
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July 19, 2019 | Presenter: Abel Gonzalez
- **Medium Voltage Cable Fault Location & Reading TDR Traces**
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Intermediate

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- **Advanced DGA Diagnostics**
Learn to identify fault gases and what causes their formation, how to evaluate the condition of cellulose insulation, examine the role DGA plays in new oil testing, and discuss obtaining samples from transformers.
- **Load Tap Changer Principles & Maintenance**
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 2019 - 10/1
 2020 - 2/25; 5/19; 8/18; 11/17
Dallas, TX
 2019 - 9/10; 10/8; 11/5; 12/10
 2020 - 1/7; 2/4; 3/3; 4/7; 5/12; 6/9; 7/7; 8/4; 9/1; 10/6; 11/10; 12/8
Cedar Rapids, IA
 2019 - 10/1
 2020 - 2/11; 6/9; 10/6
Houston, TX
 2019 - 5/21; 6/18; 9/17; 10/22; 12/3
 2020 - 3/10; 5/19; 6/9; 9/15; 10/13; 12/1
Tulsa, OK
 2019 - 10/15
 2020 - 1/28; 5/19; 8/18; 11/17
Wilmington, CA
 2019 - 5/21; 6/11; 8/6; 10/22
 2020 - 3/24; 6/23; 9/22; 12/8
- **Fundamentals of Protective Relay Testing and Maintenance**
Cedar Rapids, IA
 2019 - 12/3
 2020 - 1/21; 4/28; 7/21; 10/27
- **Chicago, IL**
 2019 - 12/3
 2020 - 2/11; 5/19; 8/11; 11/17
Dallas, TX
 2019 - 10/21; 12/16
 2020 - 3/16; 6/15; 9/14; 12/7
Houston, TX
 2019 - 10/21
 2020 - 1/21; 4/28; 7/21; 10/27
Wilmington, CA
 2019 - 10/16
 2020 - 2/11; 5/19; 8/11; 11/17
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 2019 - 10/14
 2020 - 1/6; 4/20; 7/20; 10/19
Chicago, IL
 2019 - 10/14
 2020 - 1/13; 4/13; 7/13; 10/12
Dallas, TX
 2019 - 9/30
 2020 - 3/16; 6/15; 9/14; 12/14
Houston, TX
 2019 - 10/14
 2020 - 2/10; 5/11; 8/10; 11/9
Wilmington, CA
 2019 - 10/14
 2020 - 2/3; 5/4; 8/3; 11/2
- **Introduction to SEL Relays**
Dallas, TX
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Houston, TX
 2020 - 1/28; 4/28; 7/21; 10/27
- **Substation Maintenance I (Circuit Breakers, Grounding and Batteries)**
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 2019 - 11/11
 2020 - 2/4; 4/28; 8/25; 10/27
Chicago, IL
 2019 - 11/11
 2020 - 2/17; 5/11; 8/10; 11/9
Dallas, TX
 2019 - 11/5
 2020 - 4/6; 7/6; 10/5; 12/7
Houston, TX
 2019 - 9/23; 12/2
 2020 - 3/3; 6/16; 9/22; 11/10
Wilmington, CA
 2019 - 9/23; 12/2
 2020 - 3/17; 6/2; 9/22; 12/1
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 2020 - 2/11; 5/5; 9/1; 11/3
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 2019 - 11/18
 2020 - 2/24; 5/18; 8/17; 11/16
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