

2011 PCIC Annual Conference Safety Subcommittee Meeting

Tuesday, September 20, 2011
Grand East
3:30 pm – 5:15 pm

Agenda

- Welcome
- Safety Subcommittee Officers
- Safety Subcommittee Membership Update
- PCIC Safety Excellence Award
- Reference Websites
- 2010 Subcommittee Meeting Minutes
- Outstanding Technical Contribution Award
- IEEE IAS Electrical Safety Workshop
- 2011 Safety SC Papers
- 2012 Safety SC Paper Proposals
- Special Presentation – Study of OSHA Arc Flash Injury Reports 2011 Safety SC Paper Presentations – Craig Wellman
- Special Presentation – Prevention Through Design – Lanny Floyd
- Adjourn

Safety Subcommittee Officers

- Chair Paul Sullivan DuPont
- Vice-Chair Ed Larsen Square D/
Schneider Electric
- Secretary Ilan Balasubramanian Eaton

- We will be looking for a new Secretary after the 2012 Conference. Please let us know if you are interested.

Membership Update

- A copy of the Safety Subcommittee roster is being circulated.
- Please initial by your name, and check the block for willingness to do paper reviews.
- If you are not a member of the Safety Subcommittee, we invite you to become one. Please provide your name at the end of one of the rosters. All other info comes from the PCIC member database.
- If any changes during the year, update your information at the Update Member Information link on the PCIC website.

Electrical Safety Excellence Award

- The PCIC Electrical Safety Excellence Award is used to recognize individuals for

"outstanding dedication and contributions made to advance and accelerate the dispersion of information and knowledge impacting electrical safety through activities within and outside the Petroleum and Chemical Industry Committee".

Electrical Safety Excellence Award

- The past award recipients are:
 - 1999 H Landis Floyd II
 - 2000 L. Bruce McClung
 - 2001 Ray A. Jones
 - 2002 Satish Chaparala
 - 2003 Mary Capelli-Schellpfeffer
 - 2004 Danny Liggett
 - 2005 Bill Jordan
 - 2006 David Pace
 - 2008 Tom Neal
 - 2009 Shahid Jamil
 - 2010 Daryld Ray Crow

Electrical Safety Excellence Award

The 2011 recipient has been:

- Member of numerous electrical safety and maintenance committees including NFPA 70E, NFPA 70B, ASTM F18
- IEEE ESW Leadership 2006-2008, Technical Review Committee 2009 to present
- IEEE PCIC presentations regarding electrical safety and electrical maintenance
- Regular contributor to numerous electrical magazines with articles concerning electrical safety and maintenance topics

Electrical Safety Excellence Award

- The 2011 recipient for is:



James R. White
Congratulations!

Electrical Safety Excellence Award

- We are now accepting nominations for the 2012 Electrical Safety Excellence award.
- An email will be sent to all PCIC Safety Subcommittee members with the nomination information.
- A link to the form is available on the PCIC website under About PCIC-Awards.
- Nominations are due by October 31, 2011.

Reference Websites

- There are several websites that are available to provide you good electrical resource information.
- Those websites are at the end of this presentation.
- This presentation will be available at the PCIC Safety Subcommittee website after the conference.

Roster Check

- Where are the rosters?

2010 Safety Subcommittee Meeting Minutes

- The 2010 Safety Subcommittee meeting minutes were distributed by email to Safety Subcommittee members and posted on the Safety Sub-Committee page of the PCIC Website.

<http://www.ieee-pcic.org/subcommittees/safety.html>

- Any additions/corrections?
- Motion to approve?

PCIC Outstanding Technical Contribution (OTC) Award

- PCIC is accepting nominations for the 2012 OTC award and requests the Safety SC submit a nomination.
- An email will be sent to all PCIC Safety Subcommittee members with the nomination information.
- Nominations are due by October 31, 2011.

IEEE IAS Electrical Safety Workshop

- Danny Liggett will provide an update on Electrical Safety Workshop activities.



ESW Presentation -
Liggett

**Electrical Safety Workshop
Subcommittee Meeting**



Toronto PCIC - 2011

Safety Subcommittee Report

**Electrical Safety Workshop
Subcommittee Meeting**



Toronto PCIC - 2011

- **Subcommittee Officers**
 - Danny Liggett - Chair
 - David Pace - Vice-Chair
- **Current Roster - 47**

Electrical Safety Workshop Subcommittee Meeting



Toronto PCIC - 2011

Mission of the ESW Subcommittee

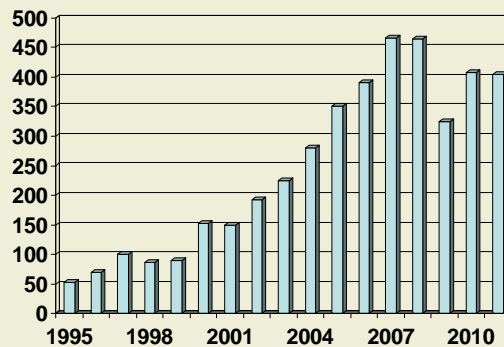
- To support and provide long-term planning for the IEEE IAS Electrical Safety Workshop that facilitates advancements in electrical safety.

Electrical Safety Workshop Subcommittee Meeting



Toronto PCIC - 2011

- History of the Workshop
 - Attendance



**Electrical Safety Workshop
Subcommittee Meeting**



Toronto PCIC - 2011

- **ESW 2011 - Toronto - Eva Clark (Chair)**
 - January 24-28, 2011
 - 404 in Attendance
 - 61 Exhibitors
 - 24 Presentations
 - 4 Tutorials

**Electrical Safety Workshop
Subcommittee Meeting**



Toronto PCIC - 2011

- **ESW 2012 - Daytona Beach - Dennis Neitzel (Chair)**
 - January 30- Feb 3, 2012
 - Daytona Beach Hilton
 - Twentieth Anniversary



**Electrical Safety Workshop
Subcommittee Meeting**



Toronto PCIC - 2011

- **ESW 2013 - Dan Doan (Chair)**
 - Dallas, TX
 - March 11-15, 2013
 - Hilton Anatole
 - Twentieth ESW

**Electrical Safety Workshop
Subcommittee Meeting**



Toronto PCIC - 2011

- **Future Workshops**
 - 2014 ESW - West Coast? (PCIC San Francisco)
 - 2015 ESW - Gulf Coast? (PCIC Houston)
 - 2016 ESW - East Coast? (PCIC Philadelphia)
 - Open to Suggestions for Cities

Roster Check

- Where are the rosters?

2011 Safety Subcommittee Technical Session Presentations

- "Arc-Flash Protection for Low- and Medium-Voltage Panels"
- "Arc Flash Calculations Using a Physics Based Circuit Model"
- "Controlling Electrical Hazards through Effective Risk Management"

2012 Safety Subcommittee Technical Session Proposals

- Safety Subcommittee will have 3 papers presented in 2012.
 - One carry-over from 2011
 - Two new papers
 - One new spare paper
- We will be voting to choose 3 papers today

2012 Safety Subcommittee Technical Session Proposals

- The following pages show the carry-over paper and new paper proposals for the Safety Subcommittee for the next PCIC Conference.
- Each person should have one ballot sheet.
- We will review each abstract and then allow you time to record your vote of interest for that each abstract.
- The Subcommittee officers will review the votes of interest and make the final decision regarding the papers for 2012.
- You MUST have your name and company listed on the review form or your vote will not count.

2012 Safety Subcommittee Technical Session Proposals

- Ignore the identification number on the paper in the following charts
- We are voting on 5 papers
 - Use numbers 1 to 5 on your voting sheet

2012 Papers – Carry-over

■ Beliefs Drive Behaviors

- Daryld Ray Crow – DRC Consulting, Ltd.
- Danny Liggett – DuPont

- Do not vote on this paper

2012 Papers – Proposals



SSC 2012 Abstracts

Roster Check

- Where are the rosters?

Special Presentation

- Presenter – Craig Wellman
- OSHA and Arc-Flash Injury Data Analysis



OSHA Injury Data -
Wellman

OSHA arc-flash injury data analysis

Craig Wellman
Retired from DuPont

Agenda

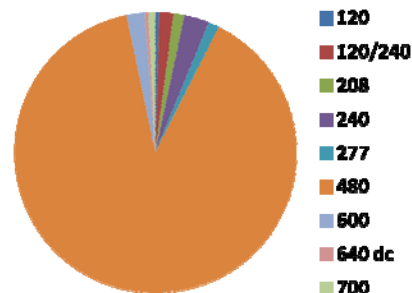
- The data source
- Voltages at which arc-flash injuries occur
- Types of injuries
- Causes
- Relate to 70E requirements
- What needs to change

The data source

- Occupational Health and Safety Administration, OSHA, part of the U.S.A. Dept. of Labor
- Date range – April 1984 to June 2007, 23 years
- Key words – "electric arc" and "burn."
- Investigations are by federal or state OSHA inspectors, not electrical specialists
- Many injuries are not in the OSHA database – it is just a sample of U.S. arc-flash injuries.

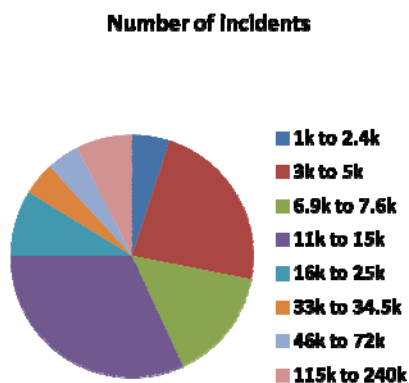
Low voltage incidents

Voltage	Number of incidents
120	1
120/240	4
208	3
240	7
277	3
480	216
600	5
640 dc	1
700	2
Unknown	87
Total	329



Medium and high voltage incidents

Voltage	Number of incidents
1k to 2.4k	8
3k to 5k	37
6.9k to 7.6k	24
11k to 15k	51
16k to 25k	14
33k to 34.5k	7
46k to 72k	7
115k to 240k	12
Unknown	43
Total	203



Numbers of injuries at low voltage

Voltage	Burns	Smoke inhalation	Shocks	Fatalities
120	1		1	
208	4		1	
240	7			
277	3			
480	278	18	5	32
600	5			1
640 dc	2			
700	5			
Unknown	105	1	5	4
Total	414	19	13	37

Number of burns at 240 V and less is 4% of 480 - 700 V burns

11% of 480 V injuries are fatalities.

Numbers of injuries at MV and HV

Voltage	Burns	Smoke inhalation	Shocks	Fatalities
<u>1k to 2.4k</u>	11			3
3k to 5k	67	1		10
6.9k to 7.6k	33	1	3	2
11k to 15k	67	2	10	8
16k to 25k	17	1		1
33k to <u>34.5k</u>	10	10		
46k to 72k	10	0		
115k to <u>240k</u>	13	5	2	4
Unknown	59	5	2	20
Total	287	25	17	48

120 Volt Arc-Flash Injury

A computer hardware technician was unplugging a multiple-receptacle power strip from a receptacle outlet located at the base of an office cubicle. The base of the cubicle had an electric raceway and 120-volt receptacle outlets installed in it. The raceway was covered by 4.5-inch-wide metal trim. As the employee was unplugging the power strip, the trim came loose and fell onto the blades of the attachment plug on the strip's power supply cord. The employee received an electric shock and burns to her hands. She was hospitalized for her injuries. The employer was aware that the trim would occasionally come loose, but provided no electrical safety-related work practices training.

70E 215 Premises wiring – Covers for wiring system components shall be in place with no unprotected openings. Raceways shall be maintained...

A high current 208 V injury

Construction contractors were installing new underground chilled-water lines. The new lines were run in an excavation and had to pass through a concrete wall. A subcontractor was hired to bore holes through the concrete wall. Two employees working for the subcontractor were to bore two 203-millimeter holes in the 472-millimeter-thick concrete wall. The excavation for the water lines was next to the wall. A concrete slab was located in the trench, and a transformer was nearby. They were using a coring machine to bore the holes. To position the coring machine, one of the employees used a jackhammer to break off part of the concrete slab in the excavation.

The jackhammer penetrated a 208-volt, three-phase underground cable embedded in the concrete and caused an electrical fault.

The ensuing electric arc burned the employee who was not using the jackhammer. He was hospitalized with first-, second-, and possibly third-degree burns on both arms up to his armpits, on his left knee and thigh, and on his left waist by his stomach. The employer had not conducted a prejob survey.

120/240 Volt Arc-Flash Injury

An employee was working for a contractor that was engaged in excavation and shoring. The employee was assigned to operate a 120/240-volt, 4800-watt electric generator used to provide power to stud-welding tools. At the start of his shift, while the generator was running, he connected the supply conductors for a tool to the generator's terminals while they were energized.

An electrical fault occurred at the terminals, and the ensuing electric arc burned the employee's right hand. He also received an electric shock. He was hospitalized with second-degree burns.

Available fault current – 220 Amps (11x FLC)

Where should the lower line be drawn for arc-flash calculation studies?

- Only 4% of burns at 240 V and less vs. 480 – 700 V
- 11% of 480 V injuries were fatalities, there were none at 240 V and less.
- Sustaining an arc is not as likely at lower voltages, but recent testing has proved that arcs can be sustained below 220 V at 2500 A.
- Arcs at lower currents should cause lesser injuries, but the data do not confirm this.

Most common tools

26 – uninsulated screw drivers mostly 480, but down to 120/240 and up to 4160

16 – uninsulated wrenches

17 – underrated test equipment -- voltage testers, voltmeters, VOM – used on 2400 and 4160 V equip.

7 – phasing meters, mostly used on MV or HV

8 – jackhammer

2 – insulated tool

Equipment being worked on

Low voltage

96 – panelboards
35 – switchgear
27 – switchboard
17 – motor control centers
12 – bus duct and plugs
10 – service boxes/panelboards
17 – safety switches
8 – kW-hr meters
2 – machine control cabinets

MV or HV

46 – pole lines
37 – underground lines
22 – transformers
10 – substations
5 – cranes

Most common tasks at LV

37 – circuit breaker replacement or addition
40 – fuse replacements or additions

480 V arc-flash injuries -- service

Three maintenance workers were replacing a circuit breaker on a 480-volt, 800-ampere circuit.

The job had been scheduled for a Sunday, with all equipment shut down. However, no one called the electric utility to deenergize the service drop from the utility pole. The crew was aware that the circuit was still energized, but decided to perform the job anyway.

The two employees who were performing the work were standing on a wooden pallet for insulation from ground. Neither of them was wearing rubber insulating gloves or eye protection.

They disconnected the load-side conductors and pulled the circuit breaker out of the panelboard while it was still attached to the energized supply-side conductors. As they were removing the screws for the supply-side conductors, they caused an electrical fault.

The ensuing electric arc seriously burned all three employees, killing one of them and hospitalizing the other two.

Consider design for 800 A service

- Utility transformer might be 500 kVA.
- Primary fuses might be:
 - 65E slow speed yielding 50 cal/cm²
 - 30E slow speed yielding 12 cal/cm²
- Option – Owner can install cable limiters in transformer secondary terminal box. Then IE is 6 cal/cm²
- (2) 500 kcmil cables each with a 500 A limiter

NFPA 70E

Requirements often missed

- Train people
- Plan the job
- Deenergize
- Test before touch
- Use proper test instruments
- Use insulated tools
- Wear PPE
- Use insulating blankets
- Understand the hazards – Arc-flash studies, labels

Replacing 208 V breaker

A maintenance worker was replacing a circuit breaker for a 100-ampere, 208-volt, three-phase, four-wire circuit. A screwdriver he was using got caught, and he used another one to try to free it. As he was doing this, he caused an electrical fault. The ensuing electric arc burned the employee. He was hospitalized with second degree burns to both arms and to his face.

Excerpt from manufacturer's instructions for circuit breakers



Warning

BEFORE MOUNTING THE CIRCUIT BREAKER IN AN ELECTRICAL SYSTEM, MAKE SURE THERE IS NO VOLTAGE PRESENT WHERE WORK IS TO BE PERFORMED. SPECIAL ATTENTION SHOULD BE PAID TO REVERSE FEED APPLICATIONS TO ENSURE NO VOLTAGE IS PRESENT. THE VOLTAGES IN ENERGIZED EQUIPMENT CAN CAUSE DEATH OR SEVERE PERSONAL INJURY.

Fuse replacement

An electrician was removing fuses from a 480-volt, 200-ampere, three-phase fused disconnect as part of a energy isolation and lockout procedure for a water pump. The employee did not check all three phases after opening the interlocked panelboard door. He removed two fuses; and, when he removed the third, an electric arc occurred. The employee suffered burns on his eyes, face, and upper body. he was hospitalized for his injuries.

How bad can it be?

An electrician was changing a 200-ampere fuse on the sixth floor of a building. The fuse had blown a few minutes earlier while he was working on a switch. As he was changing the fuse, two other employees were standing just outside the electrical closet doorway. When the electrician inserted the fuse into the energized 480/277-volt circuit, he caused an electric arc and a resulting fire. The heat generated by the arc vaporized a 120-pound aluminum bus bar. The electrician was electrocuted by the arc. The two employees standing outside the doorway were burned on their upper bodies. These two employees were hospitalized for their injuries. Four other employees died of smoke inhalation as a result of the fire...

Bottom line

Deenergize

Needs much more emphasis!

Special Presentation

- Presenter – Lanny Floyd
- Update on the NIOSH Prevention through Design Initiative



PtD Update - Floyd

Update on the NIOSH Prevention through Design Initiative



Lanny Floyd
PCIC Safety Subcommittee Meeting
September 20, 2011

Background



- Launched in 2007
- 7 year national initiative

“to address occupational safety and health needs in the design process to prevent or minimize the work-related hazards and risks associated with the construction, manufacture, use, maintenance, and disposal of facilities, materials, and equipment, and to promote this concept and highlight its importance in all business decisions.”

Opportunity in electrical safety



Hierarchy of Hazard Control Measures from ANSI Z10

Control Effectiveness ↑

- Elimination
Eliminate the hazard during design
- Substitution
Substitution of less hazardous equipment, system or energy
- Engineering Controls
Design options that automatically reduces risk
- Warnings
Automatic or manual, permanent or temporary, visible or audible warning systems, signs, barriers and labels
- Administrative Controls
Planning processes, training, permits, safe work practices, maintenance systems, communications, and work management
- Personal Protective Equipment
Available, effective, easy to use

Life Cycle Value ↑

Opportunity in electrical safety

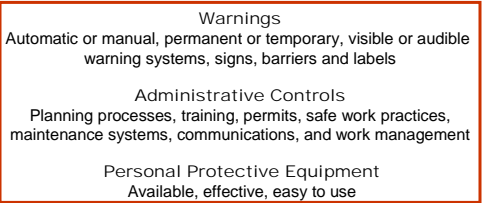


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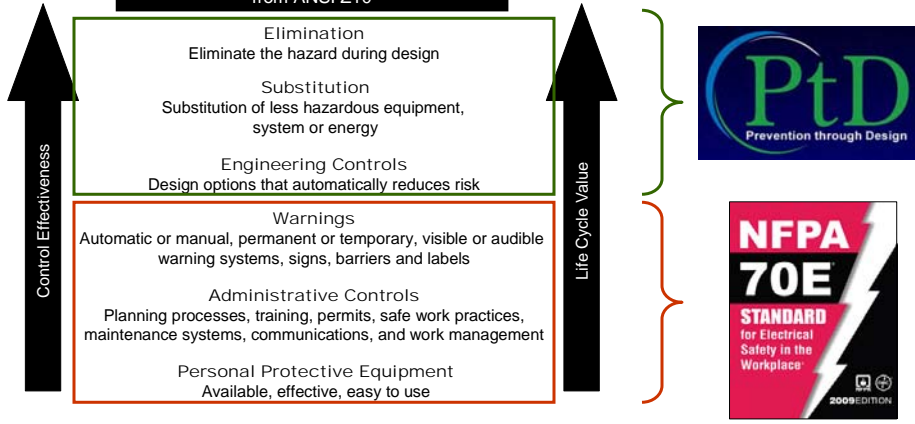
Life Cycle Value ↑



Opportunity in electrical safety



Hierarchy of Hazard Control Measures from ANSI Z10



Progress in Impacting Policy in Workplace Electrical Safety



H. Landis “Lanny” Floyd II, PE, CSP, CMRP, Fellow IEEE
Principal Consultant – Electrical Safety & Technology



The miracles of science™

NIOSH PtD Conference
Washington DC
August 22-24, 2011

IEEE Industry Applications Magazine



Impacting NFPA Standards



Effective Jan. 1, 2008, NEC 410.73 (G), 2005 Edition requires a ballast disconnect on new fluorescent fixtures.

Touch safe disconnect device replaces traditional connections for lighting ballasts

The diagram illustrates a fluorescent fixture with a touch safe disconnect device. The device is connected to the power supply and control switch. The fixture includes a series reactor, a starter, and a preheat-type fluorescent lamp (less than 30 watts). The touch safe disconnect device is shown as a small, rectangular component with a circular touch point.

Series reactor
Power supply
Control switch
Starter
Preheat-type fluorescent lamp (less than 30 watts)

The image shows the cover of the National Electrical Code (NEC) 2008, NFPA 70. The cover features the text "NATIONAL ELECTRICAL CODE International Electrical Code Series" and "nec 2008" in a large, stylized font. The NFPA logo is also visible.

Impacting NFPA Standards



Annex O Safety-Related Design Requirements

The application of <hazard analysis methods> should be used to compare design options and choices to facilitate design decisions that serve to eliminate risk, reduce frequency of exposure, reduce magnitude or severity of exposure, enable the ability to achieve an electrically safe work condition, and otherwise serve to enhance the effectiveness of the safety-related work practices contained in this standard.

Impacting IEEE Standards



Under development.....

**IEEE Standard 1814
Recommended Practice for Electrical System
Design Techniques to Improve Electrical Safety**



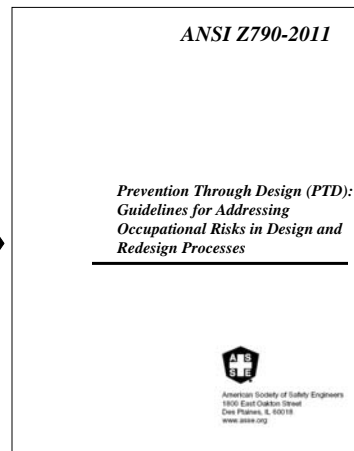
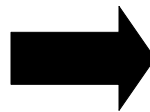
Professional Recognition



A New ANSI Standard



Technical Report published 2009



Standard approval by year end 2010

Final Slide

- Any other business for now or 2012?
- Where are the rosters?
- Adjourn

Thanks for coming!

Reference Websites

- **PCIC Safety Subcommittee**
<http://www.ieee-pcic.org/subcommittees/safety.html>
- **IEEE PCIC Membership Updates**
<http://www.ieee-pcic.org/subcommittees/membership/memberupdate.html>
- **IEEE Email Alias**
<http://elecomm.ieee.org/>
- **IEEE Electrical Safety Workshop**
<http://www.ewh.ieee.org/cmte/ias-esw/>
- **IEEE Electrical Safety Resource Center**
<http://standards.ieee.org/esrc>
- **IEEE Electrical Safety Forum**
http://www.ieeecommunities.org/ieee.esafety?invitation_key=410-F78D0DB86C

Reference Websites

- **ESFi – Electrical Safety Foundation International**
<http://www.esfi.org>
- **NIOSH – National Institute for Occupational Safety & Health**
<http://www.cdc.gov/niosh/>
- **OSHA – Occupational Safety & Health – Overhead Power Lines Website**
<http://www.osha.gov/Region7/overheadpowerlines/index.html>
- **Electrical Contractors Industry Standards**
<http://www.osha.gov/SLTC/electricalcontractors/index.html>