Risk Assessment and Fatality Prevention

Hank Schmulling, Duke Energy
Duke Energy – Fast Facts

- Fortune 250 company (NYSE).
  - Market capitalization: $50B; 2013 revenues: $25B

- U.S. regulated utility operations:
  - 7.2 million electric retail customers (IN, OH, KY, NC, SC, FL).
  - 500,000 gas customers (OH/KY).
  - 50,000 MW generation.

- Other operations:
  - Renewables: Wind and solar in 12 states (1,800 MW).
  - International: Latin America generation (5,000 MW).

- 27,948 employees.
Fatality Prevention Strategy

- Partner with EEI and ORC on strategy and metrics.
- Educate leadership on new paradigm.
- Institutionalize SIF metrics.
- Analyze data to identify precursors.
- Hazard identification, evaluation, and control.
Our Challenge

- Fatalities have occurred in 11 of 12 years. No apparent downward trend.
- There appears to be no correlation between injury reduction and fatality reduction.
- Other industries are experiencing similar results.
### Main Causes of Fatalities – 1998 to 2014

<table>
<thead>
<tr>
<th>Causes</th>
<th>Employees</th>
<th>Contractors</th>
<th>Total Employee and Contractor Fatalities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Vehicle Operations - Highway</td>
<td>5</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>Electrical Hazards</td>
<td>3</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Fall from Elevation</td>
<td>1</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Dropped/ Falling object</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Hazardous Energy (Lockout/Tagout)</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Confined Space Entry</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
Gap Analysis Approach

2014
- **Hazard Identification**
  - Developed **Keys to Life** for each business unit. The Keys to Life identify hazards of high risk activities known to cause fatalities and define behaviors necessary to prevent fatalities.
  - Communicated to employees in each business unit

2015
- **Hazard Evaluation**
  - Hazards of Keys to Life assessed in workshops using risk assessment tool.
  - Teams evaluated effectiveness of current controls.
  - Teams identified additional controls necessary to lower risk.
  - Recommendations for additional controls presented to management.

- **Hazard Control**
  - Management reviewed and approved additional controls.
  - Control plans developed to assign responsibility and due dates.
  - Business units to implement near and long term actions.
  - Business units to monitor effectiveness of controls.
Identifying the hazards in high-risk activities is a vital step to eliminating facilities. The Keys to Life highlights hazards you may encounter and defines behaviors to help maintain your safety.

We can achieve a zero-injury culture when we work according to our Safety Principles: personal accountability, hazard recognition and active caring. Continue to put safety first in all tasks by performing thorough pre-job briefings, wearing appropriate personal protective equipment and following existing procedures.

Hazardous energy control (lockout/tagout)
All sources of hazardous energy shall be properly identified, isolated, verified to have zero energy and tagged/locked prior to starting work. Do not manipulate isolated equipment or work on equipment without authorization.

Electrical safety (for Generation and other business units)
Treat all electrical equipment or systems as energized unless verified to be de-energized. Wear proper personal protective equipment (PPE) and remove all metal jewelry prior to performing electrical work. Only qualified persons shall work near exposed energized equipment. Unqualified persons shall not open enclosures that contain exposed energized electrical parts or equipment. Maintain required distances from electrical equipment and conductors.

Chemical safety
Toxic and hazardous releases and exposures to numerous chemicals can be fatal to workers. Safety data sheets (SDSs) are available and shall be reviewed before working with chemicals. Never work with chemicals without understanding their associated hazards and the controls necessary to perform work safely when considering those hazards.

Fall from elevation
Use appropriate fall protection equipment when required by the task. Inspect equipment before use and use it properly. Maintain three points of contact when changing elevation.

Driving safety
Wear seat belts, follow posted speed limits and comply with regulations. Avoid distractions that would remove your focus from the road.

Dropped objects/falling objects
Implement prevention measures where there is a potential for dropped objects. Measures shall include, at a minimum, proper barriers, exclusion zones and securing/tethering of tools and materials.

Work on waterboating hazards
Personal flotation devices shall be worn when working on water. Establish and communicate a float plan prior to departure. Maintain a means of communication with a land-based contact. Be familiar with aquatic search and rescue.

Confined spaces
Enter confined spaces only after the proper evaluation has been performed and appropriate controls have been put in place. Confirm acceptable atmospheric air quality prior to entering with an approved monitor. When required, a qualified attendant shall be present and an air quality monitor shall be in continuous use.

Heavy equipment operations
The use of spotters is required in congested areas. The operator and the spotter must use communication techniques such as radio and hand signals to assure safe operation. Do not approach or enter the path of heavy equipment without making contact with the operator.

Hazardous (classified) locations
Hazardous (Classified) Locations are areas where fire or explosion hazards may exist due to flammable gases or vapors, flammable liquids, combustible dust, or ignitable fibers or fumes. Control sources of ignition based on the location, type, condition and nature of hazardous substances present.

Cranes, lifting and rigging
Employees performing crane and rigging operations shall be qualified. Cranes and rigging shall be inspected prior to use. Critical lifts shall be strictly controlled and accompanied by a critical lift plan. Maintain positive control of loads and avoid lifting over personnel.
Gap Analysis Process

- Business unit appointed team sponsor and members.

- H&S facilitated workshop with each team to:
  - Identify high risk tasks related to the Keys to Life.
  - Use the Risk Assessment & Prioritization tool to:
    - Identify current controls of the high risk tasks.
    - Evaluate risk score with current controls.
    - Identify additional controls.
    - Evaluate new risk score with additional controls.
  - Create control plan with additional controls recommended.

- Business units own the control plan and track implementation to completion.
Quantitative risk assessment technique.

Assigns numeric values to Probability, Frequency, and Consequence.

Calculates Risk Score = P x F x C

Sorts Risk Scores into six Risk Level Categories with Action Steps defined for each level.
Administrative:
- Training
- Planned Inspections
- Audits
- Task Observation
- Supervision
- Hazard Recognition & Risk Assessment

PPE:
(for critical tasks)
- Personal fall arrest equipment
- Flame retardant clothing
- Respirator

Administrative:
- Procedures
- Work Methods
- Permits
- Design Standards
- Preventive Maintenance

Engineering:
- Elimination
- Isolation
- Enclosure
- Ventilation
- Safety-rated

Layers of Protection Effectiveness and Reliability

Stronger ← Layers of Protection (LOP) → Weaker

HAZARD

RECEIVER:
- People
- Equipment
- Material
- Environment
Hierarchy Of Controls And LOP Effectiveness

- Elimination
- Substitution
- Isolation
- Engineering
- Administration
- Personal Protective Equipment

Effectiveness Levels:
- Highly Effective
- Effective
- Somewhat Effective
- Somewhat Ineffective
- Ineffective
- Highly Ineffective
In the workshop we discuss controls at length:

- Are the right controls in place?
- Are there enough controls of sufficient strength?
- How reliable are the controls and how prone to human error?
- How well are key controls monitored for failure?
## Risk Factor Selection Worksheet

**Hazard Characterization**
- What is the specific hazard of concern? Focus on a single activity or scenario.
  - A hazard is a condition with the potential of causing injury, illness, or damage to property or the environment.
  - List the hazard of concern for a specific task per row.

**Intended Controls and Safeguards**
- List existing controls (Layers of Protection) that are currently intended to control the risk level of the hazard. (Use one cell for all controls and refer to Table A.1 or Table A.2)
- Include both preventive and mitigating controls and identify what you consider to be key controls.
- (Use Effectiveness of Controls to help determine Probability Factor)

**Uncertainty of Intended Controls and Safeguards**
- How does a failed, inappropriate, or undetected control impact the probability that an event might occur?
- How could an existing safeguard or control fail?
- Consider the Hierarchy of Controls (Adjust Probability Factor if uncertainty exists for the effectiveness of controls)
- (Use Effectiveness of Controls to help determine Probability Factor)

**Opportunity for Exposure to the Hazard**
- Consider Length of Time & Frequency of Exposure to the Hazard
- (Use to help determine Frequency Factor)

**Failure of Controls Scenario (Undesired Consequence)**
- If the hazard is not properly controlled, describe the most likely consequence or concern as the result of a failed control.
- (Use to help determine Consequence Factor)

**Probability Of Control**
- What is the likelihood of existing controls not working as intended? (Safeguards / LOC)
  - Consider the effectiveness of the controls.
  - Choose the factor of "1" if personnel exposure is not applicable.

**Frequency Of Exposure**
- How often does the task or how long does personnel exposure to the hazard occur?
  - Choose the factor of "1" if personnel exposure is not applicable.

**Consequence Severity**
- If a key control does not work as intended, what is the most likely consequence?
  - Consider the effectiveness of the controls.

**Risk Level Score**
- P x F x C

### Example Calculation

<table>
<thead>
<tr>
<th>Hazard Characterization</th>
<th>Intended Controls and Safeguards</th>
<th>Uncertainty of Intended Controls and Safeguards</th>
<th>Opportunity for Exposure to the Hazard</th>
<th>Failure of Controls Scenario (Undesired Consequence)</th>
<th>Probability Of Control</th>
<th>Frequency Of Exposure</th>
<th>Consequence Severity</th>
<th>Risk Level Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work on pipe, hazard of burn from hot water.</td>
<td>Training, PPE, Inadequate training; PPE not worn; Oscillating use; 3rd degree burns.</td>
<td></td>
<td></td>
<td></td>
<td>0.5 - Highly Effective</td>
<td>1.0 - Very rare</td>
<td>1 - Near Miss</td>
<td>0 to 11 (Level I Risk)</td>
</tr>
<tr>
<td>Install relief valve</td>
<td>Relief valve failure unlikely, Oscillating use; No injury, Possible near miss.</td>
<td></td>
<td></td>
<td></td>
<td>1 - Highly Ineffective</td>
<td>6 - Repetitive</td>
<td>100 - Catastrophic</td>
<td>16001 to 48000 (Level VI Risk)</td>
</tr>
</tbody>
</table>

### Table A.1

<table>
<thead>
<tr>
<th>Hazard Characterization</th>
<th>Intended Controls and Safeguards</th>
<th>Uncertainty of Intended Controls and Safeguards</th>
<th>Opportunity for Exposure to the Hazard</th>
<th>Failure of Controls Scenario (Undesired Consequence)</th>
<th>Probability Of Control</th>
<th>Frequency Of Exposure</th>
<th>Consequence Severity</th>
<th>Risk Level Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work on pipe, hazard of burn from hot water.</td>
<td>Training, PPE, Inadequate training; PPE not worn; Oscillating use; 3rd degree burns.</td>
<td></td>
<td></td>
<td></td>
<td>0.5 - Highly Effective</td>
<td>1.0 - Very rare</td>
<td>1 - Near Miss</td>
<td>0 to 11 (Level I Risk)</td>
</tr>
<tr>
<td>Install relief valve</td>
<td>Relief valve failure unlikely, Oscillating use; No injury, Possible near miss.</td>
<td></td>
<td></td>
<td></td>
<td>1 - Highly Ineffective</td>
<td>6 - Repetitive</td>
<td>100 - Catastrophic</td>
<td>16001 to 48000 (Level VI Risk)</td>
</tr>
</tbody>
</table>

### Table A.2

<table>
<thead>
<tr>
<th>Hazard Characterization</th>
<th>Intended Controls and Safeguards</th>
<th>Uncertainty of Intended Controls and Safeguards</th>
<th>Opportunity for Exposure to the Hazard</th>
<th>Failure of Controls Scenario (Undesired Consequence)</th>
<th>Probability Of Control</th>
<th>Frequency Of Exposure</th>
<th>Consequence Severity</th>
<th>Risk Level Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work on pipe, hazard of burn from hot water.</td>
<td>Training, PPE, Inadequate training; PPE not worn; Oscillating use; 3rd degree burns.</td>
<td></td>
<td></td>
<td></td>
<td>0.5 - Highly Effective</td>
<td>1.0 - Very rare</td>
<td>1 - Near Miss</td>
<td>0 to 11 (Level I Risk)</td>
</tr>
<tr>
<td>Install relief valve</td>
<td>Relief valve failure unlikely, Oscillating use; No injury, Possible near miss.</td>
<td></td>
<td></td>
<td></td>
<td>1 - Highly Ineffective</td>
<td>6 - Repetitive</td>
<td>100 - Catastrophic</td>
<td>16001 to 48000 (Level VI Risk)</td>
</tr>
</tbody>
</table>

### Table A.3

<table>
<thead>
<tr>
<th>Hazard Characterization</th>
<th>Intended Controls and Safeguards</th>
<th>Uncertainty of Intended Controls and Safeguards</th>
<th>Opportunity for Exposure to the Hazard</th>
<th>Failure of Controls Scenario (Undesired Consequence)</th>
<th>Probability Of Control</th>
<th>Frequency Of Exposure</th>
<th>Consequence Severity</th>
<th>Risk Level Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work on pipe, hazard of burn from hot water.</td>
<td>Training, PPE, Inadequate training; PPE not worn; Oscillating use; 3rd degree burns.</td>
<td></td>
<td></td>
<td></td>
<td>0.5 - Highly Effective</td>
<td>1.0 - Very rare</td>
<td>1 - Near Miss</td>
<td>0 to 11 (Level I Risk)</td>
</tr>
<tr>
<td>Install relief valve</td>
<td>Relief valve failure unlikely, Oscillating use; No injury, Possible near miss.</td>
<td></td>
<td></td>
<td></td>
<td>1 - Highly Ineffective</td>
<td>6 - Repetitive</td>
<td>100 - Catastrophic</td>
<td>16001 to 48000 (Level VI Risk)</td>
</tr>
</tbody>
</table>

### Table A.4

<table>
<thead>
<tr>
<th>Hazard Characterization</th>
<th>Intended Controls and Safeguards</th>
<th>Uncertainty of Intended Controls and Safeguards</th>
<th>Opportunity for Exposure to the Hazard</th>
<th>Failure of Controls Scenario (Undesired Consequence)</th>
<th>Probability Of Control</th>
<th>Frequency Of Exposure</th>
<th>Consequence Severity</th>
<th>Risk Level Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work on pipe, hazard of burn from hot water.</td>
<td>Training, PPE, Inadequate training; PPE not worn; Oscillating use; 3rd degree burns.</td>
<td></td>
<td></td>
<td></td>
<td>0.5 - Highly Effective</td>
<td>1.0 - Very rare</td>
<td>1 - Near Miss</td>
<td>0 to 11 (Level I Risk)</td>
</tr>
<tr>
<td>Install relief valve</td>
<td>Relief valve failure unlikely, Oscillating use; No injury, Possible near miss.</td>
<td></td>
<td></td>
<td></td>
<td>1 - Highly Ineffective</td>
<td>6 - Repetitive</td>
<td>100 - Catastrophic</td>
<td>16001 to 48000 (Level VI Risk)</td>
</tr>
</tbody>
</table>
List the hazard

List intended controls for the hazard

Assess the uncertainty of the intended controls

<table>
<thead>
<tr>
<th>Hazard Characterization</th>
<th>Intended Controls and Safeguards</th>
<th>Uncertainty of Intended Controls and Safeguards</th>
<th>Opportunity for Exposure to the Hazard</th>
<th>Failure of Controls Scenario (Undesired Consequence)</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the specific hazard of concern? Focus on a single activity or scenario. A hazard is a condition with the potential of causing injury, illness, or damage to property or the environment. (List the hazard of concern for a specific task per row)</td>
<td>List existing controls (Layers of Protection) that are currently intended to control the risk level of the hazard. (Use one cell for all controls) Include both preventive and mitigating controls and identify what you consider to be KEY controls. (Use Effectiveness of Controls to help determine Probability Factor)</td>
<td>How does a failed, inappropriately selected or degraded existing control impact the probability that an event might occur? How could an existing safeguard or control fail? Consider the Hierarchy of Controls (Adjust Probability Factor if uncertainty exists for the effectiveness of controls.)</td>
<td>Consider Length of Time &amp; Frequency of Exposure to the Hazard (Use to help determine Frequency Factor)</td>
<td>If the hazard is not properly controlled, describe the most likely consequence of concern as the result of a failed control (Use to help determine Consequence Factor)</td>
</tr>
</tbody>
</table>
### Determine opportunity for exposure (i.e. frequency)

1. **Hazard Characterization**
   - What is the specific hazard of concern? Focus on a single activity or scenario.
   - A hazard is a condition with the potential of causing injury, illness, or damage to property or the environment.
   - (List the hazard of concern for a specific task per row)

2. **Intended Controls and Safeguards**
   - List existing controls *(Layers of Protection)* that are currently intended to control the risk level of the hazard.
   - (Use one cell for all controls)
   - Include both preventive and mitigating controls and identify what you consider to be KEY controls.
   - (Use Effectiveness of Controls to help determine Probability Factor)

3. **Uncertainty of Intended Controls and Safeguards**
   - How does a failed, inappropriately selected or degraded existing control impact the probability that an event might occur?
   - Consider the Hierarchy of Controls
   - (Adjust Probability Factor if uncertainty exists for the effectiveness of controls)

4. **Opportunity for Exposure to the Hazard**
   - Consider Length of Time & Frequency of Exposure to the Hazard
   - (Use to help determine Frequency Factor)

### Identify “most likely” failure scenario

5. **Failure of Controls Scenario (Undesired Consequence)**
   - If the hazard is not properly controlled, describe the most likely consequence of concern as the result of a failed control
   - (Use to help determine Consequence Factor)
Probability X Frequency X Consequence = Risk Score

with current controls

<table>
<thead>
<tr>
<th>Probability Of Control</th>
<th>Frequency Of Exposure</th>
<th>Consequence Severity</th>
<th>Risk Level Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 - Highly Effective</td>
<td>1.0 - Very rare</td>
<td>1 - Near Miss</td>
<td>0 to 11 (Level I Risk)</td>
</tr>
<tr>
<td>1.0 - Effective</td>
<td>1.5 - Rare</td>
<td>3 - Minor</td>
<td>12 to 80 (Level II Risk)</td>
</tr>
<tr>
<td>2.0 - Somewhat Effective</td>
<td>2 - Unusual</td>
<td>7 - Moderate</td>
<td>81 to 160 (Level III Risk)</td>
</tr>
<tr>
<td>4.0 - Somewhat Ineffective</td>
<td>3 - Occasional</td>
<td>15 - Serious</td>
<td>161 to 600 (Level IV Risk)</td>
</tr>
<tr>
<td>6.0 - Ineffective</td>
<td>4 - Daily</td>
<td>40 - Severe</td>
<td>601 to 1600 (Level V Risk)</td>
</tr>
<tr>
<td>8.0 - Highly Ineffective</td>
<td>6 - Repetitive</td>
<td>100 - Catastrophic</td>
<td>1601 to 4800 (Level VI Risk)</td>
</tr>
</tbody>
</table>

6  3  40  720
### Tooltips – Hover over each cell

#### Probability Of Control
What is the likelihood of existing controls not working as intended? (Safeguards / LOP)
Consider the effectiveness of the controls.
- 0.5 - Highly Effective
- 1.0 - Effective
- 2.0 - Somewhat Effective
- 4.0 - Somewhat Ineffective
- 6.0 - Ineffective
- 8.0 - Highly Ineffective

#### Frequency Of Exposure
How often does the task or how long does personnel exposure to the hazard occur?
Choose the factor of “1” if personnel exposure is not applicable.
- 1 - Occasional
- 4 - Daily

#### Consequence Severity
If a key control does not work as intended, what is the most likely consequence?
Consider the effectiveness of the controls.
- 15 - Serious
- 40 - Severe

#### Risk Level Score
\[ P \times F \times C \]
- 0 to 11 (Level I Risk)
- 12 to 80 (Level II Risk)
- 81 to 160 (Level III Risk)
- 161 to 600 (Level IV Risk)
- 601 to 1600 (Level V Risk)
- 1601 to 4800 (Level VI Risk)
Objective -- Reduce the Risk Score

- Team identifies additional controls for the specific hazard to reduce the risk score.

<table>
<thead>
<tr>
<th>Probability Of Control</th>
<th>Frequency Of Exposure</th>
<th>Consequence Severity</th>
<th>Risk Level Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 - Highly Effective</td>
<td>1.0 - Very rare</td>
<td>1 - Near Miss</td>
<td>0 to 11 (Level I Risk)</td>
</tr>
<tr>
<td>1.0 - Effective</td>
<td>1.5 - Rare</td>
<td>3 - Minor</td>
<td>12 to 80 (Level II Risk)</td>
</tr>
<tr>
<td>2.0 - Somewhat Effective</td>
<td>2 - Unusual</td>
<td>7 - Moderate</td>
<td>81 to 160 (Level III Risk)</td>
</tr>
<tr>
<td>4.0 - Somewhat Ineffective</td>
<td>3 - Occasional</td>
<td>15 - Serious</td>
<td>161 to 600 (Level IV Risk)</td>
</tr>
<tr>
<td>6.0 - Ineffective</td>
<td>4 - Daily</td>
<td>40 - Severe</td>
<td>601 to 1500 (Level V Risk)</td>
</tr>
<tr>
<td>8.0 - Highly Ineffective</td>
<td>6 - Repetitive</td>
<td>100 - Catastrophic</td>
<td>1601 to 4800 (Level VI Risk)</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>3</td>
<td>720</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>
## Tooltips – Hover over each cell

<table>
<thead>
<tr>
<th>Probability Of Control</th>
<th>Frequency Of Exposure</th>
<th>Consequence Severity</th>
<th>Risk Level Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5 - Highly Effective</td>
<td>1.0 - Very rare</td>
<td>1 - Near Miss</td>
<td>P x F x C</td>
</tr>
<tr>
<td>1.0 - Effective</td>
<td>1.5 - Rare</td>
<td>3 - Minor</td>
<td></td>
</tr>
<tr>
<td>2.0 - Somewhat Effective</td>
<td>2 - Unusual</td>
<td>7 - Moderate</td>
<td></td>
</tr>
<tr>
<td>4.0 - Somewhat Ineffective</td>
<td>3 - Occasional</td>
<td>15 - Serious</td>
<td></td>
</tr>
<tr>
<td>6.0 - Ineffective</td>
<td>4 - Daily</td>
<td>40 - Severe</td>
<td></td>
</tr>
<tr>
<td>8.0 - Highly Ineffective</td>
<td>6 - Repetitive</td>
<td>100 - Catastrophic</td>
<td></td>
</tr>
</tbody>
</table>

### Notes:
- **Probability Of Control**: What is the likelihood of existing controls not working as intended? (Safeguards / LOP)
- **Frequency Of Exposure**: How often does the task or how long does personnel exposure to the hazard occur?
- **Consequence Severity**: If a key control does not work as intended, what is the most likely consequence?
- **Risk Level Score**: Consider the effectiveness of the controls.
<table>
<thead>
<tr>
<th>Key to Life</th>
<th>Highest Risk Activity</th>
<th>Before/ After</th>
<th>Example Recommended Controls</th>
</tr>
</thead>
</table>
| Heavy Equipment | Working and walking around earth-moving equipment (e.g. excavators, dump trucks, bulldozers, skid steers). Crushing or rollover hazard. | 1200/800 400  | - Develop procedure that imposes restricted work areas around heavy equipment (e.g. *Man on the Ground*).  
- Develop Working Around Heavy Equipment training.  
- Develop procedure to define Traffic Management Plan requirements.  
- Utilize telescopic conveyors when working in tight areas  
- Require specific training for non OSHA heavy equip with contractors (recognized training)  
- Close proximity Warning Devices to alert operator/pedestrian of nearby hazards.  
- GPS Restricted Route Control; Reversing cameras on dump trucks and others with limited visibility & reversing sensors (sonar). |

**Actual Workshop Example**

**First Pass - 400 point reduction in risk score**

**2nd Pass - additional 200 point reduction**
Another example

- **Before:** Free climbing wood poles

- **After:** Climbing wood poles with wood pole fall protection device
  - *Not green??? -- Some residual risk – employees still have to use it correctly.*
# Risk Level Dictates Degree of Action

## Risk Assessment and Prioritization (RAP) Tool

Choose Most Appropriate Factor For Each Column

<table>
<thead>
<tr>
<th>P - Probability Of Control</th>
<th>F - Frequency Of Exposure</th>
<th>C - Consequence Severity</th>
<th>Risk Level Score</th>
<th>ACTION STEPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the likelihood of existing controls not working as intended? (Safeguards / LOP)</td>
<td>How often or how long does personnel exposure to the hazard occur?</td>
<td>If a control does not work as intended, what is the most likely consequence?</td>
<td>P x F x C</td>
<td></td>
</tr>
<tr>
<td>Consider the effectiveness of the controls.</td>
<td>Choose the factor of “1” if personnel exposure is not applicable.</td>
<td>Consider the effectiveness of the controls.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>0.5 - Highly Effective</th>
<th>1.0 - Very rare</th>
<th>1 - Very Minor / Near Miss</th>
<th>0 to 11 (Level I Risk)</th>
<th>Maintain Current Risk Controls, PERIODICALLY EVALUATE RISK LEVEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 - Effective</td>
<td>1.5 - Rare</td>
<td>3 - Minor</td>
<td>12 to 80 (Level II Risk)</td>
<td>Maintain Current Risk Controls, CONDUCT REGULAR EVALUATION OF RISK LEVEL</td>
</tr>
<tr>
<td>2.0 - Somewhat Effective</td>
<td>2 - Unusual</td>
<td>7 - Moderate</td>
<td>81 to 160 (Level III Risk)</td>
<td>Further Risk Reduction is Recommended, CONDUCT CORRECTIVE ACTION ANALYSIS</td>
</tr>
<tr>
<td>4.0 - Somewhat Ineffective</td>
<td>3 - Occasional</td>
<td>15 - Serious</td>
<td>161 to 600 (Level IV Risk)</td>
<td>Further Risk Reduction is Required, IMPLEMENT CORRECTIVE ACTION</td>
</tr>
<tr>
<td>6.0 - Ineffective</td>
<td>4 - Daily</td>
<td>40 - Severe</td>
<td>601 to 1600 (Level V Risk)</td>
<td>Further Risk Reduction is Required, HIGH PRIORITY CORRECTIVE ACTION MUST BE IMPLEMENTED</td>
</tr>
<tr>
<td>8.0 - Highly Ineffective</td>
<td>6 - Repetitive</td>
<td>100 - Catastrophic</td>
<td>1601 to 4800 (Level VI Risk)</td>
<td>IMMEDIATE Risk Reduction is Required, SHUTDOWN OF OPERATION AT POINT OF HAZARD COULD BE REQUIRED UNTIL THE LEVEL OF RISK IS REDUCED</td>
</tr>
</tbody>
</table>

[EEI logo]
Objective - Improving the Risk Profile

Current Controls

Proposed Controls

Implemented Controls

* Theoretical Risk Scores. Actual scores available soon.
Next Steps

- Finalize control plans.
- Implement controls.
- Monitor effectiveness.
- Maintain focus on risk management long term.
Questions?

- RAP tool available with meeting materials.
- For more information:
  - hank.schmulling@duke-energy.com
  - kathy.wilmer@duke-energy.com

Keys to Life
Stay focused. Stay safe.
Appendix
### Action Plan:

<table>
<thead>
<tr>
<th>Keys to Life</th>
<th>Activity Analyzed</th>
<th>Planned Actions</th>
<th>Responsible Person</th>
<th>Due Date</th>
<th>Risk Score before Controls</th>
<th>Risk Score w/ New Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work on Water/Boating Hazards</td>
<td>Barge operations on rivers in the Midwest. Drowning/crushing hazards</td>
<td>Actions planned include...</td>
<td>PGO Sr. Manager</td>
<td>Mm/dd/yyyy</td>
<td>300</td>
<td>150</td>
</tr>
</tbody>
</table>