



Safety Measures ^{ELECTRICAL}

“Elimination is the first priority!
Ensure a risk assessment is completed before energized work tasks are completed.”

The Invisible Injury & Sequela Effects Of Electrical Shock Hazard Exposure

By Terry Becker, P.Eng., CEM, IEEE Senior Member

When a worker is exposed to the electric shock hazard there are two possible outcomes. A shock is received, and the worker survives or they die. This is the second article I have written with respect to the “invisible injury” electrical shock and the potential long-term effects, sequelae. The first article was published in the 2020 May/June Edition of the Electrical Line Magazine, Electrical Safety Measures, “Surviving Long-Term Sequelae Effects of Electrical Shock Hazard Exposure. I am including some of the information again in this article for information and emphasis.

Sequela: “A sequela is a pathological condition resulting from a disease, injury, therapy, or other trauma. Typically, a sequela is a chronic condition that is a complication which follows a more acute condition. It is different from, but is a consequence of, the first condition.” Wikipedia.

If you are a Journeyman Electrician reading this article you may have long term sequelae from been shocked multiple times throughout your career, at 120VAC, 208VAC, 240VAC, 347VAC, 480VAC, 600VAC and high voltages >751V. If you have some of the symptoms I list in this article you may want

to follow up with your family physician. The potential long-term sequelae from receiving multiple low voltage electric shocks may be psychological, neurologic or physical symptoms.

Listed below are some potential long term effects of receiving multiple low voltage shocks:

Psychological Symptoms:

Behaviour changes and attention span issues. You may be irritable, get frustrated, experience anger and may be physically aggressive. You may experience depression and post-traumatic stress disorder depending on whether you experienced “no-let-go” or became unconscious due to the shock exposure. Other sequelae may be: insomnia, anxiety, fear of electricity, panic attacks, guilt, and moodiness.

Neurological Symptoms:

Memory loss, numbness, headaches/migranes, chronic pain, poor concentration, carpal tunnel, seizure disorders, dizziness, tinnitus, and tremor.

Physical Symptoms:

Generalized pain, fatigue/cannot sleep, exhaustion, reduced range of motion, contracture, night sweats, fever, chills or joint stiffness.

Based on research completed the effects listed will change or may be more severe dependent on the shock resulting from no-let-go, was the shock momentary contact, the path the current

flowed through the body, duration and amount of current. The information above has been and is being studied in two hospitals, by scientists and medical experts. In Canada the St Johns Rehab Electrical Injury Program – <https://bit.ly/3qjp4nl> and in the USA, the University of Chicago, Chicago Electrical Trauma Rehabilitation Institute (CETRI) – <https://bit.ly/3zJilYg>.

St John’s Rehab, Ross Tiley Burn Centre, Electrical Injury Program

I found out about the St John’s Rehab Electrical Injury Program over a decade ago and I am remis in saying I regret I did not spend more time then promoting their existence and sequela related to shock. Dr. Marc Jeschke, MD, Phd FACS, FRCSC, Senior Scientist has taken over the program from Dr. Joel S. Fish, MD, MSc, FRCSC, Surgeon - Investigator.

On May 29, 2021 the Electrical Contractors Association of Alberta (ECAA) held their Annual Training Day & AGM, the keynote speaker was Dr. Marc Jeschke, his presentation was titled “Electrical Injuries: Underappreciated But Highly Impactful.”

Dr. Jeschke provided a presentation that briefly reviewed the history of electricity acknowledging initially before the invention of electricity there was electrical fatalities related to lightning strikes. After electricity was invented Dr. Jeschke quoted the first electrical fatality occurred in 1879.

Since that time there has been no detailed research into the electric shock injury until recently. Burn injuries were managed first, but more for the immediate acute trauma with no

knowledge of the potential sequela related to the electric shock exposure at low voltages and high voltages.

In his presentation Dr. Jeschke pointed to Ohm's Law, $V=IR$ and its direct relationship to acute immediate effects of electric shock and sequela. What we didn't know was how the sequela occurred and what the sequelae may be. Research completed by St John's Rehab and the University of Chicago CETRI is that electric current passing through the human body causes invisible injuries. He commented that the latest research related to "channelopathy" and "electroporation" provides evidence on how sequelae related to low voltage electrical shock can occur and can proliferate over time with the multiple potential effects listed above in this article. Human cell membranes are damaged and over time the cell damage can exasperate, resulting in cell death, he quoted it as "neurodegeneration." I may be misquoting some of this, but the research completed supports the findings Dr. Jeschke presented.

Based on the current research by Dr. Jeschke and the historical research of Dr. Fish, and additional research at the University of Chicago, Dr. Raphael Lee the invisible electrical injury is real and needs more attention in society, in the medical field and with Government Worker's Compensation Board's.

Dr. Jeschke ended his presentation at the ECAA AGM & Training commenting that "we" should establish a Canadian Electrical Injury Network (CEIN). I sponsor this idea and hope that I can support it becoming a reality.

Worker's Compensation Boards

It is critically important that electric shocks in the workplace STOP! The immediate effect can be fatal at low voltages. It is unbelievably important that if you are an electrical worker and receive a shock that you report it to your employer, that you seek medical treatment and that a WCB reporting form is completed and submitted.

If there is no WCB report you will not receive insurance. Plain and simple. Unfortunately, this will be the case with tens of thousands of electrical workers in Canada today who received electric shocks in the workplace in their careers.

John Knoll's Story Part 2:

John Knoll is a Master Electrician, and a Professional Electrical Contractor (PEC) with the Electrical Contractors Association of Alberta (ECAA) and resides in Edmonton, Alberta. Unfortunately, John is currently not working in the trade and is suffering from sequelae related to receiving multiple low voltage shocks while at work starting as an Apprentice and while he was a Journeyman Electrician. In the 2020 May/June Edition of the Electrical Line Magazine, Electrical Safety Measures, "Surviving Long-Term Sequelae Effects of Electrical Shock Hazard Exposure, I provided detailed over of John's story.

The problem John has encountered is not having reported the multiple electric shocks he received to the Alberta WCB. Since the first article I wrote over a year ago John continued to follow up with a WCB claim related to a 347V shock he received and witnesses confirming that John had received additional multiple low voltage shock. Do date his claim is still outstanding. This has not been easy on John both emotionally and financially. John's sequelae related to the multiple low voltage shock received in the workplace have not and will not go away.

John did continue with his personal journey and research into electric shock hazard and sequelae and it is because of John's efforts that Dr. Jeschke presented at the ECAA AGM & Training Day. John found out about the University of Chicago, Chicago Electrical Trauma Rehabilitation Institute (CETRI) and brought its existence to my attention and in turn I am now sharing John's research and information with my network.

I believe John's story is not an isolated case. I believe there are tens of thousands of Journeyman Electrician's in Canada, the USA, and Internationally that have long term sequelae and have not correlated them to receiving multiple low voltage shocks throughout their career. The personal mental and physical health issues, impact on family and the potential impact on continuing in the trade and potential financial impacts are significant. If you are a worker that performs energized electrical work and are experiencing symptoms listed in this article, they are most likely attributed to you receiving multiple low voltage electric shocks while working.

A big shout out and thank you to John Knoll for telling me his story, his drive, entrepreneurial spirit, his candor and sharing his emotions.

References:

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- [3] American Electrician's Handbook, Tyrell Croft Consulting Engineers. Clifford C. Carr, E.E., P.E., Fifth Edition, McGraw-Hill Book Company, Inc., 1942. "Measuring, Testing and Instruments, 158. Electricians often test circuits for the presence of voltage by touching the conductors with the fingers. 159. The presence of low voltages can be determined with tasting."
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- [5] St Johns Rehab Centre, Ross Tiley Burn Centre, Electrical Injury Program.
- [6] University of Chicago, Chicago Electrical Trauma Rehabilitation Institute (CETRI)



Terry Becker, PEng, CESC, IEEE Senior Member is the first past Vice-Chair of the CSA Z462 Workplace electrical safety Standard Technical Committee and currently a Voting Member and Working Group Leader for Clause 4.1 and the Annexes. Terry is also a Voting Member on the CSA Z463 Maintenance of electrical

systems Standard and a Voting Member of the IEEE 1584 Guide for Performing Arc-Flash Hazard Calculations. Terry has presented at Conferences and Workshops on electrical safety in Canada, the USA, India and Australia. Terry is a Professional Engineer in the Provinces of BC, AB, SK, MN and ON. Terry is an Electrical Safety Specialist, Management Consultant, and can be reached at 587.433.3777 or by email terry.becker@twbesc.ca.