High Energy Arcing Faults (HEAF) Test Program Comment Resolution

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Objective

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- Update stakeholders on the disposition of outstanding comments
  - Initial comment period
  - April 2018 workshop
  - January 2019 public meeting
  - March 2019 public meeting
  - Other stakeholder interactions

Stakeholder Comments

Test Duration

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- Is an 8-second test realistic?
  - Operating Experience
    - Operating experience has identified multiple cases where prolonged duration events have occurred in both US and International OE
      - Medium Voltage prolonged duration events are consistent with generator-fed fault conditions and protection failure events
      - Low Voltage prolonged duration is plausible at currents which potentially fall between circuit protection set points

Stakeholder Comments

Test Duration (cont.)

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- Working Group activities
  - More realistic modeling
    - Modeling will NOT be one size fits all as currently in NUREG/CR-6850 EPRI 1011989
  - NRC/EPRI WG event tree/plant configuration and protection scheme taken into account
  - Low Voltage tests will be performed at 8 seconds under the acknowledgement that the results will only be applicable to specific configurations
    - The data from the low voltage tests will be investigated by the working group for the potential to inform medium voltage extended duration events beyond the test lab capability

Stakeholder Comments
Fault Location

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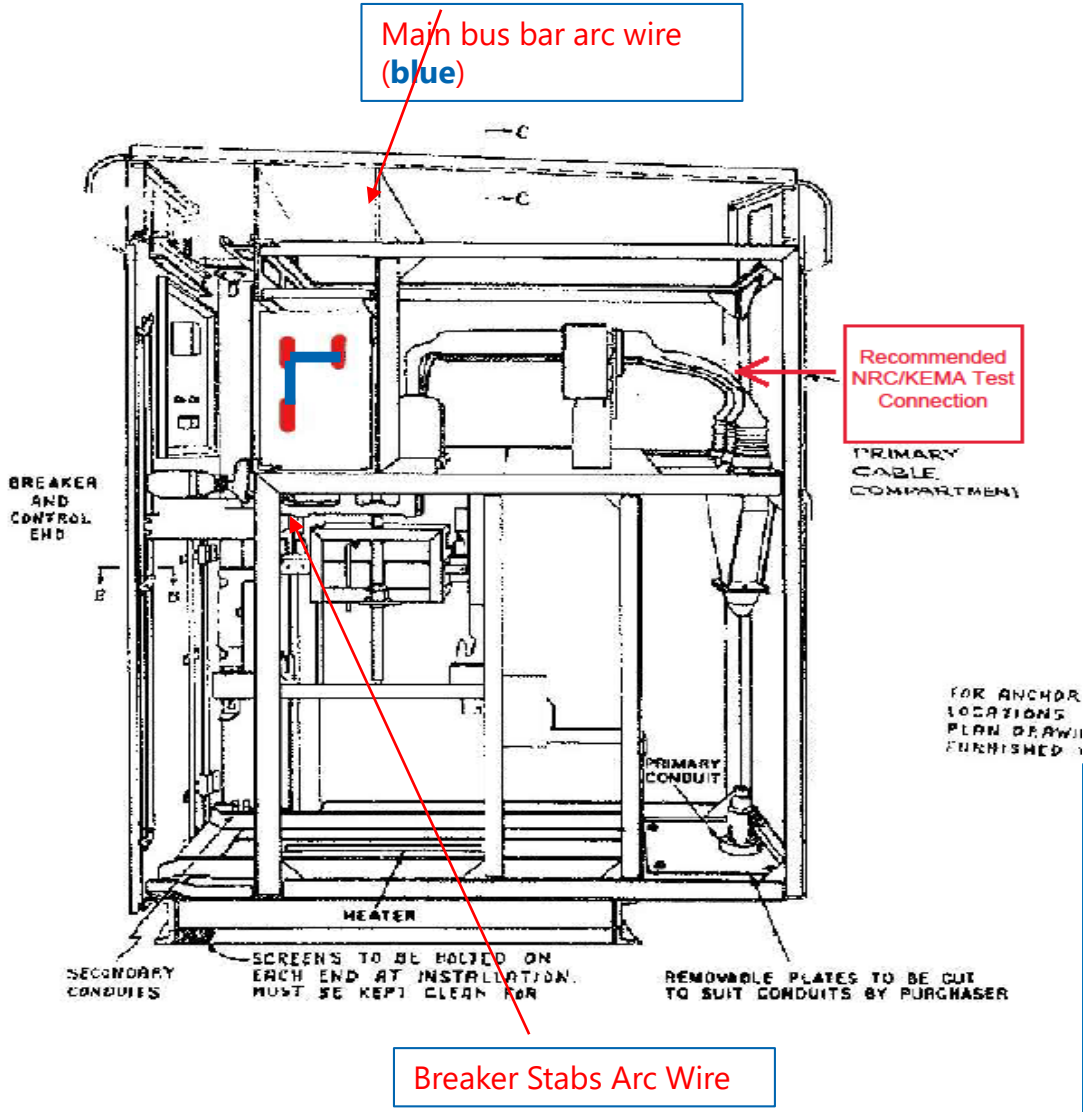
- OE on medium voltage switchgear HEAF events:
  - Majority of the medium voltage switchgear events occurred in the supply switchgear configuration
  - Majority of the faults occurred at the supply breaker stabs and main bus bars



Stakeholder Comments
Fault Location

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- Working Group Discussion
  - Supplementary test on the main bus bars in supply configuration to be conducted in 2020
  - Data from Phase I testing on the breaker stabs is being compiled for use in evaluating the impact of faults on the breaker
  - Potentially handled with split fraction in ZOI

Stakeholder Comments
Load Center Design

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- OE on low voltage HEAF events:
  - All low voltage events occurred in the load center supply cubicle
  - All faults initiated at the supply breaker stabs
- NRC has modified equipment from the initial test plan to include the supply cubicles

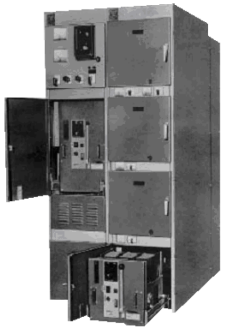

Figure 1 – Switchgear Cell

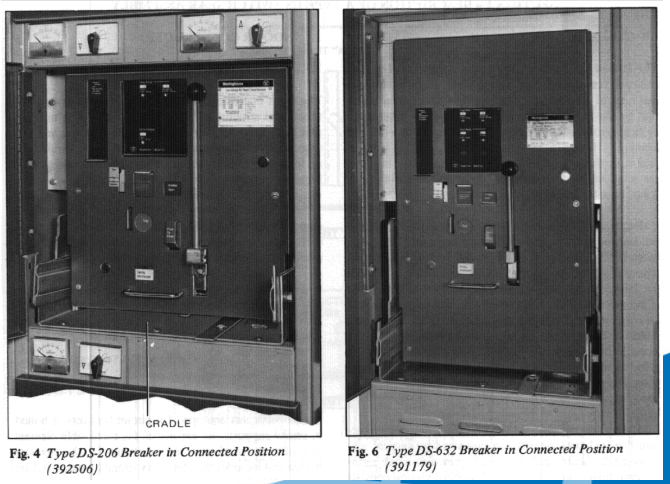

Fig. 4 *Type DS-206 Breaker in Connected Position (392506)*

Fig. 6 *Type DS-632 Breaker in Connected Position (391179)*

Stakeholder Comments
Supplementary Tests

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- Stakeholders have requested two types of supplementary tests:
  - Generator decay curve to more closely simulate generator-fed fault
  - Supply configuration switchgear test
- NRC plans to conduct both supplementary tests in Spring 2020

Stakeholder Comments
Modeling

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- The use of modeling to extend the applicable range of test data is being considered by the Working Group.
- Afternoon meeting will address:
  - Modeling approach
  - Data needs, inputs, and outputs
  - Validation and verification

Stakeholder Comments
Combustion Cloud Conductivity

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- Working group has not completely resolved this issue
  - Exploring several types of measurements (discussed in more detail in next presentation)
  - Working group consensus to evaluate the modification of the test plan to use a mock switchgear
  - EPRI provided support under the MOU to help specify the necessary design of the mock switchgear
  - Currently, no procurement contracts in place for the mock switchgear

Stakeholder Comments
Isolating the Impact AL

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- How is the impact of aluminum being isolated in testing to resolve PRE-GI-018?
  - Direct comparisons in test matrix design
  - Use of modeling
  - Small-scale testing to identify properties of aluminum
  - Verify scalability of small-scale results

Stakeholder/WG Interaction

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- External and public stakeholders have requested a way to be apprised of Working Group progress and project status
- The Working Group will be developing a master "Project Plan" to be posted publicly on the NRC website