Identifying Error Precursors and Minimizing the Impact With Human Performance

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Takeaways and Agenda

- What do we mean?
  - "Human Error/Human Performance"
- Annex Q of NFPA 70E
- Table Q.5
- Error Precursors
- Human Performance Tools
- Putting it Into Practice

What could go wrong?

- Murphy's Law
  - Anything that can go wrong will go wrong, and at the worst possible time.
- NFPA 70E®
  - Risk based approach
  - Safety by design
  - Maintenance
  - Electrically safe work condition
  - PPE

Safety Improvement has Stalled

2007: Fatalities 200

Since 2009: Downward trend has stalled

US Fatalities by Exposure (Electrical)

| NFPA 70E Edition: | 2000 | 2004 | 2009 | 2012 | 2015 | 2018 | 2021 |

Statistics from BLS. *Due to classification/coding changes, data from 1992-2009 analyzed by "contact with electrical current" and data starting in 2010 analyzed by "exposure to electricity"

Not Just Beginners!


Journey Level

Apprentices

Almost There!

74%
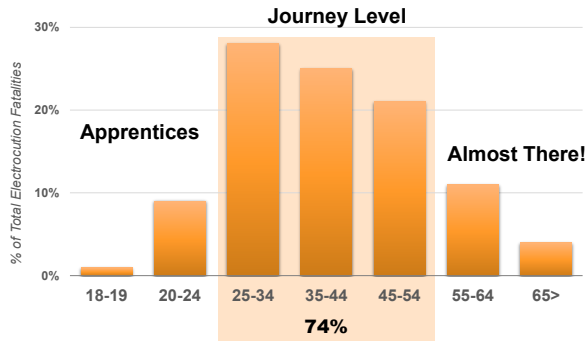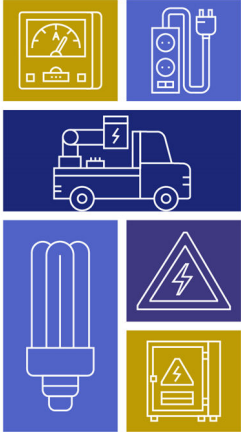
ESFI, Workplace Electrical Injury & Fatality Statistics Report 2020
Table 4 Fatal Work Electrical Injuries by Selected Worker Characteristics, 2011– 2020 (Data source: BLS)
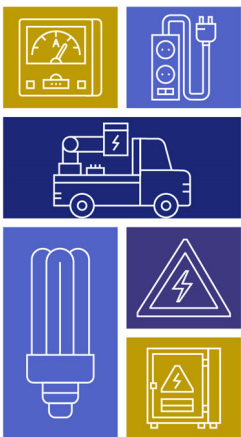
Annex Q in NFPA 70E®

- Added in 2018 edition of NFPA 70E
- Explains how human performance tools can be complimentary to the HoRC
- Contains Table Q.5 for Error Precursor ID and Mitigation
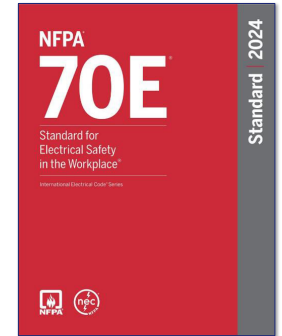
What is Human Performance?

- People are not machines, we make mistakes
- Performance can be influenced
- Error-likely situations are:
  - Predictable
  - Manageable
  - Preventable & Avoidable
- Precursors help identify a possible event

Part of Risk Reduction

Human performance is an aspect of risk management that addresses organizational, leader, and individual performance as factors that either lead to or prevent errors and their events. The objective of human performance is to identify and address human error and its negative consequences on people, programs, processes, the work environment, an organization, or equipment.

Areas with Potential for Error
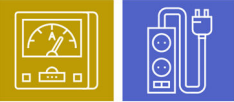
- Stages of Info Processing
  - Attention
  - Sensing
  - Encoding, Storage, Thinking
  - Retrieval, Acting
- Attention Resource Pool is shallow!
 - Attention required is inversely proportional to experience
- If identified during job planning tools can be used to minimize the impact

When does Human Error Occur?

Critical points in activities when risk is higher (increased likelihood of harm or increased severity of harm, or both) require an increased allocation of attentional resources. Allocation at these critical points can be improved by training, procedures, equipment design, and teamwork.
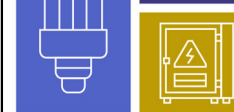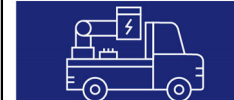
Creating a Safe Workplace

- OSHA requires employers to provide a workplace free from hazards.
  - Safer equipment designs
  - Risk assessments
  - Electrical equipment maintenance
  - Safe work practices for when hazards exist
- Employee has responsibility to comply with policies and procedures
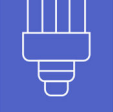 - Lack of knowledge
  - Poor attitude
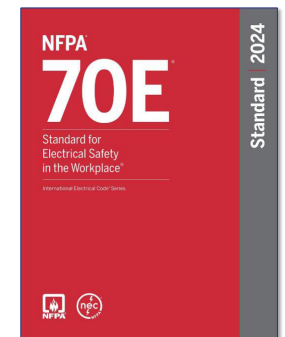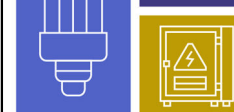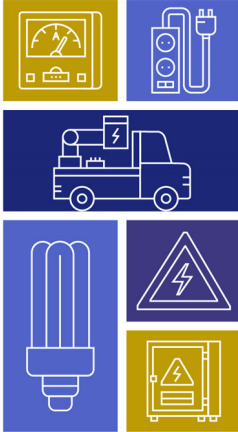 - Complacency

Table Q.5

- Three columns
  - Error Precursors
  - Optimal Tools
  - Human Performance Tools
- Designed to be used as Job Planning tool
  - Identify precursors
  - Determine which HP tool from Q.6 is best for unique precursor
  - Inform the JSP

NFPA
70E
Standard for Electrical Safety in the Workplace®
International Electrical Code Series
Standard 2024

Error Precursors

- Task Demands
  - Time demands– in a hurry
  - High workloads– memory issues
  - Multitasking
  - Repetitive actions
  - Critical steps
  - Interpretation issues
  - Unclear goals
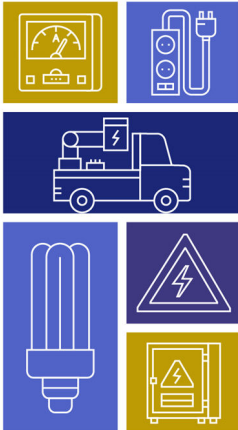 - Unclear standards

Error Precursors

- Work Environment
  - Distractions or interruptions
  - Changes in routine
  - Confusing displays or controls
  - Workarounds
  - Out of service instrumentation
  - Obscure electrical configurations
  - Unexpected equipment conditions
  - Lack of alternative indication
  - Personality conflicts

Error Precursors

- Individual Capabilities
  - Unfamiliar with the task
  - Lack of knowledge
  - New techniques
  - Bad communication habits
  - Lack of experience
  - Poor problem-solving skills
  - Unsafe attitudes
  - Inappropriate values

Error Precursors

- Human Nature
  - Stress
  - Habit patterns
  - Assumptions
  - Complacency
  - Overconfidence
  - Mind-set
  - Inaccurate risk perception
  - Biases

Human Performance Tools

- Pre-job Briefing
  - Identify hazards, assess risk and select and implement risk controls from a hierarchy of methods
- Job site Review
  - Increased situational awareness
- Post-job Review
  - Identify ways to improve and best practices
  - Peer check
- Procedure Use and Adherence
  - Step-by-step procedure read, outcome understood
  - Circle the task to be performed, check off each task as it is completed

Human Performance Tools

- Self-check with Verbalization
  - Stop, Think, Act, Review (STAR)
  - Verbalize intent before, during, and after each task
- Three-way Communication
  - Directives are repeated by receiver back to sender; receiver is acknowledged by sender
- Stop when Unsure
  - Stop and obtain further direction
  - Maintain a questioning attitude
- Flagging and Blocking
  - Identify equipment to be worked on, block equipment that is not being worked on

Putting it Into Practice

- A 23-year-old licensed construction electrician takes a job as a maintenance tech in an oil refinery. During a plant turnaround, they are tasked with performing several maintenance tasks. The refinery is under new ownership with little in the way of documentation on previous maintenance performed. The site is to perform all the year's maintenance activities in one month. Long term refinery staff has shared stories of several shortcuts they know of to get done quicker.

Putting it Into Practice

- Are there any task demand error precursors?
  - Which human performance tools would work best?
- Does the work environment present any error precursors?
  - Which human performance tools would work best?
- Does the electrician's capabilities present error precursors?
  - Which human performance tools would work best?
- Are any error precursors due to human nature?
  - Which human performance tools would work best?

Working HP into Job Plan
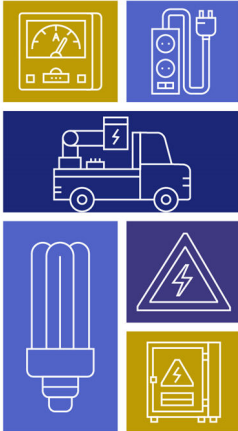
- How could results of Table Q.5 be implemented into the job safety plan required by NFPA 70E?
  - Does it effect the results of the risk assessment?
  - Does it effect what work practices will be used?
  - Does it effect the PPE being utilized, if any?

Thank you
Questions?

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