Predict and Prevent: The Art and Science of Proactive Design

NERC Human Performance Conference
Monika Bay
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What if you cannot detect something that can kill you?

Prevention

Correction

Detection
BGE by the numbers

- Oldest utility in the United States
- Merged into Exelon 2012
- Approximately 3,300 employees (includes ~ 1,100 field workers)

<table>
<thead>
<tr>
<th></th>
<th>Electric</th>
<th>Gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Territory</td>
<td>2,300 sq miles</td>
<td>3,057 sq miles</td>
</tr>
<tr>
<td>Customers</td>
<td>1,241,126</td>
<td>655,055</td>
</tr>
<tr>
<td>Transmission (500/230/115 kV)</td>
<td>1,292 miles</td>
<td>164 miles</td>
</tr>
<tr>
<td>Distribution Miles (4/13/34 kV)</td>
<td>25,159 miles</td>
<td>7,054 miles</td>
</tr>
<tr>
<td>Stations</td>
<td>244 substations</td>
<td>12 gate / 651 regulator</td>
</tr>
</tbody>
</table>
Our journey into proactive risk management

What we **can** see... yesterday’s events

What we **can’t** see... tomorrow’s events

Fatality
Injury
Near Miss
Systems  Behaviors
The STPRA* risk modeling process

- Predicts how failures can occur
- Shows how systems and behaviors are interconnected
- Assigns probabilities so we can quantify the risk
- Points to the primary risk drivers
- Helps us evaluate what’s changeable
- Helps us develop interventions that actually reduce the risk

*STPRA = Socio-Technical Probabilistic Risk Assessment
Pioneered by Outcome Engenuity
Among the highest risks we’ve identified

Gas ignition

Electrical contact

Digging

Joint trench
What the risk looks like
What the risk can lead to
What the risk can lead to
What the risk can lead to

What we can’t detect can kill us
Risk intervention

- Develop solution to detect presence of cable fault PRIOR to digging

78% RISK REDUCTION!
The other risk we uncovered
The other risk we uncovered
The other risk we uncovered
The problem is even bigger than we thought!

Left to right:
- (Y) Plastic tubing 1”
- (Y) 500 neutral
- (Y) 2/0 neutral
- (Y) Plastic tubing ½”
- (B) Plastic tubing ½”
- (B) 500 hot leg
- (B /YS) 3/0 neutral
- (Y) Plastic tubing ¾”
- (B/YS) 500 neutral
- (B/YS) Plastic tubing ½”
- (B/YS) 2/0 neutral
- (B) 2/0 hot leg
- (B) 4/0 hot leg
- (Y) Steel tubing ½”
- (B) 350 hot leg
It’s about detection and prevention!

- Fault detection solution for gas workers
- Gas detection solution for electric workers
- Cross discipline training on asset identification techniques and associated gas / electric hazards
Using risk modeling techniques to **detect** and address risk before something bad happens

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Greatest vulnerability</th>
<th>Primary intervention</th>
<th>Risk reduction projected</th>
<th>Risk reduction actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backing collisions <em>(demo project)</em></td>
<td>Switchtasking</td>
<td>STOP SCAN PRIMARY</td>
<td>66%</td>
<td>86%</td>
</tr>
<tr>
<td>Gas ignition – trench</td>
<td>Inability to detect electric fault</td>
<td>Intrinsically safe volt meter</td>
<td>78%</td>
<td></td>
</tr>
<tr>
<td>Electrical contact – trench</td>
<td>Aggressive digging</td>
<td>Soft dig tools</td>
<td>54%</td>
<td></td>
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<tr>
<td>Electrical contact – OH distribution</td>
<td>Wrong mental model</td>
<td>Anticipatory threat mgmt</td>
<td>35%</td>
<td></td>
</tr>
<tr>
<td>Line of fire</td>
<td>Risk monitor does not fire</td>
<td>Anticipatory threat mgmt</td>
<td>52%</td>
<td>49%</td>
</tr>
</tbody>
</table>
Questions