

**ESAO 8th Annual  
Conference**

# **Controlling Electrical Hazards**

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# **Objective**

**To gain greater clarity on protecting workers from electrical hazards.**

# **Electrical & Utility Safety Association of Ontario**

## **Our History**

**Founded in 1915, E&USA is the oldest of the province's health and safety associations, serving clients in WSIB rate groups 833 (generation); 835 (oil, power and water distribution); 830 (power, line clearing and telecommunications lines contracting); and 983 (communications industries). The head office is located in Mississauga, Ontario.**

**Working to achieve the collective goal of zero injuries by 2012**

# Electrical Safety Overview

Electrical safety in the workplace is particularly important due to its catastrophic results when its energy becomes no “longer in control”.

- Many workers become victims to electricity.
- We need to protect workers from something they cannot see, hear or smell.
- Humans are not designed to allow toxic energy to contact our bodies.

# Statistics Ontario Ministry of Labour

<i>Year</i>	<i>Fatalities</i>	<i>Critical</i>	<i>Non Critical</i>	<i>Powerline Contacts</i>	<i>Electrical Equipment</i>	<i>Total</i>
2006	8	18	112	201	1	340
2005	7	16	97	196	2	318
2004	7	21	84	151	1	264
2003	8	25	82	148	4	267
2002	8	28	84	132	2	248
2001	9	34	86	120	5	254
2000	7	30	73	122	5	237
1999	8	34	83	115	2	242
1998	9	34	52	108	4	207
<b>Totals</b>	<b>65</b>	<b>240</b>	<b>753</b>	<b>1293</b>	<b>26</b>	<b>2377</b>

# Statistics Ontario Ministry of Labour

<i>Category</i>	<i>Meters</i>	<i>Equipment being worked on Live</i>	<i>Proximity to live Equipment</i>	<i>Faulty Equipment</i>
Fatals:				
2006	0	1	5	2
2005	0	4	2	1
2004	0	5	2	0
2003	0	3	4	1
2002	0	2	0	0
2001	0	4	4	1
2000	0	3	3	1
1999	0	1	7	0
1998	0	4	4	1
<b>Totals</b>	<b>0</b>	<b>27</b>	<b>31</b>	<b>7</b>

# Statistics Ontario Ministry of Labour

<i>Category</i>	<i>Meters</i>	<i>Equipment being worked on Live</i>	<i>Proximity to live Equipment</i>	<i>Faulty Equipment</i>
Criticals:				
<b>2006</b>	<b>1</b>	<b>11</b>	<b>2</b>	<b>4</b>
<b>2005</b>	<b>0</b>	<b>13</b>	<b>0</b>	<b>3</b>
<b>2004</b>	<b>2</b>	<b>7</b>	<b>8</b>	<b>4</b>
<b>2003</b>	<b>2</b>	<b>11</b>	<b>8</b>	<b>4</b>
<b>2002</b>	<b>0</b>	<b>17</b>	<b>9</b>	<b>2</b>
<b>2001</b>	<b>3</b>	<b>14</b>	<b>9</b>	<b>8</b>
<b>2000</b>	<b>0</b>	<b>20</b>	<b>6</b>	<b>4</b>
<b>1999</b>	<b>1</b>	<b>19</b>	<b>12</b>	<b>2</b>
<b>1998</b>	<b>4</b>	<b>19</b>	<b>10</b>	<b>1</b>
<b><i>Totals</i></b>	<b><i>13</i></b>	<b><i>131</i></b>	<b><i>64</i></b>	<b><i>32</i></b>

# Working Live

- 50% of incidents causing injuries to workers were incidents in which one of the workers was working directly on the energized equipment.

*Prime examples are:*

- working on 347V lighting;
- installing/replacing breakers in a panel;
- installing/working on wiring in or into a panel or MCC;

# Electrical Events

**Contact with electrical energy is still the number one killer!**

**However Arc Flash events are critically injuring and disabling a large percentage of Ontario workers.**

# Rules and Regulations

## Occupational Health and Safety Act.

- Places a general duty clause “ to protected their workers” from the hazards from which they are exposed!
- Industrial Regulations
- Construction Regulations

# Provincial Regulations

- Only allow work to be performed on and around electrical installations or equipment if it is not “practical” to be locked and tagged out.

Examples: Trouble-shooting using voltage tester.

OR

- Workers are using personal protective equipment, devices, following written measures and procedures adequate to protect them from electrical shock and burn.

# 750 Volts and Below

Occupational Health and Safety Act defines “Safe Limits of Approach” for 750 volts and above.

Where do we go for 750 volts and below?

# Electrical Shock and Burn

Protect how?

Electrical Shock

Electrical Burn

# *Safety Basics*

1

Identify

2

Eliminate

3

Control

4

Protect

5

Minimize

# Electrical Hazard Identification

How do we identify something we can't see, hear or smell?

- Electrical contact
- Arc flash and blast

# Electrical Trades

- **Electrical worker training and “industry practice”**
- **Trades curriculum for provincial trades**
- **Many electrical work methods and trades procedures have been developed based on “contact hazards”**

# Electrical Contact Injuries

**Very small amounts of current can cause worker injury including death from electrical contact.**

# Introduction of Current to the Body

- **Touching an energized piece of equipment.**
- **Defective equipment, measurement equipment failures, disconnect or switch failures, defective or improper rubber gloves**
- **Working closely to energized equipment, without adequate barriers or devices to prevent contact.**
- **Substandard work methods or human error.**

# Contact Hazards

Electrical contact is identified through system design and knowledge of the operating systems.

**There are:**

- Operating voltages to reference a standard to find protective equipment to meet the quantified hazard.
- Defined distances for “ limits of approach” for all workers.
- Reference charts for voltage levels to the correct classification of rubber protective device.

# Rubber Protective Equipment

## Protecting workers from contact hazards

- Rubber gloves and rubber protective equipment is easily referenced to voltage.
- Training on their use and inspection is available through manufacturers and training agencies.
- Work procedures and practices have been based on contact hazard assessments.

# Rubber Gloves

	Maximum Voltage use phase to phase	Test Voltage
<b>Class 00</b>	<b>500 Volts</b>	<b>1000 volts</b>
<b>Class 0</b>	<b>1,000 volts</b>	<b>5000 volts</b>
<b>Class 1</b>	<b>7,500 volts</b>	<b>10,000 volts</b>
<b>Class 2</b>	<b>17,000 volts</b>	<b>20,000 volts</b>
<b>Class 3</b>	<b>26,500 volts</b>	<b>30,000 volts</b>
<b>Class 4</b>	<b>36,000 volts</b>	<b>40,000 volts</b>

# Contact Hazards

Workers that work on and in proximity to energized electrical equipment need.

- Absolute work methods
- Continuous education or proficiency
- Evaluation of practices and procedures through effective risk management

vs.  
Luck?

# **Electrical Arc Flash/Blast Injuries**

**Electrical Arc Flash/Blasts also cause severe worker injury including death from thermal energy, concussion waves, heat and debris contacting the worker.**

# Identifying Arc Flash/Blast Hazards

- **We have known about Arc Flash and Blast hazards for many years.**
- **Our ability to quantify the hazard in the industry has been fairly new.**

# Arc Flash or Blast to the Body

- Inadvertent electrical contact
- Faulty piece of equipment, switch gear, fault equipment with in switch units (door props), over current faults, lack of maintenance to breakers or protective devices.
- Loss of control of a tool, piece of equipment, device
- Inadequate risk analysis on system to identify hazard class rating for PPE.
- Substandard work practices or human error.

# ARC Flash Interest

## Temperature

Skin temperature for curable burn → 176 F

Skin temperature causing cell death → 205 F

Ignition of clothing → 752 F – 1,472 F

Metal droplets from arcing → 1,832 F

Surface of the sun → 9,000 F

Arc terminals → 35,000 F

# Flash Hazard Analysis

A study investigating a worker's potential exposure to ARC-Flash energy, conducted for the purpose of injury prevention and the determination of safe work practices and the appropriate levels of PPE.

# Arc Flash and Blast Hazards

- Thermal energy
- Molten metal
- UV light
- Extreme noise
- Toxic hazardous gas from flash and blast
- Concussion force
- Skin surface and inhalation concerns

# ARC Flash in a Box



(ARC in a box from a metal clad switchgear)

- The ARC in the box generates blast toward the worker compared to dissipating in open air.
- Industrial electrical ARC flash/blasts are very different from open air ARC blasts.
- Complete understanding of the operating system is critical to effective control of ARC blast hazards.

# *ARC Flash Open Air*



(Worker at the end of a live line tool)

- Open air ARC flash/blast compared to industrial environments.
- Rubber glove techniques changes the outcomes of ARC flash/blast potentials.

# Arc Flash/Blast

What is the issue?

Technological changes

Development of Canadian Standard

Education and awareness gaps

# Regulations vs. Standards

Regulations and rules are performance based leaving the electrical industry to fend for itself.

“Confusion!”

Canada is in the process of developing a national standard for electrical safety in the workplace. Its proposed date of completion is 2008.

# **CSA Z 462 Workplace Electrical Safety**

**Develop and implement a national safety standard for electrical safety**

- **Proposed completion date 2008**
- **Chapter 1 Safety Related Work Practices**
- **Chapter 2 Safety Related Maintenance Requirements**
- **Chapter 3 Safety Requirements for Special Equipment**
- **Annexes**

# **CSA Z 462 Workplace Electrical Safety**

**CSA Z 462 Workplace Electrical Safety will provide a tool for performing electrical work safely.**

# Cotton vs. Arc Flash Garments



# Challenges

- Change** → is driven from rules and regulations versus education on hazards
- Pressures** → from doing more with less for both resources and people

# Challenges

**Pressures**



from engrained cultures  
from all industries

**Change**



pressures from societal  
influences and people in  
general resistant to change

# Keeping Your Employees Safe

## Electrical Safety Programs

- Education and awareness
- Sharing resources for safety
- Leadership that fosters safer working cultures
- Commitment from all parties involved
- Continual improvement to eliminate workplace injuries
- The only goal should be “zero”

**Our electrical industry does not need  
another worker or family member  
traveling around to our workplaces  
speaking on workplace safety.**

THANK YOU