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DarynL@Lewellyn.com

*Understanding NFPA 70E  
and Arc Flash Hazards*

**Presented By:**

**Daryn Lewellyn, President**

**Lewellyn Technology, Inc.**

**Please Set Your Cell Phone To Vibrate**



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## *National Fire Protection Association:*

On January 7, 1976, at OSHA's request, the NFPA created a committee to write an electrical standard that OSHA could use:

**Committee on Electrical Safety Requirements for Employee  
Workplaces – NFPA 70E**



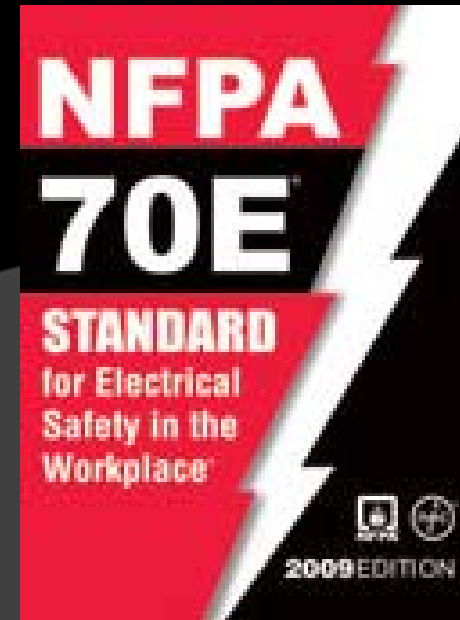
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## *NFPA 70E:*

70E – Standard for Electrical Safety in the Workplace covers the full range of electrical safety issues from safety-related work practices to maintenance, special equipment requirements, and installation.

OSHA 1910 Subpart S and OSHA 1926 Subpart K are based on this standard.





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## *OSHA & NFPA*

*How Do They  
Work Together:*

**NFPA 70E is a “how to comply” standard for OSHA electrical regulations.**



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## *OSHA & NFPA How Do They Work Together:*

“It certainly seems to me that if I’m an employer, and I want to comply with a general requirement for protecting my employees from electric shock and electric arc, that the first place I’m going to look is NFPA70E.”

David Wallis  
OSHA Director  
IEEE Interview



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## *OSHA Citation:*

**Region 5 News Release 04-479-CHI  
March 24, 2004**

**Milwaukee Company Penalized \$193,500 for Failing to Protect Workers  
from Electrical Hazards**

**.....three employees were severely burned by an arc flash and explosion that occurred while they were testing an electrical switchgear unit. OSHA cited the firm for a serious violation of federal training requirements and willful violations of lack of personal protective gear and for failing to de-energize or effectively guard exposed live equipment parts.**



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## *OSHA Citation:*

**Region 8 News Release: Thursday, March 23, 2006**

**OSHA Cites Team Electric of Denver for Alleged Safety Violations  
DENVER -- The U.S. Labor Department's Occupational Safety and Health Administration (OSHA) has cited Team Electric Inc., Denver, Colo. for unsafe working conditions following an electrical accident at a construction site in Aurora. Proposed penalties total \$115,500.**

**"This accident could have been avoided by following recognized safe practices for working around electrical hazards," said Herb Gibson, OSHA area director in Denver.**



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## *Electrically Safe Work Condition*

### **130.1 Justification for Work.**

**(A) General.** Energized electrical conductors and circuit parts to which an employee might be exposed shall be put into an electrically safe work condition before an employee works within the Limited Approach Boundary of those conductors or parts.



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## *Electrically Safe Work Condition*

### **130.1 Justification for Work**

**(1) Greater Hazard.** Energized work shall be permitted where the employer can demonstrate that deenergizing introduces additional or increased hazards.

**(2) Infeasibility.** Energized work shall be permitted where the employer can demonstrate that the task to be performed is infeasible in a deenergized state due to equipment design or operational limitations.

**(3) Less Than 50 Volts.**



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## *Understanding NFPA 70E and Arc Flash Hazards*

PPE for the arc-flash hazard is the last line of defense.

The protection is not intended to prevent all injuries but to mitigate the impact of an arc flash upon the individual, should one occur. In many cases, the use of PPE has saved lives or prevented injury.

IEEE

Std 1584-2002



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## *Chapter 1 Safety-Related Work Practices :*

- Qualified versus Unqualified Persons
- Training
- Electrical Safety Program
- Hazard Analyses for Shock and Flash
- Lockout/Tagout
- Energized Electrical Work Permits
- Approach Boundaries and PPE.



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## *Chapter 2 Safety-Related Maintenance Requirements :*

Requires electrical components, wiring, and equipment be maintained in a safe condition.

Does not prescribe specific maintenance methods or testing procedures.



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## *Chapter 3 Safety Requirements For Special Equipment:*

Requirements for batteries, lasers and power electronic equipment.

Article 350 added for R&D facilities.



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## *WHAT IS AN ARC FLASH ANALYSIS:*

It is a study of your electrical distribution system to determine if hazards exist and their severity. The study will show if a short circuit or equipment failure will result in a small spark or a life threatening explosion. This is called the incident energy.



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## *WHAT CHANGES:*

**Implementing NFPA 70E requires:**

**Arc Flash Hazard Analysis**

**Where Possible Removing Hazards Found**

**Written Electrical Safety Program**

**Energized Work Permits**

**Wearing of PPE**

**Training of Qualified Personnel (Maintenance)**

**Training of Unqualified Personnel (Operations)**

**Cultural Change**



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## *WHAT CHANGES:*

Of all of the requirements and changes the cultural change will be the most difficult.

Expensive

Time Consuming

The First Thing You Begin Working On

It Must Occur Throughout Your Facility



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# *ARC FLASH HAZARD ANALYSIS:*

**The Analysis Involves Four Phases:**

- 1. Site Assessment and Electrical System Data Gathering**
- 2. Analysis of the Data Using IEEE 1584 and/or NFPA 70E Methods**
- 3. Develop Safety Program, Determine PPE, Affix Labels**
- 4. Training**



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## *Phase One:*

### **Site Assessment and Electrical System Data Gathering**

- **Accurate, up-to-date information on the facility electrical system is absolutely essential to the analysis:**
- **Transformer Data - KVA, Voltages, Impedance**
- **Conductor Sizes and Lengths**
- **Fuse and Circuit Breaker Data**
- **Electric Utility - Available Capacity (minimum & maximum)**
- **Develop Accurate One-Line Diagrams**



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## *Phase Two:*

**Analysis of the Data Using IEEE 1584 and/or NFPA 70E Methods**

- **Short-Circuit Analysis**
- **Protective Device Coordination Analysis**
- **Interrupting Rating Analysis**
- **Arc-Flash Hazard Analysis**
- **Recommend Solutions to Problems and Identify Opportunities**



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## *Phase Three ESWP Program:*

### **Develop and Document an Electrically Safe Work Practices Program**

- Determine Policies on Electrically Safe Work Conditions
- Develop an Electrically Energized Work Permit
- Establish PPE Requirements Inside Shock Boundaries
- Determine PPE Clothing Policy
- Establish Method of Maintaining Integrity of the Arc Flash Analysis




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*THE LABEL:*

|  <b>WARNING</b> |   |
|--|---|
| <b>Arc Flash and Shock Hazard<br/>Appropriate PPE Required</b>                                   |   |
| 53 inches  | Flash Hazard Boundary                         |
| 7  | cal/cm <sup>2</sup> Flash Hazard at 18 inches |
| Category 2   | PPE - Category Appropriate                    |
| 480 VAC  | Shock Hazard                                  |
| 00   | Glove Class                                   |
| 42 inches  | Limited Approach                              |
| 12 inches  | Restricted Approach                           |
| 1 inches   | Prohibited Approach                           |
| Bus: CWP-6B Disc Prot: BNH SUB-A CB3B  |   |
| Arc Flash analysis conducted by Lewellyn Technology 800-242-6673                                 |   |



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## *Phase Four Training:*

### **Training**

- Provide training for all Qualified Employees, Supervisors, and Safety Personnel on the Electrically Safe Work Practices Program and Hazard Recognition and Avoidance (Two Days)
- Provide training for all Affected Employees - Operators, Mechanics, and Management (Half-Day)



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## THE TABLE :

*600V Class Motor Control Centers (MCCs) and Busways.*

| <b>Task</b>   | <b>Hazard Risk</b> | <b>V-rated<br/>Gloves</b> | <b>V-rated<br/>Tools</b> |
|---|--------------------|---------------------------|--------------------------|
| Operate CB or fused switch or starter with enclosure doors closed.                | 0                  | N                         | N                        |
| Read a panel meter while operating a meter switch.                                | 0                  | N                         | N                        |
| Operate CB or fused switch or starter with enclosure doors open.                  | 1                  | N                         | N                        |
| Work on energized parts, including voltage testing.                               | 2*                 | Y                         | Y                        |
| Work on control circuits while working near exposed live parts<br>120V and below. | 0                  | Y                         | Y                        |

65kA Short Circuit Current Available, .03 sec fault clearing time.

\*A double layer switching hood and hearing protection are required for this task in addition to the other Hazard/Risk Category 2 PPE requirements.



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