



Strategies for Implementing NFPA 70E

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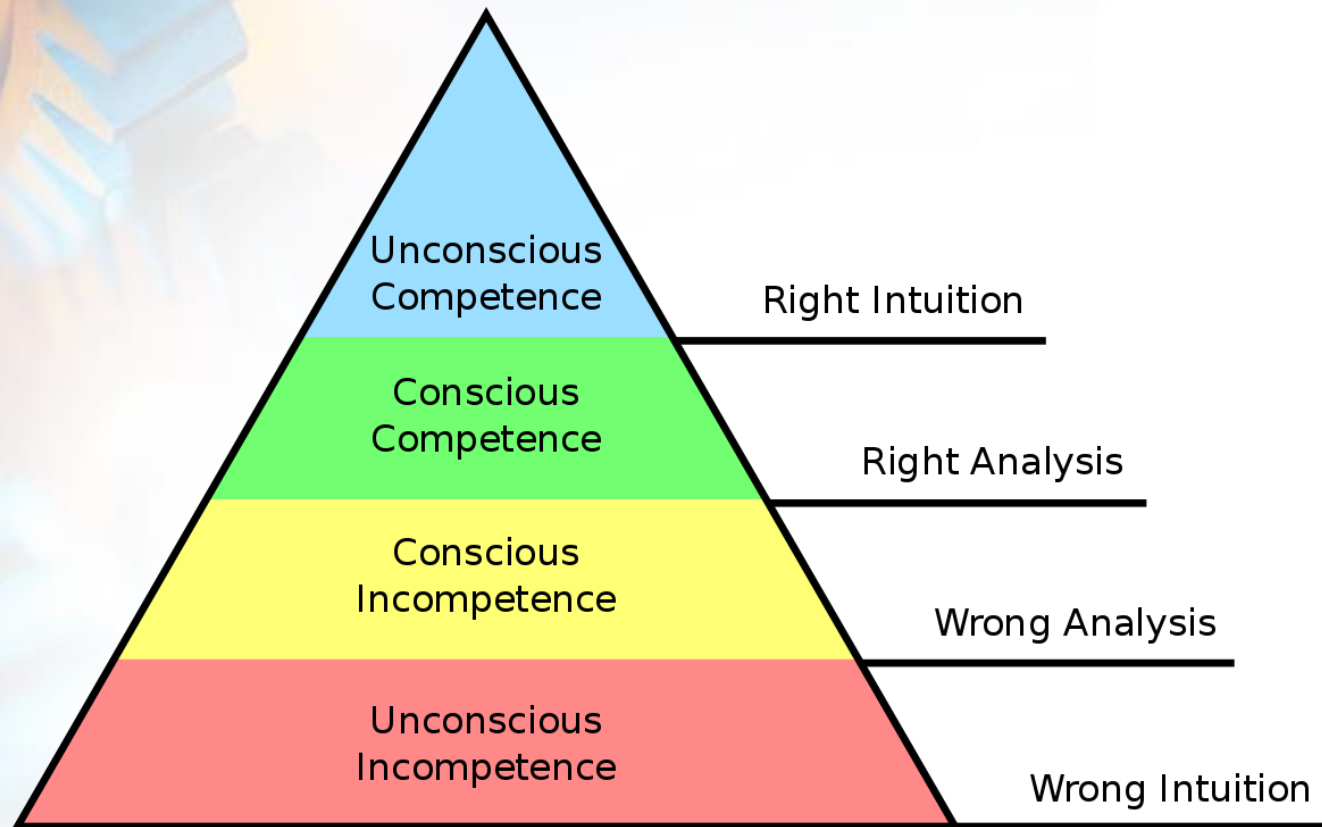
your health and safety team

Presentation Objectives

After attending this presentation you will understand:

- How an electric arc flash occurs;
- PPE protection requirements;
- Hazards of electricity from shock
- NFPA 70E® compliance strategies
- Major Changes to 2021 edition of NFPA 70E®

Hierarchy of Competence



Hierarchy of Competence

Hazards of an Electric Arc

- Arc flash temperatures may reach 35,000° F.
- Sun: 9,000° F.
- Copper expands 67,000 times when vaporized.
- Sound – 141.5 decibels 2' from blast.
- Pressure wave of 2,160 psf.

Electric Arc Flash Statistics:

Up to 80% of all electrical injuries are burns resulting from an arc flash and ignition of flammable clothing.

Approximately 5 workers are hospitalized daily with electric arc flash burns.



What causes an electric arc?

- Mechanical breakdown/failure
- Current overload
- Accidental contact:
 - ◆ Phase-to-Phase
 - ◆ Phase-to-Ground



OSHA and NFPA 70E®

OSHA does not enforce NFPA 70E®, however:

1910.132 (d)(1): PPE Hazard Assessment

1910.269 (l)(6)(iii): Requires Arc-rated clothing (Electric Utilities)

1910.335 (a)(1)(i): Appropriate Electrical PPE for Job Task

1910.335 (a)(1)(iv): Nonconductive Head Protection

1910.335 (a)(1)(v): Eye/Face Protection

1910.335 (a)(2)(i): Insulated Tools if tools may contact energized parts

1926.28 (a): Appropriate PPE (Construction)

General Duty Clause: Agriculture, Construction

OSHA VPP Auditors are asking about NFPA 70E® Compliance.

NFPA 70E® Industry Consensus Standard.

Arc Flash Prevention – Lockout/tagout!

- Lockout equipment prior to servicing and maintenance unless deenergization is infeasible: 29 CFR 1910.333 (a)(1).

Typical exceptions:

- ◆ Electrical Troubleshooting
- ◆ Emergency Alarm Systems
- ◆ Interruption of Life Support Equipment

- ***Convenience is not an acceptable excuse!***

It's all about the calories!

- Calorie: Heat to raise 1gram of water 1° C.
- Arc-rated clothing is intended to protect worker to ensure electric arc is limited to a “curable” 2° burn (≤ 1.2 calories).
- Curable Burn: Max 175° F for ≤ 0.1 second.

Hazard Risk Category (HRC)

Hazard Risk Category	Minimum Arc Rated PPE: Calories/centimeter ²
1	$>1.2 \leq 4$ calories/cm ²
2	≤ 8 calories/cm ²
3	≤ 25 calories/cm ²
4	≤ 40 calories/cm ²

Arc-Rated Clothing

- Check out the Label:



Arc-Rated Clothing

Remember:

All arc-rated clothing is also FR but,

All FR clothing is not arc-rated.



Arc Flash Labels

MDHC
277 / 480



⚠ WARNING
Arc Flash and Shock Risk
Appropriate PPE Required

28 in	Flash Risk Boundary
2.4 cal/cm ²	Flash Risk at 18 in
Level 1	Arc-rated FR Shirt & Pants & Arc-rated Face Shield
480 VAC	Shock Risk when cover is removed
00	Glove Class
42 in	Limited Approach
12 in	Restricted Approach
4 cal/cm ²	Minimum Arc Rating

Location: MDHC

Warning: Changes in equipment settings or system configuration will invalidate the calculated values and PPE requirements

BNL1
120-208V



⚠ WARNING
Arc Flash and Shock Risk
Appropriate PPE Required

78 in	Flash Risk Boundary
13 cal/cm ²	Flash Risk at 18 in
Level 3	Arc-rated FR Shirt & Pants & Coverall & Arc Flash Suit
208 VAC	Shock Risk when cover is removed
00	Glove Class
42 in	Limited Approach
Avoid Contact	Restricted Approach
25 cal/cm ²	Minimum Arc Rating

Location: PNL BNL1 BUS

Warning: Changes in equipment settings or system configuration will invalidate the calculated values and PPE requirements

Putting it all together:

- Perform Flash Hazard Analysis
- Acquire Appropriate Arc-rated clothing (ARC)
- Care and Laundering of ARC
- Electrical Safe Work Practices
- Electrical Safety Training: Article 110.6
- CPR Training: Article 110.6 (C)(2)(b)
- EH Shoes (Except in ESD Environments)
- **Whenever Possible: Lockout all Equipment!**

5 Habits of safe electrical workers:

1. Establish electrical safe work condition.
2. Wear arc-rated category 2 clothing/face shield.
3. Use GFCI with extension cords.
4. Establish shock and arc flash boundaries.
5. Use voltage-rated gloves and tools.

[illegible]

your health and safety team

Major Changes

1. Risk Assessment:

- Risk: Likelihood X Severity
- Assessing Likelihood
- Lists Electrical Tasks:

Normal Operating Condition

Abnormal Operating Condition

Major Changes (Continued)

2. Batteries (Risk Assessment)

- Batteries possess multiple potential hazards
- PPE needs to protect against hazards based upon task performed

Major Changes

3. Gloves (PPE)

- 2018 Edition of NFPA 70E® referenced ASTM D120 for voltage-rated gloves.
- Revised Table 130.7 (C)(7)(a) lists gloves by voltage.

Major Changes

4. Arc-Rated Clothing (PPE)

- Arc-Rating of outer garment (jacket; coat; rain jacket) not part of layering system are not required to be \geq incident energy exposure.
- Huh? *Confirm inner layer (shirt/pants; coveralls) \geq incident energy exposure for task.*

Major Changes

5. Job Planning Checklist (Annex I)

- Provides additional guidance on preparing for energized work tasks.
- More Comprehensive (23 Items)
- Risk Assessment included

Major Changes

6. Capacitors: New

- New Article (**360**) and Annex (**R**) address capacitors.
- 360.1 Scope
- 360.2 Definitions
- 360.3 Stored Energy Hazard Thresholds
- 360.4 Specific Measures for Personnel Safety
- 360.5 Establishing an Electrically Safe Work Condition for a Capacitor(s)
- 360.6 Grounding Sticks

Summary

During this presentation you learned:

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Conclusion

Questions or comments?