HEAF LIC-504 Public Meeting Notes

November 16, 2022

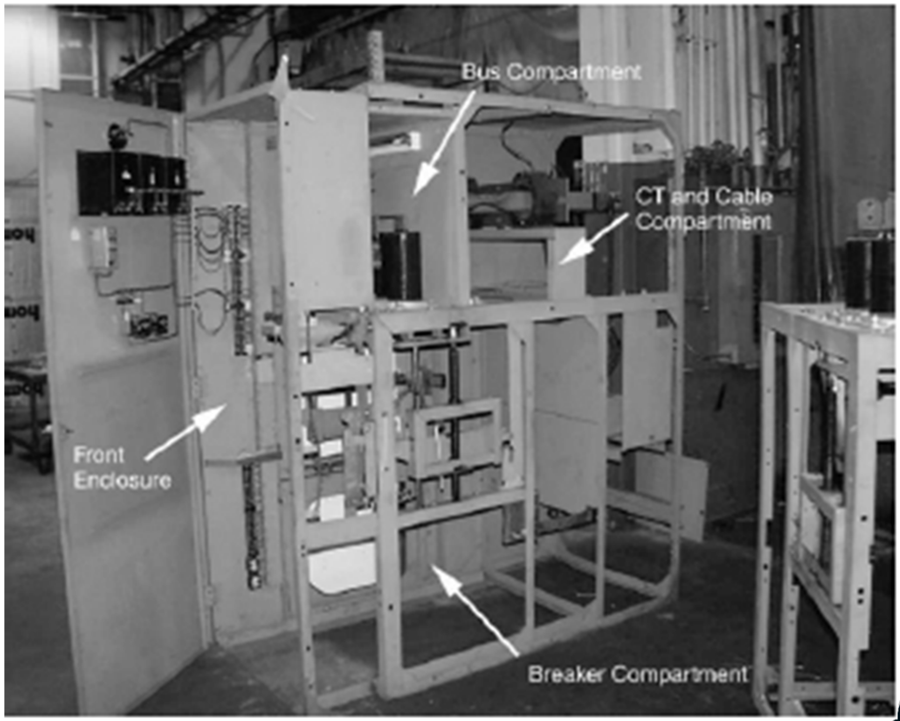
DUKE ENERGY®

Topics

- Importance of HEAFs
- HEAF prevention
- Application of the draft methodology

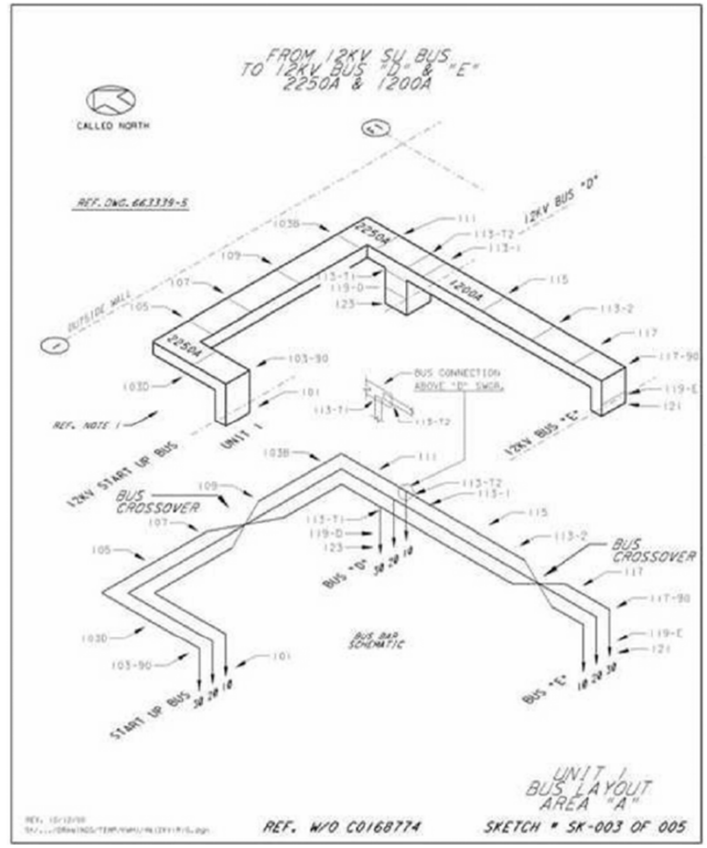
Importance of High Energy Arcing Faults (HEAFs)

- HEAFs are a hazard inherent to generating stations and any high-energy industrial application
- Can occur on both active (breaker) and passive (busbar) components in electrical distribution systems
- Primarily a generation risk due to conservative design and preventative operating practices



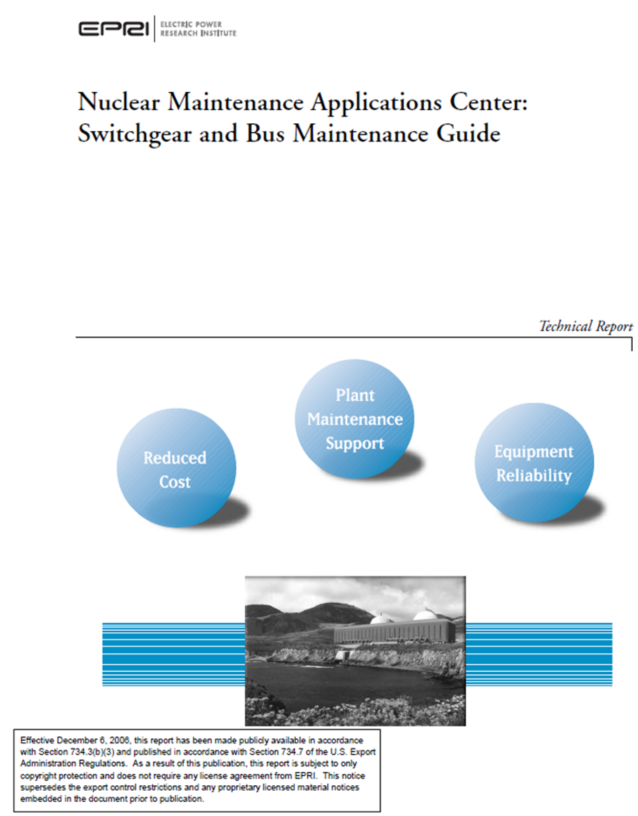
Importance of High Energy Arcing Faults (HEAFs)

- Degradation precursors are long-term and slow-developing
- Damage and energy release develops almost instantly once a HEAF occurs
- HEAF prevention and mitigation drive electrical system design and operating practices
- As with any high-energy or high-hazard system, safety is paramount



Prevention of HEAFs

- Design to prevent, protect, and mitigate
  - Protective relaying
  - HEAF shields
  - Clearance distances
  - Procurement
- Share and respond to Operational Experience
  - EPRI reports
  - OE reviews/communications
- Preventive maintenance and inspections
  - Especially on passive components
  - Clear inspection guidance is critical



Prevention of HEAFs

- Common failure mechanisms
  - Degraded insulation
  - Moisture or debris intrusion
  - Loosening of bolted connections due to cyclic heat/loads

- Technology upgrades have improved both design and testing capabilities
  - Partial discharge testing
  - fiber optic technology for temperature monitoring
  - acoustic monitoring
  - thermography.

Standard	Title
D 150-98 (R2004)	Standard Test Methods for AC Loss Characteristics and Permittivity (Dielectric Constant) of Solid Electrical Insulation
D 1654-1992	Standard Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments Document
D 229-2001	Test Methods for Rigid Sheet and Plate Materials Used for Electrical Insulation
D 257-99	Standard Test Methods for DC Resistance or Conductance of Insulating Materials
D 2671	Standard Test Methods for Heat-Shrinkable Tubing for Electrical Use
D 412-1998A (R2002) e1	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension
D 5374-93 (R2005)	Standard Test Methods for Forced-Convection Laboratory Ovens for Evaluation of Electrical Insulation
G 21-1996 (R2002)	Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
D 2303	Standard Test Methods for Liquid-Contamination, Inclined-Plane Tracking, and Erosion of Insulating Materials
B 187/B 187M – 02	Standard Specification for Copper, Bus Bar, Rod, and Shapes and General Purpose Rod, Bar, and Shapes

Draft Methodology Application

- Improved realism
  - switchgear zones of influence
  - NSBD ZOI shape
  - modeling differences across the electrical distribution zones
- New Insights
  - Importance of fault clearing times
- Effort to implement
  - Bus duct targets for the new ZOIs were a considerable effort to collect due to locations in overheads

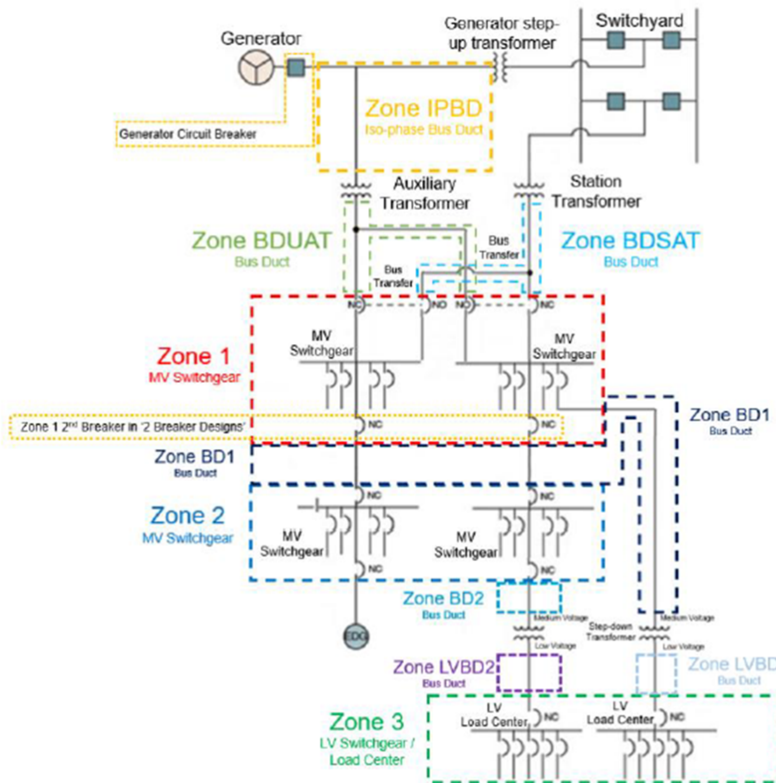


Figure 4.1-1: HEAF Fault Zones (Excerpt from Draft Methodology [3])

Questions