

Introduction

NFPA 70E - Electrical Safety in the
Workplace

Introduction

- Introduction to NFPA 70E
- Electrical Safety in the Workplace
- Course is about 30 minutes long.
- Objective is to cover:
 - How to Identify major hazards associated with arc flash
 - The types of arc flash and how they occur
 - How to protect yourself from arc flash hazards
 - Employer requirements for protecting workers from arc flash hazards

Introduction

- What is NFPA 70E
- National Fire Protection Association (NFPA)
 - Started in 1896
 - Research & Development of Fire Safety Standards
- Publishes over 300 consensus codes and standards
- Intended to minimize the possibility of fire and its effects

Electrical Hazards

- Why NFPA 70E is necessary
- Electrical hazards result in:
 - An average of 411 deaths each year
 - 4th leading cause of death in construction.
 - 9% of all construction fatalities.
 - One arc flash related death every day.
 - Thousands of recordable and disabling injuries
 - Don't let yourself become one of these statistics!

Electrical Hazards

- Deaths by contact with electricity 2003-2005
 - Electrical power installers – 31.8
 - Earth drillers – 13.4
 - Helpers – 5
 - Electricians – 4.8
 - Iron workers – 3.5
 - Welders – 2.3
 - Roofers – 1.3
- Prevent becoming a statistic by identifying and mitigating electrical hazards and following safe work procedures.

Electrical Hazards

- Why Focus on Electrical Safety?
- On average:
 - 30,000 non-fatal electrical shock accidents occur each year
 - 3,000 reported flash burn incidents
- These numbers reflect people who were lucky they survived!

Electrical Hazards

- To protect yourself from electrical hazards you should know:
 - Basic electrical principles
 - How electricity works and why;
 - Electricity's hazardous properties
 - OSHA requirements
 - Safe work procedures.

Arc Flash Hazards

- What is an Arc flash?
- Arc flash:
 - The sudden release of electrical energy through the air
 - Gives off intense heat and light that cause severe burns
 - Can reach temperatures as high as 35,000 degrees
 - Produces pressure waves by rapidly heating the air, creating a blast effect.

Arc Flash Hazards

- Arc Flash Hazards
- 3 Primary Hazards of Arc Flash
 - Thermal Burns
 - High Pressure Wave
 - Molten Metal Droplets

Arc Flash Hazards

- Arc Flash Hazards
- Thermal Burns
 - caused by the extreme heat generated by an arc flash
- Arc Flash is an un-controlled arc
 - Similar to a Lightning Bolt
 - Often fatal
- Hottest recorded temperatures on Earth
 - 35,000 degrees Fahrenheit

Arc Flash Hazards

- Arc Flash Hazards
- High Pressure Wave
 - Sudden expansion of air around arc flash
 - Throw workers across a room and into equipment
- Force can exceed 2,000 pounds/square foot
- Hearing loss is common
 - 140 decibels (equivalent of a jet engine)

Arc Flash Hazards

- Arc Flash Hazards
- Molten Metal Droplets
 - Caused by vaporized metal
- At 35,000 degrees Fahrenheit:
 - All known materials are vaporized
 - Copper becomes a liquid or gas...
 - Can penetrate the body like shrapnel and be inhaled
- Proper precautions necessary for your safety

Understanding NFPA 70E

- What work practices does NFPA 70E require?
 - Chapter 1, Safety-Related Work Practices
 - Article 100, Definitions
 - Article 110, General Requirements for electrical Safety-Related Work Practices
 - Article 120, Establishing an Electrically Safe Work Condition
 - Article 130, Working On or Near Live Parts

Understanding NFPA 70E

- Training Requirements
- Employees shall be trained:
 - In safe work practices and procedures for specific jobs or tasks
 - To understand and recognize electrical hazards
 - In classroom and on-the-job
- Training will be different and is determined by exposed risks.

Understanding NFPA 70E

- Qualified Person
- Only a Qualified Person may perform work on or near energized electrical conductors
- Training Requirements at a minimum include:
 - Safe work procedures and precautionary techniques
 - Select and use proper PPE:
 - Identify exposed energized parts from other parts
 - Determine nominal voltage of live parts
 - Understand safe approach distances
- Training and verification of knowledge must be documented

Understanding NFPA 70E

- Qualified Person
- Training Requirements
 - Skills, experience and knowledge critical for effective hazard training
 - Training must meet the needs and requirements of the tasks performed
- Qualified person must be able to recognize all electrical hazards in their workplace

Understanding NFPA 70E

- Energized Work Considerations
- Compelling Reason for Energized Work
 - Inconvenience or financial reasons are not compelling reasons for performing energized versus cold electrical work
 - Infeasible means impractical or incapable of being performed any other way.
- Energized electrical work risks lives...
- Perform de-energized whenever possible
 - Hot work should always be the last option on the table

Electrically Safe Work Condition

- Electrical Safe Work Condition
- NFPA 70 E states:
 - Live parts to which an employee might be exposed shall be put into an electrically safe work condition before an employee works on or near them unless the employee can demonstrate work on energized components can be justified .
- Viable Justifications:
 - De-energizing introduces additional or increased hazards
 - Interruption of life support equipment,
 - De-energizing is infeasible due to equipment design or operational limitations.
 - Start-up or troubleshooting diagnostics and testing

Electrically Safe Work Condition

- Hot Work is Required:
- Before starting each job, safety planning meeting must be held to discuss:
 - Procedures to be followed
 - Special precautions
 - Energy source controls - LOTO
 - Personal Protective Equipment
 - Other work in or around the system you are working on

Electrically Safe Work Condition

- An Electrically Safe Condition requires the following:
 - Determine all sources of electrical supply
 - Open disconnect for each source
 - Verify all disconnects fully open or withdrawn
 - Apply lockout/tagout devices
 - Test each phase conductor
 - Ground phase conductors where necessary

Electrically Safe Work Condition

- Failure to Lock and Tag Energy Source
- Failing to adequately lock and tag out energy sources is not considered an electrically safe work condition!
 - Safe work practices shall be used just like working on live parts
 - Applies to all equipment
 - Including temporary, permanent or portable equipment

Electrically Safe Work Condition

- Energized Electrical Work Permit
- Permit shall include the following items
 - Description of circuit and equipment
 - Justification for performing energized electrical work
 - Description of safe work practices
 - Results of shock hazard and flash hazard analysis
 - Shock protection boundary
 - Personal protective equipment
 - Means to restrict access to unqualified persons
 - Evidence of pre task planning meeting
 - Work approval signatures

Electrically Safe Work Condition

- Energized Electrical Work
- Perform electrical hazard analysis if:
 - Live parts can not be placed in a safe work condition
- Shock Hazard Analysis
 - Determine limited, restricted and prohibited approach boundaries and PPE
- Flash Hazard Analysis
 - Determine arc flash boundary and PPE for personnel within this boundary
- Use Energized Electrical Work Permit

Electrically Safe Work Condition

- Shock Hazard & Arc Flash Hazard Analysis
- Does a shock hazard exist?
- What is the degree of the hazard?
- Does an arc flash hazard exist?
- What is the degree of the arc flash hazard?
- Does a co-occupancy hazard exist?
- Will other workers be exposed?
- What authorization is necessary?

Approach Boundaries

- Shock Approach Boundaries
- Shock approach boundaries are identified as:
 - Limited
 - Restricted, &
 - Prohibited
- Personnel must be qualified to cross the Limited Approach Boundary.
- Crossing Restricted Approach Boundary requires a qualified person AND PPE protection from shock

Approach Boundaries

- Shock Boundaries
- Identified in Article 130
 - Recognizes that any tool or similar object must be considered to be an extension of a person's body

Approach Boundaries

- Arc Flash Hazard Analysis
- An arc flash hazard analysis shall be done to:
 - Protect personnel from injury by arc flash exposure
 - Determine the flash protection boundary and potential thermal exposure to personnel
 - Determine PPE and protective equipment for workers inside the flash protection boundary
- Equipment may be labeled with the results of the arc flash hazard analysis and shock protection analysis

Approach Boundaries

- Conducting a Flash Hazard Analysis
- Conducting an arc flash analysis:
 - Is a complex process
 - Requires specialized training and education.
 - Typically conducted by electrical engineers familiar with power analysis studies
- Alternative methods available
 - Reference the NFPA 70E document for details

Labels and PPE

- Labels
- Warning Labels:
 - The use of labels is required for all equipment and it must specify:
 - Arc Flash Boundaries
 - Shock Hazard Boundaries
 - Type of PPE that must be used.

Labels and PPE

- Proper PPE
- Selecting the proper PPE is a critical step in providing yourself the maximum protection available.
- NFPA 70E includes tables to help you choosing the correct PPE for the job

Labels and PPE

- Inspecting PPE
- Clothing shall be inspected prior to use by user.
 - Clothing or flash suits that are damaged shall not be used.
 - Clothing that become contaminated with grease, oil or flammable liquids or combustible materials shall not be used.
- V-rated gloves shall be inspected prior to use and shall be tested and certified every 6 months.

General

- Never reach blindly into areas with energized conductors
- Ensure adequate lighting is available
- Never wear conductive jewelry and clothing such as watchbands, bracelets or necklaces
- Use only insulated tools rated for the voltage you are working with

General

- Warnings & Barricades
- Protecting unqualified persons from shock and arc flash approach boundaries
 - Barrier tape
 - Orange cones
 - Signage
 - Plastic chain
 - Use an attendant to warn others approaching the area

Employer Responsibilities

- Employer Responsibilities
- Your employer must:
 - Provide a safe and healthful workplace
 - Utilize consensus standards such as NFPA 70E to ensure a safe workplace
 - Conduct a Flash Hazard Analysis
 - Determine the flash protection boundary and specific PPE

Employer Responsibilities

- Employer Responsibilities
- NFPA 70E is an industry consensus standard that your employer must follow
- Employers must:
 - Conduct Electrical Hazard Analyses and Arc Flash surveys
 - Evaluate proper PPE is available and use correctly
 - Ensure employees are adequately trained

Summary

- Summary
- NFPA 70E is designed to protect the worker from electrical hazards
- All the rules and regulations are useless if you don't follow and apply them as designed
- Nothing is more important than YOUR Safety and the safety of your CO-WORKERS
- Never take short cuts and apply what you learned!
- Ensure that you are always working in a safe manner and environment.

NFPA 70E Links

- Resources
- <http://www.nfpa.org/c>
- [atalog/product.asp?pid=70E12&order_src=A381&gclid=COjHzOK5v64CFWMGRQodRI4nog](http://www.nfpa.org/atalog/product.asp?pid=70E12&order_src=A381&gclid=COjHzOK5v64CFWMGRQodRI4nog)