Puget Sound Energy
Barrier Boards
Overview

- General overview of an electrical contact incident
- Innovation from Tragedy
- Where we are today
General Incident Information

In 2016, a PSE Substation Crew was tasked with replacing a 13kV distribution breaker in an open air substation. While in the process of replacing the breaker, an Apprentice Wireman made contact with the 13kV bus. He recovered from his injuries and is back to work today as a Journeyman Wireman.

This accident led us to a new innovation in Substation Operations for protecting workers.
• The Wire crew was replacing a distribution breaker located between breakers that were energized on either side.

• The station could not be taken offline, the mobile substation wasn’t an option and circuits could not be picked up in the field.

• Crews designated energized components with caution tape and discussed dangers during job briefings. The crew was working outside of the regulated “Minimum Approach Distance” and performing the job safely.

• The job scope is common and was well planned. The crew was on day one of a four day job.
New Breaker Installation

• At the time of the injury, the employee was installing paddles on top of the new breaker. He had noticed a difference in the way bolts were installed on the neighboring energized breaker circuit #26 paddles. With the new paddle in hand he extended his arm and pointed to breaker #26 paddle.

• The employee was on a ladder. We estimate that as he pointed, he encroached within 3 inches of the energized paddle and there was an arch from the breaker through his body and exited his other hand which was resting on the newly installed breaker.

• He fell off the ladder and the crew responded and called EMS.
Source of Electricity:
The injured employee reached out with his right hand (copper paddle in hand) to point to a bolt configuration PCB 26. The bracket came within 3 inches of the energized drop (in circle, colored red). The electricity jumped the air gap to the paddle.

Pathway to Ground:
The injured employee’s left hand was resting on the lifting eye (in circle, colored blue). The breaker box had not yet been connected to the main substation grounding grid, however electricity was able to pass through the breaker box and find a pathway to ground through the concrete pad.
Copper paddle used by employee
Caution tape installed on the breakers that remained energized
Employee Status

- The apprentice received burns on both hands and temporarily had difficulty using his hands.
- He has now regained full use of both hands, passed his Wireman Journeyman exam and is now working as a PSE Substation Journeyman Wireman.
Post Incident

- PSE hired an outside consultant to conduct a root cause analysis and we cooperated with L&I in their investigation.
- The root cause analysis produced seven action items that could help reduce this risk in the future. Three of the seven would require significant design and infrastructure changes to many of existing substations; such as adding system redundancy in and out of the station, and increasing spacing between existing breakers. PSE is considering these, but our focus was on changes that could be made immediately to protect our workers. They included:
  1. Investigate the use of insulating barriers between breakers.
  2. Benchmarking with other utilities.
  3. Training.

The rest of this presentation will focus on #1.
The Evolution of the “Jarred Barrier”

• “Barrier” – A physical obstruction which is intended to prevent contact with energized lines or equipment or to prevent unauthorized access to a work area. WAC 296-45-035 Definitions.

• A team from PSE Substation Operations and Safety was formed to investigate industry solutions available to protect our craft workers when the working distances are close to energized equipment. After an extensive search, we determined that the barriers currently on market were not effective for our situation.

• The team decided to pursue making our own in-house solution.

• The team had multiple brainstorming sessions, and developed cardboard models. Using the models, the team went through an iterative design process using feedback from craft employees and road shows. Based on the discussions and design meetings, a working prototype was developed.
13kv Distribution Barrier Board
• Custom sized fiberglass barrier material to fit in between energized open air distribution circuit breakers.
• To be hung from the surrounding support steel by the use of hot sticks.
• Custom fiberglass hooks w/ plastic adjustable chain and various strategic holes to offer installation versatility, with different feeder bay assemblies.
• On site demonstrated and approved by Washington State Dept. Labor and Industries Inspectors.
115kv Open Sw. Barrier
• Used on 55kv-230kv open energized vertical or center side break gang operated switches.
• Installed on “Dead” side of an energized switch, so as to safely maintain or terminate the dead side of the switch.
• WAC 296-35-325 (10) It shall not be permissible to consider one part of a high voltage switch or disconnect as deenergized for the purpose of doing work on it if the remainder of the switch or disconnect remains energized, unless approved barriers are erected which will prevent employees who are doing work on such equipment, from coming in direct contact with the energized part.
• Custom HDPE fabricated hooks sized for various diameter switch arms.
• Also Washington State Dept. L & I approved.
Questions?