ELECTRICAL SAFETY FOR THE ELECTRICAL WORKER

RWIP Final Report

October 2021

Abstract

Final report on the development of the Research and Workplace Innovation Program (RWIP) sponsored electrical training program to help satisfy the educational and training requirements of Manitoba's electrical workers and their representative industries.

ELECTRICAL ASSOCIATION OF MANITOBA

Strength in Connection

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PROJECT TITLE

Electrical Safety for the Electrical Worker

EXECUTIVE SUMMARY

Thank you to the Workers Compensation Board of Manitoba, Research and Workplace Innovation Program (RWIP), for making it possible for the Electrical Association of Manitoba (EAM) to develop five (5) electrical courses that would fill the needs of the Manitoba Electrical Industry.

The contents of each course are in compliance with current:

- Provincial and Federal legislation, including the Criminal Code of Canada.
- City of Winnipeg electrical by-laws.
- Canadian workplace safety standards including the:
    - Canadian Standards Association (CSA):
        - Canadian Electrical Code Part I, Safety Standard for Electrical Installations.
        - Z460 - Control of hazardous energy — Lockout and other methods.
        - Z462 – Workplace Electrical Safety.
        - Z463 – Maintenance of Electrical Systems.
    - Other relevant standards including Canadian Electrical Code part II & III, IEEE, ASTM, etc.
- Industry best practices.
- Safe Work Manitoba Guidelines.

Each course can be delivered within a regular 8-hour workday in a classroom setting and will be made available by the Worker's Compensation Board of Manitoba for delivery by qualified electrical trainers.

The courses include:

1. OHS Electrical Legislation.
2. PPE for the Electrical Worker.
3. The Electrical Supervisor.
4. Grounding and Bonding.
5. De/Re-energizing after renovations.

Attendees must successfully complete a course quiz to receive a certificate of completion which is valid for a period of three years.

ABOUT THE ELECTRICAL ASSOCIATION OF MANITOBA

With over 800 members, the Electrical Association of Manitoba (EAM) is the industry association that represents all sectors of the electrical industry within Manitoba, including contractors, manufacturers, distributors, manufacturer agents, educational institutions, low voltage industry, etc.

EAM is a non-profit organization providing a variety of services, such as up-to-date industry information, representation to government, industry-leading educational and training programs, and offers great networking opportunities to aid member organizations and their employees to stay current with industry requirements and trends.

The EAM is affiliated with the Canadian Electrical Contractors Association (CECA), providing Manitoba contractors with a direct link to the national body. CECA is a federation of provincial and territorial electrical contractor groups that represents electrical contractors at the national level. It represents the interests of 8000 electrical contractors across Canada who generate over $5 billion in revenues and who directly employ 70,000 people.[1]

Through this affiliation, the Electrical Association of Manitoba members and prospective members will be able to access a wider array of information, programs, and services. The association will also be able to appoint a representative to CECA's National Board.[1]

BACKGROUND

Electricity poses credible risk for safety and health-related loss for all stakeholders, and most importantly, for workers. Electrical workers may be exposed to electrical hazards daily during their regular routines. The potential for shock, electrocution, arc flash and arc blast injuries can be mitigated by proper workplace processes and procedures and developing qualified electrical workers through on-going training and education. Having the training and awareness to know how to avoid electrical hazards to the worker as well as personnel in proximity to electrical hazards is essential to reducing incidents and changing the safety culture within the electrical community.

In Manitoba, electrical workers currently do not have wide access to health and safety training & educational support specific to their trade and industry. They need to go out of province to facilitate these needs, deeming the training very costly, if not unaffordable.

Table 1 shows the nature and number of Workers Compensation Board (WCB) injury claims in the electrical industry in 2015-2016. While none of these incidents resulted in fatalities, each one had the potential to do so had the situation been slightly different.

Table 1 - Electrocution Claims by Nature of Injury			
	Claims		
Injury Nature	2015	2016 YTD	2015-2016 YTD
Electrical burns, n.e.c.		1	1
Electrical burns, ins.	1	5	6
Electrocutions, electric shocks	16	7	23
Second-degree electrical burns	3	1	4
Third-degree electrical burns	1		1
Grand Total	**21**	**14**	**35**

As of 2017 there were 603 companies in the WCB rate codes and approximately 8,300 licensed electricians registered with the Province of Manitoba, office of the fire commissioner. Electrical contractors in Manitoba fall into WCB rate codes where safety resourcing and support is provided by the Construction Safety Association of Manitoba (CSAM).

CSAM was established to assist a broad spectrum of construction contractors and thus does not currently have the capacity to facilitate specific industry-required training or resources for electrical workers. While the EAM is recognized as being the best suited to champion the development of the proposed course material, CSAM offered their support of the program and contributed to the project's success through membership on the RWIP Project Advisory Committee (PAC).

The EAM Safety Committee consulted industry leaders to identify gaps in worker knowledge and training opportunities. The consultations along with recent industry injury statistics identified the training and education gaps for various industry sectors ranging from work in lower-risk residential applications to higher-risk industrial.

To provide the ability to reach clients throughout the Province of Manitoba, it was agreed that the proposed training could be delivered in-class face-to-face or online using video conferencing, or a combination of both.

It was imperative that the courses reference current Canadian legislation, safety standards, codes and guidelines, industry best practices, and manufacturers' recommendations. Its also important that the training packages are reviewed on a regular basis to ensure compliance with current legislation and industry standards.

The proposed training packages were presented, and letters of support were received from a cross-section of organizations representing electrical workers in Manitoba.

Table 2 - Letters of support were received from the following in 2017	
Title	**Organization**
Executive Director	Electrical Association of Manitoba Inc.
Director Maintenance and Security	University of St. Boniface
Health and Safety Specialist	University of Winnipeg
Chair of Electrical, Math, and Science	Red River College
Executive Director	Made Safe
Executive Director	Construction Safety Association of Manitoba
District Occupational Safety & Risk Coordinator	Manitoba Infrastructure and Transportation
President	Merit Contractors
Director of Facilities and Safety	Assiniboine Community College
Education and Training Coordinator	International Brotherhood of Electrical Workers (IBEW) Local Union 2085

COURSE DEVELOPMENT

EAM began the development of five (5) one-day electrical workplace safety training workshop courses in June 2018 with the goal of reducing the frequency and severity of electrical incidents and injuries within the electrical industry. A project timeline was established and following the development of a Project Advisory Committee (PAC) terms of reference, a PAC was convened consisting of safety and health practitioners and regulators representing a cross-section of provincial electrical industries and workplaces.

The PAC met physically through the first half of the project then, due to covid-19 restrictions, by video conference to review the progress of the courses, provide feedback and direction, and to define the approved training provider for the courses.

The PAC role was to:

- Establish timelines and a project plan for the development of the deliverables,
- Review, assess, advise, and evaluate the training courses at stated milestones,
- Decide on the format of the pilot for the courses that will best meet the needs of the association/industry,
- Determine the evaluation process and knowledge transfer plan.

Subject matter experts were contracted to develop the courses based on pre-defined criteria and within the established timelines while under the scrutiny of the PAC. Based on feedback, all required revisions were completed and the courses received tentative approval by the PAC contingent upon focus group feedback.

Workshops 1, 2, & 3 were then evaluated in-class to focus groups of impartial students who provided feedback of the content, presentation, and value. Due to the covid-19 restrictions imposed in 2020 and continuing into 2021, workshops 3 & 4 have not been presented to a focus group for their feedback prior to the project completion date March 31, 2021.

The evaluated workshops received overall positive feedback and only minor adjustments were necessary to prepare them for future presentations.

A course description and a lesson plan were developed to assist the approved training provider in delivering the course. A multi-choice quiz was written to evaluate the learner's comprehension. Course videos received approval for use from the video rights holder(s).

TARGET AUDIENCE

- Electrical workers representing all Federally and Provincially regulated workplaces in the construction, manufacturing, and institutional sectors.
- Union and non-union electrical workers.
- Supervisors and other workplace leaders responsible for directing the work of:
    - electrical workers, and/or

    - non-electrical workers/personnel/visitors who may be in proximity to workplace electrical hazards.
- Workplace Safety and Health professionals/consultants.
- Workplace Safety and Health Committee members and representatives.
- OHS Students in colleges and universities.
- CRSP and CHSC candidates.

PROJECT DESCRIPTION

The courses reference current Canadian legislation, safety standards and codes, industry best practices, and manufacturers' recommendations. The target audiences include electrical workers, their supervisors and management, OH&S students, and workplace safety and health representatives.

All workshops are designed to be delivered by an approved training provider (facilitator) in a classroom setting and take 8 hours to complete while allowing for regular breaks. Students are kept engaged through class discussion, workshop exercises, videos, and quizzes. Students receive a workbook they can use for in-class notes and to take away for future reference.

Learning goals are evaluated using a multi-choice quiz to assess the students' comprehension of the instruction. A pass mark of 80% has been assigned to the quizzes. Certificates are awarded upon successful completion.

1. Electrical Legislation

This course will provide a review of Part 38 (Electrical Safety), Part 25 (Work in the Vicinity of Overhead Electrical Lines), and other applicable parts of the Manitoba Workplace Safety and Health Regulation. The course also will include review of Part 8 (Electrical Safety) of the Canadian Federal Occupational Health and Safety Regulations, as well as the Canadian Standards Association (CSA) Z460 (Control of Hazardous Energy) and Z462 (Workplace Electrical Safety) standards, as applicable.

Students are provided with a loaner copy of the consolidated Manitoba Workplace Safety and Health Act and regulations to be used in-class to find information and become familiar with its contents.

2. Personal Protective Equipment (PPE) for the Electrical Worker

This course will cover the selection, use, and care and limitations of basic and specialized arc-rated and shock-rated clothing, as well as electrical specific dielectric tools and equipment. Participants will learn how to select the appropriate clothing, tools and equipment for their job task. The course will cover pre-use inspections, regular testing requirements and practical use of clothing, tools and equipment.

The presentation relies on the use of sample PPE providing students the opportunity to experience up-close some of those discussed in the PowerPoint. The sample protective gloves are used to provide a hands-on demonstration of the pre-use inspection required by Canadian safety standards.

3. The Electrical Supervisor

This course will cover the knowledge needed to be an effective supervisor of those working with and around electricity. The material will differ from the courses developed for workers in that it will include all aspects of a required supervisor course, while also including the specific requirements an electrical supervisor must be aware of and maintain, including:

- Legislative requirements, including the Manitoba Workplace Safety and Health Act and Regulations, the Criminal Code of Canada
- Review of CSA Z460 (Control of Hazardous Energy), Z462 (Workplace Electrical Safety), Z463 (Electrical Systems Maintenance)
- Lockout/tagout
- Energized electrical work permits
- Electrical specific hazard identification and risk assessment tools
- Working with live power, including temporary power
- Pre-job safety planning and documentation
- Rights, roles and responsibilities of supervisors and employees
- Internal Responsibility System (IRS)
- Documentation, due diligence, compliance, and planning

- Hazard recognition and control/risk assessment
- Inspections, Incident/causation, and investigation
- Problem solving (Plan-Do-Check-Act, or PDCA, cycle)
- Principles of continual improvement

4. Grounding and Bonding

The instructor will cover the proper selection and installation of temporary protective grounding as required and explain principles of grounding, bonding, including equipotential bonding to protect people, equipment, and buildings. Course objectives include:

- Advise on Provincial and Federal Occupational health and safety acts and regulations
- Identify Industry Publications, Electrical code standards, Industry best practices & Manufacturers Recommendations
- Examine Effects of Current Flow on the Human Body
- Cover an Incident on Equipotential Bonding and Grounding (EBG)
- Review Canadian Electrical Code Part I sections related to grounding and bonding
- Identify other Parts of the Canadian Electrical Code related to grounding and Bonding
- Inform on maintenance, inspections, hazard identification and training

The various codes and legislative requirements are pulled together to inform the student of the requirements and how to find them. Information related to maintenance and inspections of temporary protective grounding, hazard identification and training is provided.

A real-life temporary protective grounding incident is presented followed with a discussion on what went wrong and the recommended solutions.

5. De/Re-Energizing New/Renovated Construction

This course provides an understanding the complexities of shutdown, safety practices, commissioning plans and the required documentation.

Topics include the risks of shutdown and the importance of effective shutdown maintenance, the required PPE throughout the project, temporary protective grounding and bonding, and the steps to re-energize renovated or newly constructed electrical equipment and systems. The role and required participants of the shutdown team and the commissioning team is discussed and the importance of documentation is emphasized.

This course will include a review of CSA Z460 (Control of Hazardous Energy), Z462 (Workplace Electrical Safety), as well as the applicable sections of Part 38 (Electrical Safety) of the Manitoba Workplace Safety and Health Regulation. Participants will learn:

- Systematic procedures of de-energizing and re-energizing electrical systems
- Grounding of electrical systems when de-energizing
- PPE requirements, including tools and equipment
- Pre-/post-testing of circuits while de-/re-energizing buildings
- Proper isolation of circuits during both processes

THE ELECTRICAL TRAINING PROVIDER STANDARD

Although not within the original scope of the RWIP project the PAC considered it prudent to define the minimum qualifications and attributes for the facilitation of the electrical training packages.

Although the training packages were developed by qualified and competent individuals working within the framework outlined by the PAC, reviewed by peers, and with input from students, future presentations would not receive the same scrutiny. Therefore, to ensure consistency in the quality of future course delivery by individuals who were not involved in the project, a PAC sub-committee was established to develop the Electrical Training Provider Standard. The sub-committee met independently and provided draft proposals for review and feedback from the PAC at large.

The purpose of the Electrical Training Provider Standard is to establish the minimum requirements for quality and consistency in the delivery of the training packages. The standard is applicable to all individuals, corporations, associations, and organizations that intend on facilitating one or more of the training packages developed under this RWIP project.

Having an Electrical Training Provider Standard will help to:

- ensure that workers exposed to the potential hazards associated with energized electrical work receive high quality and consistent training;
- strengthen workplace safety culture by elevating the profile and importance of preventing electrical incidents; and
- reduce the number of electrical incidents, injuries, and fatalities.

The Electrical Training Provider Standard provides direction on:

1. Instructor/facilitator qualifications, education, and competencies,
2. Recommended insurance coverage for instructors providing the training,
3. Training record retention,
4. Class evaluation expectations,
5. Extent of the personal information required from the student (i.e., email, address, etc.),

It's recommended that whenever practical while facilitating a dedicated class, supplemental information is included regarding workplace-specific: policies and procedures, hazards, and equipment.

LOOKING AHEAD

The Electrical Association of Manitoba has committed to updating the workshops when necessary due to changes in legislation, codes, and standards and offering the material to any industries/organizations/facilities interested in providing the training themselves, through a reputable training provider. The workshops will be scheduled for regular review on a 24-month schedule.

Other recommendations to be presented to the EAM board will consist of the establishment of a committee to oversee the managing of the course material and the frequency of review. The review should coincide with the release of new editions to CSA CE 22.1-21 The Canadian Electrical Code Part I and CSA Z462-21 Workplace Electrical Safety. The committee will also be required to review the legislation and other standards that were referenced in the presentation.

It's also recommended the courses may be delivered through video conferencing during times of a pandemic or to remote/isolated communities.

APPROVED BUDGET

See Table 3 for the Electrical Safety for the Electrical Worker project budget requests submitted for approval.

Table 3 – EAM RWIP Approved Budget

		Year 1	Year 2	Total	
	Budget Item	**WCB $ Request**	**WCB $ Request**	**WCB $ Request**	**Justification of Funds**
1	Salaries, Benefits, Consultancy fees.	Project Manager/Consultant - $18,000 Electrical expert - $46,000 Accounting costs - $5,000	Project Manager/Consultant - $18,000 Electrical expert - $46,000 Accounting costs - $5,000	$122,000	Project Manager for duration of RWIP. Consultant for course development. Accountant to track and measure all funding.
	Subtotal	*$69,000*	*$53,000*	*$122,000*	
2	Material and supplies	$5,200	$5,000	$10,200	Printing, mailouts, faxes, publications, dielectric tool samples, arc flash PPE.
	Subtotal	*$5,200*	*$5,000*	*$10,200*	
3	Equipment (purchase, rental, lease)	$3,600	N/A	$3,600	Laptop, printer/fax machine, projector use donated in-kind by EAM.
	Subtotal	*$3,600*	*N/A*	*$3,600*	
4	Knowledge Transfer	$8,000	$10,000	$18,000	PAC member recruitment, PAC meetings, networking functions, marketing brochures, printing, conference fees,

					web promotions, email blasts.
	Subtotal	*$8,000*	*$10,000*	*$18,000*	
5	Travel, Accommodations, Meals.	$3,600	$6,500	$10,100	Travel to Brandon, Dauphin, Steinbach and other rural locations as required.
	Subtotal	*$3,600*	*$6,500*	*$10,100*	
6	Other costs	$500	$500	$1000	Recognition for PAC member participation and assistance with program development.
	Subtotal	*$500*	*$500*	*$1,000*	
	Total WCB Funding Request	**$89,900**	**$75,000**	**$164,900**	

NOTES:

[1]*Electrical Industry News Week. Electrical Association of Manitoba Joins CECA.* *https://electricalindustry.ca/changing-scenes/1689-electrical-association-of-manitoba-joins-ceca*