

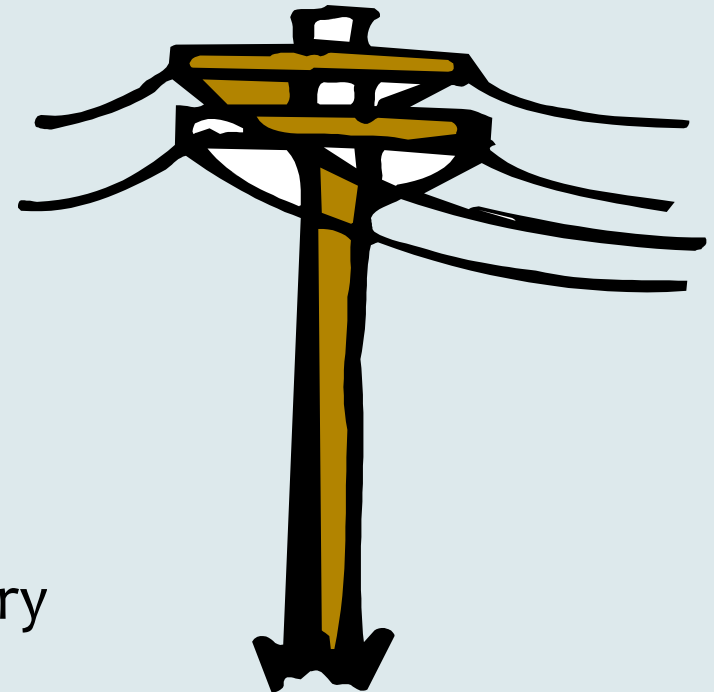
5 Key Strategies to Prevent Electrical Injuries

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Grain Elevator Safety Concerns

My 5 Areas of Greatest Concern

- Bin Entry
 - Lockout
 - Falls from Heights
 - Rail
 - Electricity
-
- Mistakes are Very Unforgiving!
-
- Electrical Injuries
 - 4th leading cause of death in industry



5 Key Strategies

1. Make Sure Employees are Aware of Electrical Hazards
2. Choose, Evaluate & Approve Workers
3. Provide Electrical Safety & Technical Training
4. Provide & Maintain Electrical PPE & Clothing
5. Provide Leadership to Ensure Compliance

Key Strategy #1

**Make Sure Employees
are Aware
of Electrical Hazards**

Awareness of Hazards

How aware are your employees of shock hazards?

- 95% admit to having been shocked
- Good that they lived
- But added feeling of invincibility

- Especially at lower voltages
- Current as low as 25 mA can cause nearly instantaneous death under the right conditions

Current Range & Effect

Current	Effect
1 mA	Barely perceptible
1 – 3 mA	Perception threshold (most cases)
3 – 9 mA	Painful sensations
9 – 25 mA	Muscular contractions (can't let go)
25 – 60 mA	Respiratory paralysis (may be fatal)
60 mA or more	Ventricular fibrillation (probably fatal)
4 Amps or more	Heart paralysis (may restart through CPR)
5 Amps or more	Tissue burning (fatal if vital organ)

Awareness of Hazards

How aware are your employees of arc blast hazards?

- The Charlie Morecraft story
- My introduction to the arc blast hazards
- Effect of burns on body
- 1st, 2nd & 3rd Degree Burns
- Age + % of Body Burned

Awareness of Hazards

Arc Blasts

- Occur at any time
 - Extremely high temperatures
 - Bright light, Loud noise, Pressure wave
 - Molten metal, Shrapnel
 - Clothes can catch on fire
- Occur in Various Ways
 - Tool contact, dropped part
 - Faulty insulation, Loose connection
 - Equipment installed by someone who is not qualified

Awareness of Hazards

Westex Video

- Equipment similar to most elevators
- Tool contact creates arc blast
- Clothing catching on fire is MAJOR concern

- Show Video (poly-cotton clothing)

- Determine hazards – Fault & Coordination Study (electrical engineer)
 - Available incident energy
 - Shock hazards

Awareness of Hazards

- Until we began this type of training, some workers were reluctant to wear correct clothing and PPE
- Do your workers know when they will be shocked or hit with an arc blast?
 - If yes, they only need to be prepared those times
 - If not, they always need to be prepared

Awareness of Hazards

- Are your employees aware of these hazards?
- How do you get that message to them?
- How often do they get that message?

- Awareness that this could happen gives them a chance, if they believe it could happen to them!

#1 Strategy –

Make Employees Aware of Hazards!

Key Strategy #2

**Choose, Evaluate &
Approve
Electrical Workers**

Choose, Evaluate & Approve Workers

“Qualified” Electrical Worker Definition

- Approved by Management
- Trained in Safety Related Work Practices
- Have technical experience & expertise to perform the task required
- Can be “Qualified” for some tasks but not others

Choose, Evaluate & Approve Workers

Management Responsibility

- Make sure employees assigned to perform electrical work are qualified and know what they are doing
- Make sure everyone else knows that they cannot perform electrical work
- How to Accomplish?

Choose, Evaluate & Approve Workers

- Approved by Management
- How does your manager know that workers have the experience and expertise to perform electrical work?
 - Technical or Trade School / Passing Grades
 - Instruction from a “Qualified” Person
 - Evaluation from a “Qualified” Person
 - Each Task
 - Each Type of Equipment

Choose, Evaluate & Approve Workers

- Plant Management signs off on every electrical worker
- It may be a better strategy to hire out most electrical work if workers are not qualified!

#2 Strategy –

Choose, Evaluate & Approve Electrical Workers

Key Strategy #3

**Provide Electrical Safety
& Technical Training**

Provide Safety Training

- Safety Training for Unqualified Workers
 - Tell them they can't perform electrical work
 - Explain Use of power tools, cords, GFCI, etc.
- Safety Training for Qualified Workers
- Should be conducted at least every 3 years
 - Plant Management
 - Qualified Electrical Workers

Provide Safety Training

- Hazards of Electricity
- Safe Work Practices
 - PPE
 - Flame Resistant (FR) Clothing
 - Tools
 - LOTO
 - Approach Boundaries
 - Rescue practices
 - Shock
 - Release from Contact with Live Parts



Provide Safety Training

- Requirements for Electrical Equipment
 - Labeling
 - Clearance Distances
 - In front of panels
 - From overhead lines
 - MCC Requirements

 WARNING	
Arc Flash Hazard	
8 cal/cm²	PPE required - Category 2
1.5 feet	Working distance
8 feet	Flash hazard boundary
Under 1 KV	

Provide Technical Training

- Basic Electrical Maintenance Skills class
 - Use of a contractor to train and evaluate workers – one example: “Electrical Training USA”
 - Help develop the curriculum (What you need)
 - Basic Electricity
 - Single Line Diagrams
 - Use of a Voltage Detector Device
 - Starters (components & function)
 - Motors
 - Transformers
 - Evaluate every electrical worker using a meter
 - Required by NFPA 70E



Provide Technical Training

- Electrician trains & evaluates qualified workers
 - How to troubleshoot before resetting an overload or tripped breaker, or replacing a fuse – make sure it is not an electrical “problem”
 - Changing motors
 - Electrician informs plant management that on this day the “Qualified” worker performed the task just like they would have

Provide Training

- Electrical Workers need to be knowledgeable to know how to stay safe
- Supervisors need to be knowledgeable to know how to properly lead & monitor their workers and contractors

#3 Strategy –

Provide Electrical Safety and Technical Training

Key Strategy #4

**Provide & Maintain
Electrical PPE and
FR Clothing**

PPE & Clothing



- Workers knowing what to wear in every situation is critical for staying safe
- PPE & Clothing is designed to prevent death, not to prevent injury
- NFPA 70E provides guidelines
- Workers must be well trained to be prepared in every situation

PPE & Clothing

- Gloves are my #1 Safety PPE
 - Rubber to protect from Shock
 - Leather to protect rubber glove & from Burns from Blast
- Hands are most like place to be shocked
- Select the correct gloves
- Inspect before each day's use
- Send in for testing every 6 months

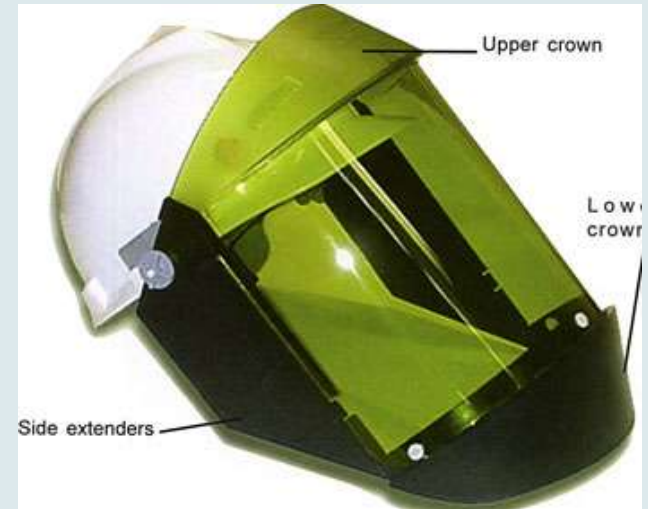


PPE & Clothing

- FR Rated Clothing is Vitally Important
- Based on Hazard Risk Category (0, 1, 2, 2*, 3, 4)
- Ratings in Calorie per Square Centimeter (1.2, 4, 8, 25, 40 & over 40)
- Prevent third degree burns
- Clothing on fire after an arc blast a HUGE hazard
 - Long sleeves, long pants
 - Button up! – Do not roll up sleeves

PPE & Clothing

- Face and Head Protection
- Double Layer Switching Hood
- Face Shield and Balaclava
- Voltage Rated Hard Hat
- Safety Glasses



PPE & Clothing

- Ensure PPE & Clothing Properly Cared For
 - Storage
 - Cleaning
- Ensure Employees have what they need and use it – EVERY TIME!

#4 Strategy –

Provide & Maintain Electrical PPE and Clothing

Key Strategy #5

**Provide Leadership to
Ensure Compliance**

Provide Leadership

- Expect Rules to be Followed Every Time
- Find out WHY a rule might not be followed
 - Equipment not available?
 - Equipment not being taken care of?
 - Not properly trained?
 - Do not consider rules to be important?
- Do not force electrical workers to work too fast
 - Every move must be planned and deliberate

Provide Leadership

- Provide regular feedback
 - Positive Feedback is best
 - Let's everyone know what is expected
 - The more positive feedback the better!
- Examples of Positive “Pinpointed” Feedback
 - “Good to see you wearing your gloves”
 - “Make sure you take the time to change to FR Clothing”
 - “It is really important that you shut off the power first! Good work!”
- Examples of Feedback Sending the Wrong Message
 - “Can you see how long that truck line is?”
 - “We all would like to get out of here sometime tonight, OK?”

Provide Leadership

- If Manager or Supervisor does not address why the rule was not followed, they are in effect saying it is OK to break the rules
- Don't be the one who says "I told him a hundred times"
- Draw the line in the sand
- Would rather fire someone than to see them seriously hurt at work

Provide Leadership

- You can buy PPE & Clothing and train constantly BUT if you do not provide positive feedback and enforce your rules, you will not likely have 100% compliance!

#5 Strategy –

Provide Leadership to Ensure Compliance

Conclusion

- Electrical workers must know possible hazards
- Management must approve Electrical Workers
- Electrical workers need to be knowledgeable
- Supervisors also need to know what is expected (Confidence in knowing the requirements)
- Training, PPE, Tools, and Time are all important ingredients

Conclusion

- The most important requirement: Leadership

Leadership is Always the Problem!

Leadership is Always the Answer!!

Questions??

- Thank You for your time and attention.