

50 years **Electrical** **Business**

HOW ABOUT YOU?

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See page 5.

■ Also in this issue...

- Do you know hazard, risk and risk assessment?
- Reflections from the 2014 Electrical Safety workshop
- Were ghosts calling the Poltergeist Site?

“I don’t have to do it right. I have a rework crew!”

How to **not** make more money

PM # 40065710

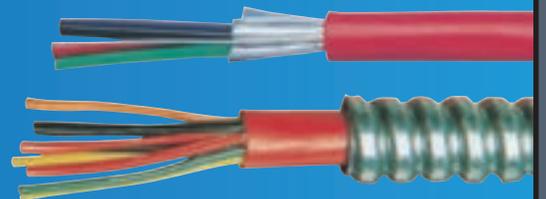
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EBMag is featuring a different guest editor on this page every issue during our 50th anniversary year. You can always reach the editor at acapkun@annexweb.com.

Richard Kelly is chief electrical inspector & manager, Safety Services, with the Government of Nunavut, and an IAEL-certified electrical inspector. He is chair of the Canadian Advisory Council for Electrical Safety (CACES) and an Executive Committee and voting member of the Canadian Electrical Code-Part 1.

Go North young man... go North!

Canada's North is looking more like the new gold rush, but I have often seen electrical contractors come North only to lose their shirts, shoes and socks because they underbid a project! Hopefully, my tips below will help the electrical contractor who wants to work in Nunavut.

We have no electrical supply houses nor rental outfits for ladders, scaffolding, pipe threaders, wire pullers and so forth, and very few retail outlets will carry the tools needed for electrical installations. If you think you need 50 half-inch EMT LBs, ship 60. If you need four good drills, send six. Split up your shipments; do not put all 60 LBs in one crate.

Getting materials and equipment to your work location is done by ship or aircraft. Marine transport is cheaper but can take many months of advance planning, as marine (sealift) cargo vessels only operate in the North during summer months (July to September). Shipping goods and personnel by air is very expensive, and flights are often delayed by weather and/or higher-priority cargo.

Limited options for lodging exist in smaller communities; while they all have at least one hotel, sharing rooms with other guests is often the norm due to a lack of rooms. Rates can start at \$250 or higher per night per worker (but this often includes meals). Rental housing may be available, but may be prohibited because of your contract. Food prices are also quite high. Rental vehicles may be available, but are more costly in comparison to renting in the South.

All journeyman-level electrical workers you wish to send to Nunavut must be registered with the Safety Services section of the Government of Nunavut before they

may legally work. All apprentices must be registered in their home jurisdiction or with the Nunavut apprenticeship branch.

Safety Services requires complete plan reviews, and it must accept the state of the final design before electrical installation permits are issued. (Permits are issued to the Electrician of Record for a project, not his employer. At this time, we do not register contractors.)

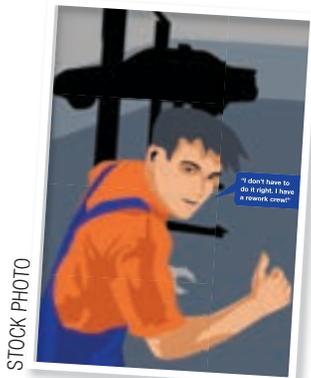
You should look into insurance for your workers that covers the cost of medical evacuation from the North.

Many of our communities have restrictions on the import and consumption of alcohol, so check those rules and follow them closely. You will also have the opportunity to purchase some exceptional Inuit art and crafts; don't be afraid to bargain, but remember: the artisans often rely on sales to feed their families.

The old adage "When you give respect, you get respect" is very true in Nunavut. You may be approached by local residents looking for employment. There are many hard-working individuals in our communities who would make great additions to your crew. Ensure you offer a fair wage and follow all legal requirements when hiring local workers.

Remember, too, that there are cultural realities—such as wildlife harvesting opportunities—that may impact worker attendance. For the employer who understands these realities, a good working relationship with the worker and his community is often the result.

Working in Nunavut can be a wonderful, enriching experience. Careful consideration to my tips will help ensure your success. **EB**



STOCK PHOTO

On the Cover and Page 20
How to *not* make more money

Why is rework on industrial sites widely accepted? All the money spent on rework comes off the bottom line and, with ever-decreasing profit margins, it becomes imperative to reduce the amount of rework.

Contents

8 IEEE IAS Electrical Safety Workshop

Earlier this year, EBMag attended the IEEE Industry Applications Society Electrical Safety Workshop—an excellent venue for meeting like-minded professionals with a shared passion for electrical safety.



10 Do you know hazard, risk and risk assessment?

An occupational health and safety (OH&S) professional would regard the answer to the question "What is the difference between hazard and risk?" as obvious but, for many electricians, electrical technicians and technologists, the answer might not seem so obvious.



16 So you have an electrical safe work standard... but is anyone actually following it?

Your company has a good-quality electrical safe work standard that has been rolled out to workers, but how closely are they following it? Understanding the gap between your standards and worker behaviour in the field is absolutely essential to keeping your workers safe from electrical harm.



22 Were ghosts calling the Poltergeist Site?

Tenants in an entire multi-storey building complained of dropped calls and phones ringing with no one on the other end. These intermittent phone problems had eventually escalated to the point where the phones were sometimes ringing by themselves *even when unplugged* from the phone jack.

DEPARTMENTS

- 4 Industry News
- 7 Electrical Safety 360
The Electrical Utility Safety Rules are a foundational tool
- 23 Personalities
- 24 Calendar
- 25 Products & Solutions
- 26 Code File
Are all outdoor receptacles exposed to weather?
- 26 Code Conundrum



Capital Safety expands in Western Canada with acquisition

Capital Safety (home of the DBI-Sala and Protecta brands, www.capitalsafety.com) has acquired Fall Protection Group Inc. (fallprogroup.com)—a Calgary, Alta.-based training provider to at-height workers.

“The acquisition of Fall Protection Group expands our footprint in training and consulting

services, which will provide our customers with a broader range of solutions,” said Stephen Oswald, Capital Safety CEO. Meantime, Ron O’Neil, director of Fall Protection Group, added, “We are thrilled with this acquisition, which will provide tremendous opportunity for Fall Protection Group”.

Capital Safety is a global player in height safety and fall protection equipment, with 27 operating sites worldwide.

ELECTRICAL BUSINESS is the magazine of the Canadian electrical community. It reports on the news and publishes articles in a manner that is informative and constructive.

Editor

Anthony Capkun - acapkun@annexweb.com

Group Publisher

John MacPherson - jmacpherson@annexweb.com

Account Managers

Scott Hoy - shoy@annexweb.com
Melanie Kirk - mkirk@annexweb.com

Associate Editor

Alyssa Dalton - adalton@annexweb.com

Art Director

Svetlana Avrutin - savrutin@annexweb.com

Production Manager

Kathryn Nyenhuis - knyenhuis@annexweb.com

Subscriber Customer Service Representative

Marie Weiler - mweiler@annexweb.com

President

Mike Fredericks - mfredericks@annexweb.com



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CIRCULATION: Marie Weiler
e-mail: mweiler@annexweb.com
Tel: 1-866-790-6070 • Fax: 1-877-624-1940
Mail: P.O. Box 530, Simcoe, ON N3Y 4N5

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Symtech learns electricity not the only killer on solar rooftops

Symtech Innovations Ltd. has been fined \$90,000 after a worker died following a fall through a skylight while working on rooftop solar installation.

In February 2012, employees of Symtech were on a jobsite in North York, Ont., installing solar panels on the rooftop of an industrial building. The rooftop had a large surface area divided down the middle by a row skylight openings, with skylights in place. The skylights looked down into the building through to the main floor (about 5 m below).

A worker employed by Symtech as its acting foreperson at the project site spoke with a co-worker, then turned and began walking toward the north end of the roof. After taking a few steps, he slipped and reached out to brace the fall on a skylight. The skylight did not support the worker's weight and the worker fell through it to the floor below. He was critically injured by the fall, dying about a week later.

Symtech Innovations Ltd. pleaded guilty to failing as an employer to install protective coverings over skylights located on the roof while work was proceeding. The company was fined \$90,000, with an additional 25% victim fine surcharge.

"Transformation Underway" at APPrO 2014

Don't miss your opportunity to network with Canada's power generation industry's key decision-makers and influencers at one of the most active networking hubs in the business.

The 26th annual Canadian Power Conference & Networking Centre (a.k.a. APPrO) is taking place November 18-19 at the Metro Toronto Convention Centre (www.appro2014.com).

Featured speakers include: Colin Andersen, CEO of Ontario Power Authority (OPA); Bruce Campbell, president & CEO of the Independent Electricity System Operator (IESO); Anthony Haines, president & CEO of Toronto Hydro; and a favourite of delegates, Sean Conway.

Leading thinkers will present their ideas on trends that are likely to affect the energy sector's overall direction, such as:

- How are distributed generation, demand-response, energy

storage, electric vehicles, microgrids and smart grid technology changing the nature of the electric sector?

- How to reconcile the rapid pace of technology change with the slower processes of public engagement and capital replacement?
- The effect of technology change and market restructuring on investment. Do new opportunities outweigh the new risks?
- What are the techniques for managing

infrastructure development in an increasingly complex, conflict-prone and volatile world?

- How will the Long-Term Energy Plan (LTEP) need to change going forward?

APPrO (Association of Power Producers of Ontario) represents more than 100 companies involved in the generation of electricity in Ontario, including generators and suppliers of services, equipment and consulting services.

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Affiliated Distributors enjoys positive Q2 2014



Where market leaders grow

Affiliated Distributors (AD)—a North American industrial and construction products buying and marketing group—reported 8% growth across all divisions in the second quarter, 2014 (www.adhq.com).

Total sales for the first half of the year were \$15 billion, and the Electrical Division was up 6%.

“The second quarter showed an impressive rebound from a first quarter, that was strongly impacted by weather,” said Bill Weisberg, AD’s chair and CEO. “The determination and creativity demonstrated by our independent members and our strong supplier partners is inspiring.”

In Q2 2014, AD members hired 2203 new employees, opened 89 new locations and made three acquisitions.

SurgePure announces Ontario and Quebec representation

Doug Piebiak, CEO of SurgePure Canada (www.surgepure.ca), announced the appointment of new agencies in Ontario and Quebec: Brian Griffin and Bibi Hanoman of Electrical Sales Network, and Jean-Claude and Mathieu St-Onge of Promellis Inc., respectively.

Both agencies have stated that adding SurgePure to their industrial surge protection line complements their other products, as most lighting manufacturers are promoting SPDs for their lighting packages. SurgePure sees both firms as great fits because they each have staff with electrical backgrounds.

SurgePure is a provider of surge protection devices since 1978.

2014 Source lighting design competition now accepting entries

Eaton (www.eaton.com) has announced that its Cooper Lighting Division (www.cooperlighting.com) is now accepting entries for the 38th Annual Source Awards national lighting design competition.

The competition—which focuses on furthering the understanding, knowledge and function of lighting as a primary element in design—is open to all lighting designers, architects, engineers, professional designers and consultants who use lighting and controls products from the Cooper Lighting business in interior or exterior design projects.

“We’re always looking for the most creative and innovative use of state-of-the-art lighting products and techniques,” said Mark Eubanks, president of Cooper Lighting. “The awards ask participants to combine aesthetics, creativity and technical performance to address specific lighting needs while meeting project constraints and design concept goals.”

For more information, visit www.cooperlighting.com/sourceawards.

CanSIA releases “Made in Alberta” blueprint for building solar industry

The Canadian Solar Industries Association (CanSIA, www.cansia.ca) has released “From Proven Reserve to Developed Resource: Realizing the True Value of Solar Energy in Alberta” (bit.ly/1mCpDQ8), a position paper on solar energy policy options for Albertans.

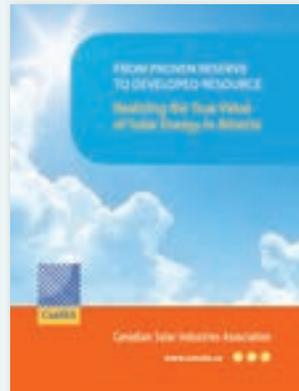
“This is a ‘Made in Alberta’ blueprint designed to round out the province’s electricity system,” said John Gorman, CanSIA president and CEO. “Alberta is clearly a leader in oil and gas; these recommendations pave the way to making it a leader in renewable energy as well.”

“As the province proceeds to retire its coal fired power plants, it will need an additional 7000MW of new power generation. Solar energy can play a significant role in providing consumers with a clean alternative,” noted the association.

The paper outlines recommendations “that would ensure a meaningful role” for solar energy in the province’s electricity mix. A strong solar energy market means:

1. Giving consumers the power of choice;
2. Reducing greenhouse gas (GHG) emissions; and
3. Diversifying electricity supply.

“Alberta has before it a great opportunity to embrace the huge benefits of solar,” said Gorman. “The sun shines in Alberta more than in any other province, and Albertans understand the value of a strong energy resource. We’ve been talking about it for years; it’s now time to move forward.”



CanSIA is urging the government to present its framework so that planning for the future can begin immediately. It recommends that the Government of Alberta:

- Introduce a renewable and alternative energy framework that charts the path for a minimum of 1.5% of Alberta’s electricity demand to be met by solar in 2022.
 - Enhance its micro-generation regulation by increasing the price paid for exported solar electricity to reflect an appropriate market value which would enable Albertans to realize a fair value for the solar electricity they generate.
 - Introduce a Climate Change and Emissions Management Fund (CCEMF) program that targets accelerated adoption of solar in the residential and non-residential sectors with “Clean-Energy-Adders” to support the mandate of the Climate Change and Emissions Management Corporation (CCEMC) while longer-term policy solutions are developed.
- Introduce an Interim Demonstration Pilot Program for large-scale solar to give rise to 150MW build capacity and overcome regulatory barriers before long-term policy is finalized.

The Alberta government has promised a new “Renewable and Alternative Energy Framework” in 2014.

Women wanted! EHRC officially launches Bridging the Gap



Electricity Human Resources Canada (EHRC) unveiled its Bridging the Gap project: a public-private initiative aimed at increasing the representation of women as skilled workers in the electricity and renewable energy sector, in Ontario and nationally (www.electricityhr.ca).

“With women representing only 1/4 of the electricity industry workforce, and fewer than 5% in the trades, it’s vital that we encourage women to become more engaged and represented,” said Michelle Branigan, CEO of EHRC. “Given the severe skills gap shortage that the industry faces, women offer organizations a solution to the pending labour crisis.”

EHRC is establishing itself as the central point of contact for providing women with information on career training, mentoring opportunities, apprenticeships and support. The association aims to strengthen existing initiatives and foster an environment for the development of practical and effective programs targeting women who are entering the workforce (at the high school, apprenticeship, college and university level), and

women currently working within the sector.

The electricity industry faces an aging workforce, along with massive upgrades of its infrastructure, notes EHRC. Labour shortages are expected to be widespread among dozens of occupations and professions that encompass trades, engineering, management and administration.

“The electricity and renewable energy sector is poised for huge growth in the coming years, and we know that close to one in five new jobs in Ontario are expected to be in the skilled trades in the next decade,” said Reza Moridi, Ontario’s minister of training, colleges and universities. “That’s why it’s so important that Employment Ontario and the [EHRC] are helping provide women with important information about these very attractive career options.”

Funding for Bridging the Gap came from Ontario Power Generation (OPG), Hydro One, Employment Ontario, Alberta Innovation & Advanced Education and Engineers Canada. EHRC adds its partners include industry, government and stakeholders, such as educators, labour union groups and others, who have come together to advise on the initiative (electricityhr.ca/bridgingthegap).

Visit bit.ly/1svb0FR to watch the video. **EB**



| Mike Doherty

The Electrical Utility Safety Rules are a foundational tool

The “Electrical Utility Safety Rules” (the EUSR)—published by the Infrastructure Health & Safety Association (IHSA)—has been a part of Ontario’s T&D sector for 100 years but, before we explore it, let’s review how the EUSR came to be.

Over 100 years ago, consumers were very excited to have electrical power delivered to their homes and businesses, but the cost in human suffering was staggering. The T&D electrical sector was extremely hazardous back then, with a mortality rate of about 50% for workers.

(It’s been said that IBEW started a program whereby the widow of an electrical worker killed on the job would be given \$50. The story goes that after just two-and-a-half years, the IBEW went broke due to the payouts.)

Of course, there were also other serious workplace injuries, such as falls. The safety situation was totally unacceptable, leading, in part, to the development and implementation of the earliest form of the EUSR: the Constitution and General Rules of The Electrical Employer’s Association of Ontario and Accident Prevention Rules in 1914.

The Electrical Employers Association (later known as Electrical & Utility Safety Association [E&USA]) was created to deliver high-quality, leading-edge safety education in the T&D sector in 1915, making it the oldest health and safety association in Ontario. (E&USA was amalgamated in 2009 with several other associations to form IHSA.)

Existing Ontario legislation, Construction Regulation 181(1), states:

181(1) Except where otherwise required by this Regulation, electrical work performed on

or near electrical transmission or distribution systems shall be performed in accordance with the document entitled “Electrical Utility Safety Rules” published by the Electrical & Utilities Safety Association of Ontario Inc. and revised January 2009. O.Reg. 627/05, s.4; O.Reg. 443/09, s.5.

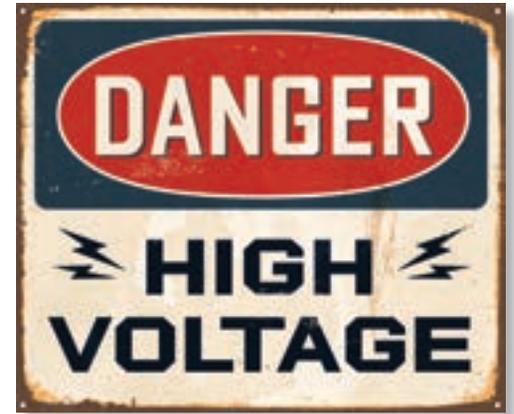
181(2) Sections 182, 187, 188, 189, 190, 191 and 193 do not apply to electrical work that is performed on or near electrical transmission or distribution systems if the work is performed in accordance with the document referred to in subsection (1). O.Reg. 627/05, s.4.

Also, existing Ontario legislation for Industrial Regulation 42(2) states the following:

42.2 Work performed on electrical transmission systems or outdoor distribution systems rated at more than 750 volts shall be performed in accordance with

- (a) the Rule Book, Electric Utility Operations, published in 1990 by the Electrical Utilities Association of Ontario Inc.; or
- (b) the Ontario Hydro Corporate Safety Rules and Policies, dated 1994. O.Reg. 630/94, s.1; O.Reg. 144/99, s.3.

(Obviously, the current Ontario Occupational Health & Safety Act will need to be updated to note the change of E&USA to IHSA, but also the change from Ontario Hydro to Hydro One and Ontario Power Generation. One can only hope this will be done at the earliest opportunity. It’s a challenge for any government to align legislation to keep up with changing business units.)



Al Beattie, IHSA’s president and CEO, has copies of the original rulebook from 1914 (it’s a fascinating document), and enjoys handing them out alongside the current version as he explains the rich history of the electrical safety associations and related legislation.

On a 5-year update cycle (with the latest edition publishing 2014), the EUSR is the law and a foundational tool in Ontario for the T&D sector. In my next column, I’ll take a closer look at how the EUSR functions and why. **EB**

A well-known subject-matter expert and speaker on electrical safety, Mike Doherty is a licensed electrician and the health & safety manager with PowerTel Utilities Contractors Ltd. An IEEE senior member, Mike has served as technical committee chair for CSA Z462 since its inception in 2006. He is a member of NFPA 70E and official liaison between Canada (CSA) and U.S.A. (NFPA) for electrical safety. His specialties include electrical safety and health & safety management, consulting, training, auditing, and electrical incident investigations. Mike can be reached at mdoherty@powertel.ca.

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ELECTRICAL SAFETY WORKSHOP (ESW)

Watch EBMag's VIDEO "The Most-Efficient Electrical Safety Education... Anywhere!" from the 2013 ESW in Texas, and you'll learn why it's a key event when you're passionate about electrical safety.

The 22nd annual ESW is being held January 26-30, 2015, in Louisville, Ky. Visit www.ehw.ieee.org/cmte/ias-esw/ESW2010.html, and stay tuned to EBMag and EBMag.com.



After first learning about, then attending, our first IEEE IAS Electrical Safety Workshop (ESW), EBMag was hooked on what electrical safety guru Mike Doherty dubbed the "Superbowl of electrical safety".

Where else can you bump into so many professionals with a shared passion for electrical safety? Where else can you network with so many top minds from around the world, and learn where electrical safety is going to be in five years?

Despite being a niche event, ESW truly attracts delegates and speakers from around the world, representing anyone from forward-thinking electrical contractors and research institutions to large, sophisticated multinationals. Upon arrival, the first delegate I met hailed from Trinidad and Tobago; the first presentation I sat in on was delivered by a Chinese national.

"Changing the electrical safety culture" is ESW's motto, and the 21st installment lived up to that calling, setting an attendance record with 531 delegates, and boasting 62 exhibitors, 39 technical presentations and six tutorials.

For EBMag's full photo gallery from the 2014 ESW, visit EBMag.com's Photo Gallery (under Industry News), and scroll down to "GALLERY: IEEE IAS Electrical Safety Workshop (Feb 2014) San Diego".



Steve Leblanc of ArcelorMittal Mining Canada presented an excellent study that asked the question "Are You Safe with your Temporary Protective Grounds?". A delegate sitting next to me commented that there's a lot to learn from this paper. We thought so, too, so we adapted it into an article for EBMag (appears in June 2014, p.22).



Wei Wu of China was among the first presenters, who spoke of "Surface Leakage Protection"—a technology that focuses on electrocution/shock protection before electrical incident, and removes the power supply to an appliance when leakage occurs on the surface of the appliance—again, before a person experiences an electrical incident.

While discussing how to incorporate a live work policy into your electrical safety program, MES Consulting Services' Ken Mastrullo (left) noted there are two ways people write their Live Work Policy:

- 1) for safety, meaning it is clear and concise, or
- 2) for compliance, which usually means it is general and subject to interpretation.



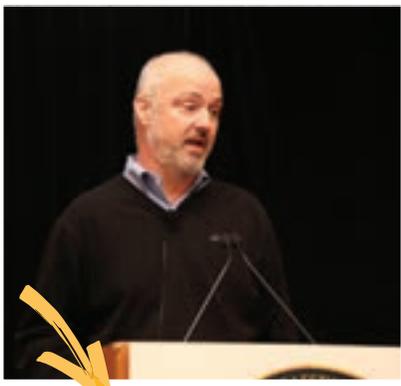
"The \$125,000 Field Mouse" got everyone's attention... was this somehow akin to the \$6-Million Man? Instead, Scott Carroll's presentation explained the importance of having the correct phase barriers in place to shield fuses, contactors, buswork, etc. His paper examined an incident involving the installation of a new medium-voltage motor control centre (MCC) in which no phase barriers had been installed between the section of bus that connects the fuses and the contactor. The result was an arc flash incident when a field mouse entered the MCC and came into contact with these connections.

A very practical presentation, "Lighting Safety Considerations", explored lighting safety factors that help mitigate safety concerns in industrial settings, such as elevated work, cuts/lacerations, burns and shock. Energized work involving lighting is among the leading causes of work-related injury among electricians, noted presenters Scott Seaver of Hubbell and Matthew Leong of DuPont.

Lighting is really tricky in industrial environments, they said, noting the involvement of moving equipment, ladders, scissor lifts, chemical vats, etc. They discussed design, maintenance, location, installation, ergonomics and hazardous location concerns for lighting systems, and reminded delegates that, as customers, they don't have to settle for what's out there: "Talk to your manufacturer... make a better mousetrap".



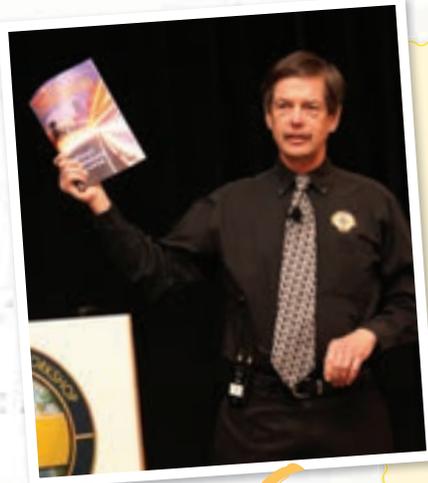
Reflections from the 2014 Electrical Safety Workshop



Too often, contracts get let to the lowest bid, and Shermco's Robert Loveless argued that hiring a contractor is not just about commercial terms... training and experience also matter. "Consider the high price of a low bid," he cautioned. Robert's presentation, "What is the Quality of Your Contractor's Qualified Electrical Workers?" (based on a paper co-authored by Michael Moore), looked at the pitfalls involved when hiring the wrong, non-compliant contractor, and gave pointers on how to ensure onsite personnel can complete the given project successfully and safely. Before ending, though, Robert said the contractor, too, must hold the host company to a higher standard. "It's a two-way street," he said, "and helps the host in the long run".

Ron Zieber (right) of TransAlta and Ken Cox discussed key audit methods and questions used to evaluate worker behaviors and adherence to corporate electrical safe work standards. Their research, "Ask the Right Question", was prompted by the question: "Are the approaches used and the questions asked during an audit really uncovering all aspects of worker behaviour?"

They started with the assumption that a company has a quality Electrical Safe Work Standard (ESWS) that had been rolled out to workers, but how closely are practices in the field actually aligned with the ESWS? Enter the third-party audit, in which human factors play a significant role in getting accurate data on electrical behaviors happening in the facility. Looking at the various phases of an audit, what are some key methods and audit questions used to properly assess a program, evaluate worker behaviours, and appraise worker adherence to corporate standards? (see page 14)



Lanny Floyd, adjunct professor, Advanced Safety Engineering & Management with the University of Alabama (Birmingham), and principal consultant & global electrical safety competency leader with DuPont, asked delegates how they would answer the question: "How would you describe electrical safety excellence?". Is it Zero electrical injuries? Is it having an up-to-date arc flash study and arc-rated PPE? Is it being in compliance with a standard like NFPA 70E?

"No," said Lanny, explaining instead that electrical safety excellence "can be found where individuals or organizations are committed to an electrical safety culture that: seeks and promotes prevention through design; ensures reliability of equipment identified as critical to electrical safety; and cultivates resilience to human error" to reduce the risks of mishaps in electrical systems to as low as reasonably practicable.

"Electrical injury is very rare," explained Lanny (as compared to other workplace injuries), "but when it happens, it is severe... It's not about the likelihood, but the severity!". In a follow-up comment to Lanny's presentation, Daniel Roberts asked delegates to consider: "Are you creating safety, or preventing injury?"



John Aeiker (photo) and Danny Liggett from Aeiker Safety Associates and DuPont, respectively, challenged delegates to look at electrical hazard analysis from a process safety management (PSM) perspective. In the industrial world, a hazard analysis is typically an in-depth look at the hazards associated with a process involving hazardous chemicals and/or flammable materials (Process Hazard Analysis, a.k.a. PHA).

Aeiker and Liggett asked delegates to think of an electrical distribution system just like a process, then a PHA would easily translate into an Electrical Hazard Analysis (EHA). Using these analysis tools to perform an EHA of the distribution system of a facility greatly enhances understanding and knowledge of the associated hazards while providing a systematic method of risk and hazard reduction.

There's a lot of buzz around the notion of 'qualified worker', and industry finds itself struggling to find consensus on what that entails. Irozenell Pruitt of DuPont asked the question: "Do you know what your qualified people know? Do you know *what they don't know?*"

Through her presentation "Qualifying and Keeping Your Employees Qualified", Irozenell explained a person is not necessarily qualified just because he holds an electrical licence, has passed an exam or has years of experience in the trade.

Instead, a qualified worker is someone who has received training in—and demonstrated skill and knowledge in—the construction and operation of electric equipment and installations, and the hazards involved. As such, someone who is qualified to work on one piece of equipment is not necessarily qualified to work on another.

Irozenell did, however, provide a 6-step process for qualifying workers, and keeping them qualified: 1) training, 2) skills demonstration, 3) regular supervision, 4) annual audits, 5) retraining, and 6) documentation. **EE**



Do you know hazard, risk and risk assessment?

Daniel Roberts



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Hint... it doesn't have to be that complicated

An occupational health and safety (OH&S) professional would regard the answer to the question “What is the difference between hazard and risk?” as obvious but, for many electricians, electrical technicians and technologists, the answer might not seem so obvious.

In the English language, the words *hazard* and *risk* are used in many different contexts and with various shades of meaning and, sometimes, interchangeably. So what are the commonly accepted meanings of the terms in the North American OH&S context? How do they apply to electrical safety?

Why are these words important?

NFPA 70E “Electrical Safety in the Workplace” and, more recently, CSA Z462 “Workplace Electrical Safety”, have steadily gained acceptance as electrical safety best practice standards. Some provinces in Canada refer to CSA Z462 in their regulatory application guidelines, and at least one is looking at adopting the standard.

From the beginning, CSA Z462 and NFPA 70E remained technically harmonized with each other, but it was noted during the development of the 2012 editions that they were not always in harmony with other safety standards in their treatment of risk. For example, the word *risk* is used 184 times in CSA Z462-2012 with different shades of meaning: sometimes it referred to the *likelihood* of something occurring; sometimes it referred to the combination of the *likelihood of occurrence* and the *severity of harm* (the OH&S meaning of the term); and sometimes, as in the phrase *hazard/risk*, the meaning wasn't at all clear.

A task force was set up to study this issue and make recommendations that would bring the 2015 editions of NFPA 70E and CSA Z462 into harmony with other safety standards. The task force members came from key sectors including, among others, labour, industry, regulators and contractors. Over 80 separate recommendations were created, all of which resulted in revisions to both standards. The terms *hazard*, *risk* and *risk assessment* have been defined. The content in the standards has been revised and aligned so that, when each term is used, it is used consistently and in accordance with the agreed-upon definition.

Since the next editions of NFPA 70E and CSA Z462 will use the risk assessment language of the safety professional, it is important for electrical pros to have a basic grasp of this topic.

What is the difference?

One thing the task force noted is there are as many variations of the definition of *hazard*, *risk* and *risk assessment* as there are safety standards defining them. However, all the definitions share common elements. Here, then, are simplified versions of these three definitions, along with a brief explanation:

Hazard is a potential source of harm. In layman's terms: Is there something that can hurt me? The *source of harm* is invariably associated with some type of energy. Therefore, hazard identification is a process of finding and categorizing sources of harmful energy. For example: The flow of electric current through the body that results from contact with an energized 347V conductor can cause harm. From the worker's perspective, the energized 347V conductor is the identifiable source of harmful energy.

Risk is the combination of the *likelihood of harm occurring* and the *severity of that harm*. Two key concepts in the definition of risk are *likelihood* and *severity*. Analyzing risk involves quantitatively or qualitatively estimating the likelihood of harm occurring and the severity of that harm. Before your eyes glaze over and you start imagining complex charts and algorithms to predict the likelihood of occurrence and severity of harm, read on... it doesn't have to be that complicated.

Risk assessment is a process that begins with hazard identification, analyzes the risk associated with that hazard, and concludes with risk evaluation.

Most of us practice a qualitative form risk assessment as we engage in everyday activities. We perform this assessment without using a complex matrix to analyze each factor that contributes to the likelihood of occurrence or harm and the severity of harm. Instead, we use the most elementary of risk matrices: Yes and No.

When mowing the lawn, driving a car or walking to the corner store, we consciously or subconsciously identify sources of harm. We analyze and estimate the risk associated with each identified source (Can I get hurt? How bad could it be?). We qualitatively evaluate the level of risk as acceptable or unacceptable with a simple Yes or No response.

Continues page 12

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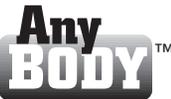


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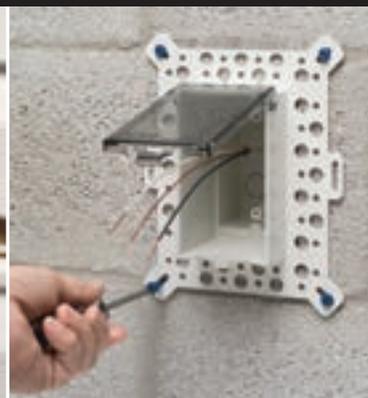
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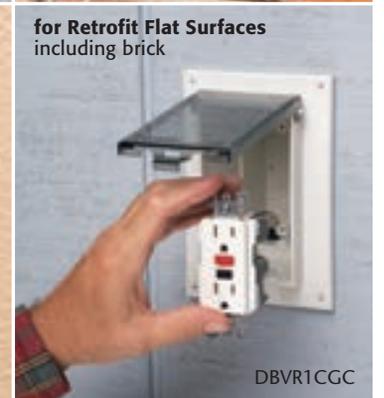
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Research suggests that most of us tend to underestimate the likelihood of the occurrence of harm, and greatly underestimate the severity of harm (the “bad things happen to someone else” syndrome). This is due to how we develop our perception of risk. There are two mental systems we use to process risk: analytical and experiential. The former is logic-oriented and governed by conscious thought processes while the latter is feeling-based and governed by associative connections from previous experiences. We tend to favour the latter because it is quicker and easier.¹

Applying the principles of OH&S risk assessment brings methodology and rigour to the process. It forces us to be analytical and, very importantly, it comes with a hierarchy of risk control methods based on three simple principles:²

- Remove the source
- Change the consequences
- Change the likelihood

How will Z462 and 70E (2015) be affected?

The term *hazard analysis* has been replaced by *risk assessment*, so instead of a *shock hazard analysis* the standards will refer to a *shock risk assessment*. However, other than the change in terminology, the shock hazard requirements that follow remain the same.

The important revision is the addition of a hierarchy of risk control. The 2015 editions of each standard will refer to this hierarchy three times:

1. The hierarchy of risk control methods will be listed
 - a. Eliminate the hazard.
 - b. Substitute other materials, processes or equipment.
 - c. Engineering controls.
 - d. Systems that increase awareness of potential hazards.
 - e. Administrative controls e.g. training and procedures, instructions and scheduling.
 - f. Personal protective equipment (PPE), including measures to ensure its appropriate selection, use and maintenance.
2. An employer will be required to have a risk assessment procedure to:
 - a. Identify hazards
 - b. Assess risks
 - c. Implement risk control according to a hierarchy of methods
3. A qualified worker will be required to be trained in the decision-making process necessary to:
 - a. Perform job safety planning
 - b. Identify electrical hazards
 - c. Assess the associated risk
 - d. Select the appropriate risk control methods from the hierarchy of controls

The beauty of the analytical risk assessment process and the hierarchy of controls is there is no room for experiential risk assessment. It is unemotional. Inconvenience, or client or production pressures are not part of the equation. It requires that hazards be eliminated when it is possible to do so. Ultimately, it works in the best interest of workers and their employers.

What will this mean for the electrical worker?

The safety professional loves risk assessment and the hierarchy of risk controls. They can be applied to any type of risk at any stage in the life cycle of a product, process or service (see the Preface of CSA Z1002 “Occupational health and safety – Hazard identification and elimination and risk assessment and control”). It enables decision-makers to effectively reduce risk before the worker begins interacting with the process or product.

For example: when purchasing electrical distribution equipment, an employer can reduce risk by specifying that the product utilize ‘substitution’ and ‘engineering’ risk control methods such as ‘finger-safe’ technology, 24vac rather than 120vac controls, and externally accessible communication ports rather than ports that are only accessible by opening equipment doors.

At the field level, where the electrical professional is practicing his craft, risk assessment can be quite simple, as when performing a shock risk assessment. Electric shock occurs when electric current passes through the human body. Shock from electrical equipment is usually prevented by ‘substitution’ and ‘engineering’ risk control methods such as insulation, isolation, guarding, equipment design or a combination thereof.

Hazard identification

Identifying the potential for electric shock involves identifying situations when exposure to electric conductors is not adequately controlled by insulation, isolation, guarding or equipment design. This usually occurs when the electrical worker removes a cover or in some other way compromises the insulation, isolation, guarding or equipment design. This might be done for the purposes of maintenance, installation, repair or testing.

Risk analysis

Analyze the likelihood of making electrical contact using a Yes or No matrix. Is the insulation, isolation, guarding or equipment design compromised, or will a worker’s actions compromise it such that electrical contact is possible? Notice that the question is about the possibility of electrical contact (analytical) not whether the worker can be careful enough to avoid electrical contact (experiential). CSA Z462 and NFPA 70E identify a safety boundary called the *restricted approach boundary* as the distance within which contact should be considered a possibility.

Analyze the severity of harm of using a Yes or No matrix. Could electrical contact result in harm (e.g. burns, loss of body parts or death)? This is where some electrical workers get themselves into trouble; it is likely they have endured several electrical contacts during their career without any measurable physiological effects (experiential), yet they know that electrical contact—even at 120V—can be fatal (analytical).

When the answer to both questions is Yes, the worker must utilize the hierarchy of controls starting with elimination. Is possible to eliminate the hazard (de-energize by following an approved lockout procedure) and still complete the task (analytical)? For example, it is possible to perform maintenance, installation and repair

while equipment is de-energized, but it is usually not possible to perform diagnostic testing while equipment is de-energized.

The Canadian and Ontario Electrical Codes actually address the “possible versus not possible” question in Subrule 2-304(1): “No repairs or alterations shall be carried out on any live equipment except where complete disconnection of the equipment is not feasible”.

When is de-energizing not feasible? Appendix B of the Canadian Electrical Code replies: “Examples of tasks that are not feasible when electrical equipment has been completely disconnected are troubleshooting of control circuits, testing and diagnostics”. Note that installation, maintenance and repair are not included in the listed examples.

When de-energizing is not feasible, the tendency is to jump to the last risk control method: PPE. While the risk control method of substitution is not usually possible at the field level, the use of engineering controls such as temporary barriers (rubber insulating blankets or other cover-up materials) can be an effective risk control method.

Diagnostic testing, including testing for the absence of voltage during a lockout procedure, requires the use of a combination of administrative risk control methods (e.g. worker qualifications, training use of procedures) and PPE.

One is not the other

Hazard and risk *are* different. A hazard is a thing... a source of harm. Risk is an estimation of the likelihood of harm occurring and the severity of that harm. The estimation can be based on a complex scoring matrix, or a simple Yes or No matrix.

Risk assessment and the hierarchy of risk control methods have been successfully applied for years to all manner of workplace hazards. Electrical hazards are not so unique that they need to be treated differently.³ The 2015 editions of CSA Z462 and NFPA 70E have adopted risk assessment and the hierarchy of risk controls, ensuring that the risk associated with electrical hazards is effectively controlled. **EE**

Notes

1. Floyd, A. and Floyd H.L.; Cultural Drift and the Occlusion of Electrical Safety; IEEE Transactions on Industry Applications, Volume: 50, Issue: 3. Visit ieeexplore.ieee.org.
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Daniel Roberts is the senior manager, electrical safety consulting, at Schneider Electric Canada. He serves on several standards-writing technical committees, including Canadian Electrical Code-Part I, CSA Z1000 and Z1002, and as the CSA Z462 vice-chair. Daniel also received the 2013 CSA Award of Merit for “sustained and influential contributions to OH&S and electrical safety standards”. He can be reached at daniel.roberts@schneider-electric.com.



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So you have an electrical safe work standard...

... but is anyone actually following it?

Ron Zieber and Ken Cox

Your company has a good-quality electrical safe work standard that has been rolled out to workers, but how closely are they following it? All of the time? Most of the time? Sometimes?

Understanding the gap between your standards and worker behaviour in the field is absolutely essential to keeping your workers safe from electrical harm. This article explores two key themes associated with electrical safety audits:

1. What questions need to be asked to understand the most basic safety behaviours in the field?
2. What human factors need to be considered during audit interviews to ensure responses are accurate and tell the whole story?

Among the many facets of an audit (e.g. review of facility electrical standards and procedures, facility tour and inspections, interviews, the development of an audit report and action items), this article focuses solely on the human factors of which you, as an auditor, need to be aware as you interview workers to understand the behaviours that are *actually occurring* in the field. Getting candid responses from workers is both an art and a science.

Pre-interview preparation

When preparing for audit interviews, consideration should be given to the following:

1. Should the auditor have an electrical background? Electrical workers tend to share candid responses with someone they perceive understands what they do on a daily basis. For non-electrical safety professionals involved in organizing an audit, consider co-interviewing with someone who does possess an electrical background.
2. When selecting a sample of workers to interview, is there any value in interviewing a recent hire? The answer is Absolutely! Newer workers can provide great insight into the effectiveness of the safety onboarding process. Ideally, one should aim to interview a blend of new, intermediate and veteran workers.
3. Is it worthwhile for auditors to interview not only electricians, but also instrumentation & control technicians, operators or other non-electrical workers? I&C technicians may only be authorized to work with control voltages, but if they work on (or in proximity to) voltages greater than 50, they should be included in the interview process. In some facilities, operators may have the training and authorization to perform some limited electrical tasks, so they, too, should be included.

Other workers, such as mechanical tradespeople, may have limited interaction with electrical gear but will be regular users of portable electric power tools and extension cords. As such, a small sample of these workers should be included. And don't forget to include key managers, electrical engineers or safety specialists.

4. Are there opinion leaders/influencers who should be included on the interview list? Are there workers who are passionate about electrical safety? Consider phoning the supervisor of each worker on the interview list and find out a bit of information on each person.
5. Where is the best location to conduct interviews? A quiet room may be the best location to meet for 1-on-1 interviews from the auditor's perspective, but the worker may prefer to meet in his shop or another location where he feels most comfortable. In our experience, some of



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the most honest discussions pertaining to safety have occurred while joining a worker on his maintenance rounds.

6. Confidentiality ground rules... request that the boss *not be present* in the 1-on-1 interviews. Depending on the safety culture at the facility, workers may not feel free to respond with complete candor when they think they can be overheard by a supervisor, or even a fellow worker.

The interview icebreaker

Workers and even their supervisors may feel that something they reveal to you could get them into trouble. To get to the stage where interviewees are completely honest with the auditor regarding electrical safety behaviours that may be occurring when no one is watching, it is critical that the auditor foster an environment of trust. This is particularly important when the auditor and interviewee have never met.

Before proceeding into the structured Q&A part of the interview process, it is important for the auditor to put the worker at ease. The following approaches can really help in getting the interviewee to open up and provide candid and accurate information.

1. Start by finding out some personal information about the worker. Did he grow up in the area? Does he have children? Workers are sometimes more motivated to stay safe on behalf of their loved ones rather than for themselves.
2. Find out the work background of the worker. How long has he worked for the company? Where did he work prior to joining the company? What is his current role? These questions can provide additional insight into relevant questions to ask during the interview process.
3. Take a minute to highlight your own electrical credentials. Bring a copy of the facility's single-line electrical drawing to the interview. The interviewee is likely going to be skeptical of you (i.e. "This auditor guy doesn't know our equipment or how we do things here"). To get candid interview responses, it is important the interviewee feels you know your stuff.
4. Let interviewees know that audit write-ups will be anonymous, although audit summaries and action items will be provided to management at a corporate level. If you've arranged to meet your interviewees as a group before you leave the site, let them know they will see the findings first.

5. Take a couple of minutes to talk about an electrical safety incident in which you, or someone you know, was involved. In our experience, this can be a tremendous enabler in encouraging an interviewee to open up and share his own shock and arc experiences. It also helps them understand why you are so passionate about electrical safety. These shared stories can create a powerful bond.

Behavioural audit questions

Most large companies have already developed a set of audit interview questions. Here's an excerpt from one of our company's set that may be helpful in uncovering workers' daily behaviours:

1. "Please tell me what an electric shock is. How much current can cause electrocution?" We're not overly concerned with correct answers at this point; these questions are great for getting interviewees thinking about how little current can result in electrocution. They are also great leading questions for some of the questions that follow.
2. "Have you or one of your colleagues ever experienced a severe shock at work or at home?" If the worker has a story to tell, don't forget to ask "How did this event impact you or your family?"
3. "What is the highest voltage at which you have been shocked?" It is both sobering and surprising to learn how many workers—particularly veteran electricians—have been shocked on 480V or 600V systems at least once over their careers.
4. "Can you tell me what an arc flash is? How is an arc flash created?" Again, we're not overly concerned with correct answers, and these are good leading questions for some of the questions that follow.
5. "Have you or one of your work colleagues ever been involved in an arc flash incident?" If they have a story to tell, ask them how it happened. "What impact did this event have on your life? On the life of your family?" These shock and arc flash stories need to be documented because stories are the single-most powerful communication tool available to us. They communicate on a much deeper level than statistics and pie charts. There may also be opportunity to share these anonymous stories with other facilities or company management when support for the company electrical safety program is required.
6. "Is there any type of work that

would bring you out of your comfort zone?" This question really highlights whether the worker understands his limitations and practices self-imposed (or company-imposed) boundaries.

7. "Do the electrical contractors at this facility follow the electrical safe work standard?" When the contractors' and facility's standards differ, the higher of the two standards should be used.
8. "With what types of energized electrical tasks are operators or I&C technicians involved?" For example, are operators trained and qualified to rack

circuit breakers? Are I&C technicians involved in troubleshooting circuits in panels with mixed power and control voltage sources?

9. "How is the absence of voltage testing performed <1000V? How is the tester tested?" Electrical workers who are unable to answer this fundamental question adequately may be exposed to significant safety risks, and fundamental safety practices will need to be addressed.
10. "How is absence of voltage testing done >1000V? How is the tester tested?"


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11. "Do non-electricians ever use multimeters? Non-contact voltage detectors? For what type of work?"
12. "Are there people, equipment or tools about which you are concerned?"
13. "Do you have the right to refuse unsafe work?"
14. "Have you ever had to refuse unsafe work? If Yes, please talk about the situation." We've discovered that, in some cases, electrical workers had been asked to perform unsafe work by supervisors who were non-electrical and unaware of the associated hazards.
15. "Are 'minor' shocks reported to your supervisor? In any follow-up action carried out?"
16. "How does management feel about unsafe actions or equipment?"
17. "Are hardhat-mounted, arc-rated face shields and balaclavas available? Under what circumstances are they worn?"
18. "When you are exposed to potentially energized bare conductors or circuit parts, at what voltage (>50, at 120, >120, or higher) do you wear your voltage-rated gloves?" This is an absolutely fundamental question for understanding actual worker behaviour relative to facility policy.
19. "Would you pull a new circuit into a 120/208V

lighting panel live?" This could be construed as a *trick question*, as not all companies may explicitly forbid this practice. However, doing this type of work may require several layers of controls, such as arc-rated clothing, voltage-rated gloves and, perhaps, an arc-rated face shield, barriers, a safety watch, and several levels of authorization in an Energized Electrical Work Permit.

20. Lastly: "What do you see as the biggest electrical hazard in your work?" This is one of the most important questions for uncovering risks missed in earlier audit questions... and you may be quite surprised by what you hear!

Concluding the interviews

Taking high-quality notes during interviews with individual workers is important; however, it may be wise to consider not taking any notes while discussing a sensitive issue with some workers. In cases where the interviewee answers a question that is dangerously incorrect, the auditor bears a responsibility to take action while respecting the confidentiality of the interview. (This includes discussing the correct answer.)

As an auditor, it is critical to uncover the gaps between a facility's standards and actual worker behaviour in the field. For this to happen, the auditor must find ways of connecting with workers so they are willing to be completely transparent regarding electrical safety behaviours. Being sensitive to these human factors during the interview portion of electrical safety audits and asking behaviour-related questions are key to uncovering actual electrical safety behaviours, allowing deficiencies to be addressed and, ultimately, keeping those workers safe. **EB**

Ron Zieber is the lead electrical engineer for Hydro Operations at TransAlta Utilities (Calgary, Alta.). He chairs the corporate e-safety team and has performed audits at more than 40 of his company's generating sites, including wind farms, hydro, gas and coal-fired power plants. Ken Cox is the engineering manager at Weyerhaeuser's oriented strand board manufacturing plant in Elkin, N.C. In 2001, an electrical fatality at the Elkin site prompted them to rethink their electrical safety practices, training and procedures. This article is based on the paper "Ask the right question" from the IEEE IAS Electrical Safety Workshop (ESW) 2014. Reprinted with permission ©2014 IEEE.

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Take a look at their stories and our incentives at saveonenergy.ca/electrical-business



How to **not** make more money

Quality control, not rework, pays dividends

Rob Colclough

*Oh, that building?
That's where we fix
all of our screw-ups!*

That was the response I got from the service attendant at a repair shop. I stood there for a moment—a bit in shock, actually—expecting his response to be some kind of attempt at humour (that failed, by the way). To my surprise, the attendant stood there, stoic, and completely on the level.

To bring you up to speed, I had brought my vehicle into the local garage that morning because, well, it was having issues and needed some professional help. Upon arriving at the repair shop, I noticed they were constructing a new building behind the garage, right where the employee parking used to be. Being a curious person, I asked the attendant “What’s the new bay for?”.

I thought the response was going to be something along the lines about how the business was growing and they needed to expand their facility to accommodate more work but, as you saw from the opening line, the actual reply was not at all what I expected.

I quickly made a weak excuse—something along the lines about forgetting something in my car and that I’d be right back—then drove away from there as quickly as I could in search of a ‘reputable’ repair shop... never to return.

OK, you got me... that story is *completely made up*, but I use it to emphasize the point that *rework is unacceptable*, regardless of industry. So why is rework on industrial sites more widely accepted?



STOCK PHOTO

“He didn’t seem at all concerned with the fact that over 30 of the workers on his payroll were devoted solely to handling the errors his construction crews were making.”

What got me on this train of thought was this: while on an industrial site recently, I bumped into a group of supervisors from the same company, and we started to chat. One of them introduced himself as the general foreman in charge of rework crews. Wait a minute, I thought to myself, let me get this straight... this guy is the general foreman in charge of a group of tradespeople specifically dedicated to rework? He probably oversees 2-3 foremen who each have 8-12 guys under them whose job it is to strictly *handle the mistakes* made by the construction crews.

The general foreman’s project manager was next to introduce himself, and he didn’t seem at all concerned with the fact that over 30 of the workers on his payroll were devoted solely

to handling the errors his construction crews were making.

Am I the only one who sees a problem with this?

Now this is not the first, nor will it be the last, project to have dedicated rework crews. I have seen them on industrial projects all across Canada, but the fact that these crews *even exist* and are viewed as part of the project is a bit unsettling, to say the least. So I started thinking: “What if this were the norm in other industries? How would that be viewed?”. That’s how the made-up story of the auto repair shop was born.

Are you really making money from rework?

For the sake of argument (and easy math), let’s say the average charge-out rate per project personnel was \$100. With 30 guys at 10 hours/day = \$30,000 per day the project manager’s company was paying to handle a completely avoidable situation.

Can you see why reducing the amount of rework is so important?

Maybe you’re thinking, “Yeah, but my project is a lot smaller. We only have 5 guys handling rework”, or maybe your crews handle their own rework and no one is

“Are you tracking your rework costs? Part of the reason rework is not taken more seriously is that most projects do not track it. Just how much money is OK to flush down the toilet, anyway?”

specifically dedicated to handling repairs. OK, then *your* project is obviously not spending \$30,000 per day, but *it is spending* something. Do you even know how much?

Are you tracking your rework costs? Part of the reason rework is not taken more seriously is that most projects do not track it. Just how much money is OK to flush down the toilet, anyway?

All the money spent on rework comes off the bottom line and, with ever-decreasing profit margins, it becomes imperative to reduce the amount of rework.

And we all know time = money, so what about the time wasted on fixing errors. Every hour spent on rework is an hour that could have spent completing your project. So you're really losing 2 hours for every 1 hour spent on rework. Now that \$30,000 bill just jumped to \$60,000... and that amount gets even higher when you add the administrative time wasted, and the added time required by QC to verify the work was completed to the client's requirements.

The overall cost of rework has been pegged at somewhere between 2.5x to 3.5x the original estimated install price, and do you know how much a project estimator puts in his bid for rework? Exactly. Zero.

A project manager once explained to me, “But our project is Cost/Plus. Don't worry about the rework... we'll still get paid to fix it”. That blew my mind. I responded to him with this hypothetical situation:

“Let's say you hire a company to come into your house to do a complete kitchen renovation, and they quote you \$6000 to do the job. Then, at the end, they hit you with a bill for \$10,000. When you ask why the final amount is so much higher than the original quote, they explain that they accidentally installed the wrong cabinets and had to tear them out. Because those cupboards were now ruined, you were expected to pay for their mistake.”

The project manager said he would be pissed. So how is his rework situation any different?

In with the new job. Same as the old job?

On a particular jobsite years ago, back when I worked as an inspector, I spotted some deficiencies and showed the foreman the issues. I pointed out that the site specifications showed a different installation requirement than what his

crew had installed, and that was why I wanted him to fix it.

His response (which you know is being said right now on a project somewhere) was “That's how I did it on my last job”. (Note: the quickest way to getting under the skin of any decent inspector is to say “That's how I did it on my last job”.) “Besides,” he said, “Cable tray is cable tray.”

“Interesting way to look at it,” I replied. “Now let's look at coffee, because coffee is coffee, right? So you go to the local Timmy's and order a medium double/double and the server hands you a large black. When you ask the server why he gave you the wrong order, he explains you're getting a large black because that's what the last three customers ordered and, besides, ‘Coffee is coffee.’”

The foreman figured that server would had to have been, well (how do I put this nicely), mentally slower than the average population. So why should it be OK for the foreman to build something the same way he had before—regardless of the client's specs—and not OK for the server at Timmy's? Simply put, it's not OK.

We are all responsible for quality

We are all in the service industry, and are expected to build the project (whatever it may be) error-free and to the client's stated and implied expectations—not ours. Should the foreman above have been expected to the pay for the coffee he didn't ask for or want? We want the client to return, not the project.

Rather than being reactive to quality control issues, we must be proactive and focus on doing things right the first time. Like the issue of electrical safety, we need more discussion on improving quality on jobsites over the course of the entire job, not just at the bitter end when we are forced to engage a Rework Crew. This means hiring for the right attitude, training on what constitutes a quality installation, having supervisors share more information with their crews, and so on.

I constantly remind my clients and others to change the paradigm. Put yourself on client's side of the fence. Were you the client, would you find rework acceptable? If the answer is No, then don't support the paradigm that encourages it. Rework from a customer's point of view is unacceptable and unprofessional, and forces them to take their business elsewhere. **EB**

Rob Colclough heads up BQS Inc. and has helped numerous industrial companies develop or improve their quality management systems. His work experiences encompass quality inspection, management and consulting, and he developed and teaches QC inspection and management courses at IBEW's training centre in Alberta. You can reach Rob at bqsinc@hotmail.com or (587) 983-3981.

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Were **ghosts** calling the Poltergeist Site?



There must be an earthly answer to these phone problems

Patrick J. Lynch, P.Eng.

Business chaos and huge dollar losses were mounting quickly due to a suspected afterworld haunting throughout our client's customer's entire office building. Simply put, the problem manifested as intermittent phone service throughout the entire multi-storey building, and all the business tenants complained of dropped calls and phones ringing... but with no one at the other end!

These intermittent phone problems equally affected all the businesses within the building. An initial investigation was performed by the local phone company's technical service group. They performed all the standard tests but could not find the cause of the problem. After several months of zero success, the phone executives decided to fly in their technical troubleshooting gurus from their head R&D office.

The elite R&D group was instructed "to leave no stone unturned". They immediately replaced the entire phone system with a new one and installed all new programming.

The phone problem persisted. Out of frustration, the R&D group even installed a

temporary 500-ft ground cable, connected from their centralized phone system to the grounded metal fire hydrant piping system nearby outside.

The phone problem persisted. The elite R&D group had invested over 1000 hours (plus expenses for travel, lodging, food, etc.) investigating the phone problem, and had yet to find a solution. They were puzzled and frustrated because the phone system was working perfectly at every other site... except this one.

Out of sheer desperation, one of the R&D guys searched the building's records for any clues, and he learned one amazing fact: the building had been built on top of a former cemetery.

Within the phone company's circles, the problem site quickly became known as the 'Poltergeist Site'.

The R&D group could find no "earthly reason" for the phone problem, which had escalated to the point where the phones were sometimes ringing by themselves *even when unplugged* from the phone jack.

Were spirits from the afterworld ringing the phones, trying to connect to their long-lost relatives? Did they unfinished business in this world?

Call in the ghostbusters

By this point, the phone group had wasted over 1500 hours (plus expenses) and had exhausted all of their technical expertise in attempting to solve the problem. Reluctantly, the phone executives sought external assistance.

Many of our past clients jokingly refer to our group as their favourite 'ghostbusters' so, when we were referred to the phone company, it was a perfect fit: ghostbusters hired to solve a suspected spectre problem at the Poltergeist Site.

(Not to brag but, once onsite, the problem took us less than 6 hours to solve... *without* the help of an exorcist.)

So what were we looking at?

- A power problem?
- A grounding problem?
- A design problem?
- Some other problem?
- A combination of problems?

We initially discussed the issue with the building's tenants, who noted the problems would build up during the morning, peak around noon then gradually taper off in the afternoon. Our test equipment corroborated their account, as it recorded similar airborne electrical interference patterns hourly.

There is a restaurant on the ground floor of this office building that caters primarily to business lunch clientele. The restaurant's operation exhibited an hourly pattern similar to our recorded electrical interference pattern.

With the necessary approvals, we entered the restaurant and noticed our equipment immediately began picking-up very high radiated electrical interference levels, which appeared to peak in the kitchen area. Upon further investigation, it was determined the kitchen refrigeration compressor system for the walk-in freezer was the culprit.

It was radiating very high RF electrical interference levels, which were then electrically coupling adversely into the main telephone system, which was located directly overhead on the next floor.

Conclusion

The refrigeration system controls were quickly repaired and, to no surprise, all the building's phone problems disappeared immediately. All businesses now had their critical phone systems restored, as the Poltergeist Site's ghosts had been 'exorcised'. The phone company, however, will have to re-examine its phone equipment's level of susceptibility to electrical interference. **EB**

Patrick J. Lynch, P.Eng., has been the president of Power Line Systems Engineering Inc. since 1986. He graduated Electrical Engineering from the University of Waterloo in 1975, and has successfully directed Power Line's completion of over 1100 complex electrical engineering site disturbance investigations around the globe. Visit www.powerlinesystems.ca.



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John Salmon

It is truly with great sadness that EBMag reports the passing of **John Benjamin Salmon**—the result of an accident at his home in Kitchener, Ont.—on July 19, 2014. He was in his 56th year. A regular contributor to Electrical Business Magazine, John was well-known across the industry. A licensed construction and maintenance electrician, and a master electrician, John was a vice-president at Electrical Contractors Association of Ontario (ECAO) and chair of Ontario's Electrical Contractor Registration Agency (ECRA). A voting member on the Canadian Electrical Code Part 1, John also represented both ECAO and the Canadian Electrical Contractors Association (CECA) as the Codes & Standards chair.



PHOTO © CANADIAN AID FOR CHERNOBYL

Northern Cables (www.northerncables.com) has committed to a 5-year sponsorship (\$5000 per year) of the annual Gala Dinner and Auction held by **Canadian Aid for Chernobyl**—a nationally registered non-profit charity providing children's respite, humanitarian and medical aid and assistance, and reconstruction of institutional washroom and laundry facilities benefiting victims of the Chernobyl nuclear disaster.

— *With files from Eric McKenzie.*

The **Energy Council of Canada** (ECC, www.energy.ca) has announced **Anthony Haines**, president and CEO of **Toronto Hydro** (www.torontohydro.com), as the **2014 Canadian Energy Person of the Year**.



Connie Chabot

Stelpro (www.stelpro.com) announced **Connie Chabot** is now vice-president of sales & marketing for North America, where she will

work to expand Stelpro's footprint in the United States. She possesses nearly 20 years of experience in the industry, and most recently served as VP sales & marketing for the Canadian market.

EthoSolar (www.ethosolar.com) has appointed **Kevin Allan** director of sales & marketing, describing him as a "seasoned sales professional with over a decade of executive management experience". His expertise in the renewables and energy sector will bring new strength to the department, while also ensuring clients receive the premium solution for their solar energy needs, said the company.



Denis Lavoie

LED Roadway Lighting has announced **Denis Lavoie** as company president. **Charles Cartmill** will continue in his role as CEO, focusing on strategic initiatives, whereas Lavoie will oversee daily operations. Lavoie possesses more than 20 years of experience in international sales & marketing, and senior management. He joined LED Roadway (www.ledroadwaylighting.com) in January 2013, most recently serving as executive vice-president, sales & marketing. **EB**

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IN CASE YOU MISSED IT...



VIDEO • Back in April, Nedco Ontario launched the 10th edition of Electrifest, and EBMag was there to celebrate alongside attendees Mardi Gras-style. Visit bit.ly/1pnotNg.

VIDEO • The Electrical Contractors Association of Hamilton and members of Hamilton's IBEW Local 105 were on-hand to answer questions and let students try out some interactive demos at the latest installment of Future Building. Visit bit.ly/1kXIETj.



IES Street and Area Lighting Conference
Illuminating Engineering Society
September 14-17, Nashville, Tenn.
Visit www.ies.org/salc

AEL's Round-up Alberta Gala
Alberta Electrical League
September 18, Calgary, Alta.
Visit albertaelectricalleague.com

ECRA Licence-Holder Meeting
Electrical Contractor Registration Agency
September 24, Thunder Bay, Ont.
November 4, Mississauga, Ont.
Visit bit.ly/1uHm54o



IAEI Canadian Section Meeting
Int'l Assoc. of Electrical Inspectors
September 26-28
Niagara-on-the-Lake, Ont.
Visit bit.ly/1gv5z2U



NECA Convention & Trade Show
Nat'l Electrical Contractors Association (U.S.)
September 27-30, Chicago, Ill.
Visit www.necaconvention.org



CANEW (Canadian Airports Nat'l Electrical Workshop)
Canadian Airports Electrical Association (CAEA)
September 29-October 3, Regina, Sask.
Visit www.canew.ca



AD North American Meeting, Electrical Supply Division
Affiliated Distributors
October 5-8, Chicago, Ill.
Visit www.adhq.com



BCEA/IESBC Lighting Education and Expo
October 16, Coquitlam, B.C.
Visit bit.ly/1trIWFy

Certi-Fire Instructors and Training Conference
October 17-19, Port Credit, Ont.
Contact Lyndsy Miceli at lmiceli@ecao.org or (416) 675-3226

Power of Water Canada Conference
Ontario Waterpower Association
October 19-21, Niagara-on-the-Lake, Ont.
Visit conference.owa.ca

EHRC National Forum
Electricity Human Resources Canada
October 24, Toronto, Ont.
Visit electricityhr.ca

CanWEA Annual Conference & Exhibition
Canadian Wind Energy Association
October 26-29, Montreal, Que.
Visit www.canwea.ca

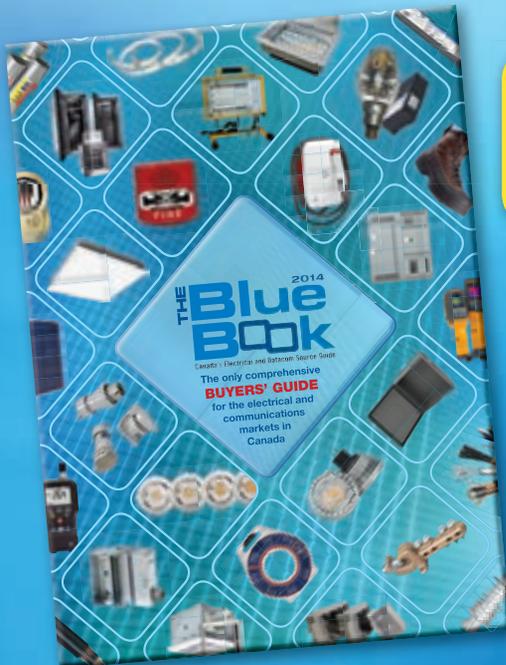


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EB lighting products

Standard debuts E-Lume Omni A19, G4/G9 lamps



Standard Products has introduced the E-Lume Omni A19 LED lamp, available in a dimmable and non-dimmable version. Boasting consistent lamp to lamp colour and light, no UV emissions and long-life, the E-Lume Omni comes in 60W and 100W replacement lamps. Meanwhile, the G4/G9 promise bright and crisp white light in a compact profile, while minimizing energy, maintenance costs and generating less heat than halogen equivalents, says Standard. Suitable applications for the G4/G9 include task, undercabinet, pendant and accent lighting. **STANDARD PRODUCTS**
www.standardpro.com

Civilight enters North American LED lighting marketplace



Civilight North America announced it has entered the LED lighting category and is offering indoor LED lamps in Canada, the States and Mexico. The company says its focus is strictly on LED products, offering a complete line of indoor LED lamps with three series—Architectural (highest quality); Professional (best price/performance); and Commercial (best ROI)—in PARs, BRs, linear tubes, bulbs (A19 and candelabra) and spots (MR16s and GU10s). The company also offers LED downlights for an integrated solution. Civilight's lamps are suitable for commercial, industrial and residential applications, including retail, hospitality, office, restaurant, worship, government, showroom facilities and residential. The lamps promise an L70-rated lifetime of up to 40,000 hours. **CIVILIGHT**
www.civilight-na.com

Philips expands Hue line with Lux bulb, 3D-printed luminaires



Philips has expanded its Hue line of iOS-compatible LED bulbs with the addition of Hue Lux, which only emits white light. According to the company, the bulb allows users to enjoy “great quality, functional white light for everyday living” and “perfect digital dimming control”. Through the app, users can remotely control bulb brightness, set schedules, and more. The company has also unveiled what it says is the world's first 3D-printed connected luminaire, a design addition to the expanding Hue range. Combining the light, art and technology world, the luminaires boast limitless light effects and are available in table and hanging pendant versions. **PHILIPS**
www.philips.com

EB products

Rapid Roll protects your worksite and those around it



Rapid Roll is a portable, temporary fencing system created to provide a quick barrier and protect both pedestrians and workers. “Pylons, traffic cones and caution tape are often used for their speed and portability,” noted Tom Beraldo, president, “However, these warning tools also can be easily disregarded, allowing for distracted pedestrians to walk into harms way.” Set-up can be completed by one operator in a few minutes, and post variations allow for an unlimited number of indoor and outdoor, open and closed designs for protecting various sites. The system can also link together to create a larger perimeter. The Rapid Roll system is based on retractable fencing

technology, and is available in a range of colours in 50-ft and 100-ft lengths. **RAPID ROLL**
www.rapidroll.ca

Megger insulation resistance tester MIT1525 rated at 15kV

Megger is offering the insulation resistance tester (IRT) MIT1525 rated at 15kV, which measures motors and generators above 34,500V and equipment rated above 35kV. It tests the insulation resistance of high-voltage power cables and buses, large motor/generator windings as well as substation transformers. Suitable for applications that use cables, transformers, motors/generators, circuit breakers and bushings, the MIT1525 boasts 3000m-altitude operation and rapid charge capabilities. As well, it promises 5% accuracy with a maximum resistance up to 3 TΩ. Preconfigured



diagnostic tests include Polarization Index, as well as a Step Voltage test, Dielectric Discharge test and Ramp test. **MEGGER**
www.megger.com

Arlington low profile sconce box FCS405R

Arlington Industries' non-metallic low profile 4-in. diameter sconce box (#FCS405R) claims to be the time-saving solution to retrofit installations with shallow wall cavities or obstructions running behind the wallboard. Boasting easy installation with a 4-in. hole saw in an existing 1/2-in. or 5/8-in. wall, it accommodates most sconce light canopies and hides the box completely, says Arlington. The kit includes a non-metallic cable connector and mounting wings/screws for drywall. **ARLINGTON INDUSTRIES**
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ADVERTISER INDEX

ADVERTISER.....	PAGE
AD Rewards	28
Arlington Industries.....	11
Columbia-MBF (Atkore).....	18
BlueBook Source Guide	24
Canadian Standards Association.....	26
Comac	22
FLIR Canada	17
I-Gard.....	23
IPEX Electrical.....	2
Mersen.....	27
Nexans.....	1
Northern Cables	7
Nsi Industries	21
Ontario Power Authority	19
Schneider Electric.....	14,15
Standard Products	13
Thomas & Betts	1, 5
United Wire & Cable	4
Valvo Electrical Supply Ltd	25

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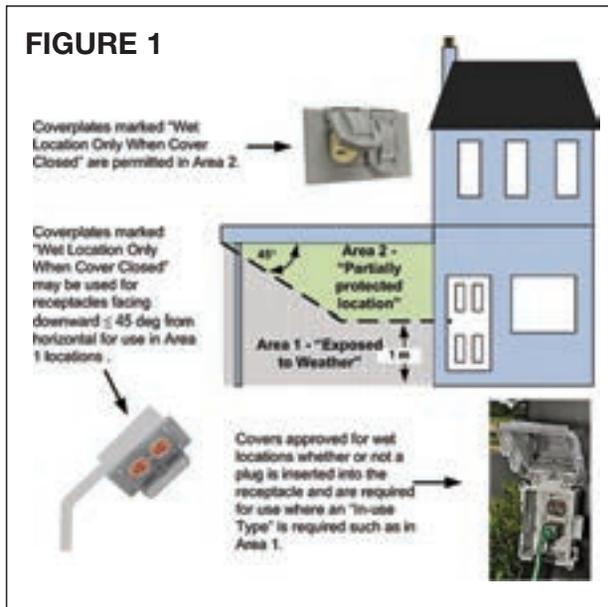
Are all outdoor receptacles exposed to weather?

Rule 26-702 of the Canadian Electrical Code (CEC) requires all receptacles exposed to the weather to have covers; it further requires “in-use covers” for 15A and 20A receptacles. The “in-use covers” provide protection to the receptacle, regardless of whether a plug is inserted.

But an important question has been raised on the application of this rule: are all receptacles installed outdoors considered “exposed to the weather”?

“Exposed to the weather” is not a defined term in the code. However, the CEC does define Outdoor Location as any location exposed to the weather, and further clarifies that locations sheltered from the weather are considered damp—not wet—locations.

Electrical Safety Authority (ESA) submitted a proposal to the CEC-Part 1 Committee to clarify this rule requirement and ensure consistency. The proposal—which has been accepted—recognizes the protection provided by soffits, overhanging balconies, canopies, marquees, roofed open porches and similar architectural elements against precipitation that may drip, splash or flow on or against receptacles located outdoors, thereby reducing the environmental



protection requirement for damp locations.

For example: to determine whether a receptacle location is damp and not wet, a zone defined in its borders by an imaginary 45° line from the roof edge and a horizontal line from at least 1 m off finished grade (or balcony or porch floor that is considered “finished grade”) is identified in Figure 1.

This easement applies to the outlets in the ‘areas’ identified in Figure 1:

- **Area 1:** “In-use” cover suitable for wet locations is required.
- **Area 2:** A cover marked “Wet Location Only When Cover Closed”—not of the “in-use” type—is permitted.

Until the next edition of the CEC is published (2015), a logical approach is needed to ensure compliance with this simple rule requirement, and your AHJ will have more specific interpretations. Also note that “in use covers” will be required to be marked “Extra duty” in CEC 2015. **EB**

Nancy Hanna, P.Eng., is the engineering manager for Codes & Standards Department at Electrical Safety Authority (ESA) where, among other things, she participates in the development of bulletins, guidelines and technical communication concerning code interpretation and consistency issues. She is a LEED Accredited Professional, and is a member of several CSA TSCs for CEC Part 1, including Sections 24, 32, 46, 50 and 64. Nancy can be reached at nancy.hanna@electricalsafety.on.ca.

Questions and answers compiled by the Electrical Safety Authority | VISIT WWW.ESASAFE.COM

Tackle The Code Conundrum... if you dare!

Answers to this month's questions in October's Electrical Business.

How did you do with the last quiz? Are you a...

- Master Electrician ? (3 of 3)
- Journeyman ? (2 of 3)
- Apprentice ? (1 of 3)
- Plumber ?! (0 of 3)

Question 1

Receptacles in basic care areas and located in areas that are routinely cleaned using liquids that normally splash against the walls shall be installed not less than [] above the floor.

- a) 250 mm b) 300 mm c) 500 mm d) 600 mm

Question 2

Bare or insulated conductors not enclosed in grounded metal shall be used in electrical equipment rooms accessible only to authorized persons.

- a) True b) False

Question 3

All receptacles of CSA configuration 5-15R and 5-20R installed in childcare facility shall be tamper-resistant receptacles, unless rendered inaccessible behind a stationary appliance.

- a) True b) False

Answers: EBMag August 2014

Q-1: For a retail store, the minimum ampacity for service or feeder conductors shall be based on a basic load of [] W/m² of the area of the building plus other special lighting loads, equipment loads, heating and air conditioning loads.

- c) 30 W/m². Ref. Rule 8-210, Table 14.

Q-2: For wind turbines forming a small wind system connected to single dwellings, turbine output circuits shall be permitted to have a maximum nominal voltage up to:

- d) 600V. Ref. Rule 64-302.

Q-3: Unless the ground fault circuit interrupter is an integral part of an approved factory-built hydromassage bathtub, or located behind a barrier, it shall be installed not closer than:

- c) 1.5 m. Ref. Rule 68-068.

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