UNITED STATES
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May 17, 2016

MEMORANDUM TO: Brian E. Thomas, Director
Division of Engineering
Office of Nuclear Regulatory Research

FROM: Thomas H. Boyce, Chief ***/RA/***
Regulatory Guidance and Generic Issues Branch
Division of Engineering
Office of Nuclear Regulatory Research

SUBJECT: INITIAL SCREENING RESULTS FOR PRE-GI-018, PROPOSED GENERIC ISSUE ON HIGH ENERGY FAULTS INVOLVING ALUMINUM COMPONENTS

This memorandum documents the completion of the GI Program staff's initial screening of a proposed generic issue (GI) related to vulnerability of electrical equipment that include components made of aluminum when subjected to high energy arc fault (HEAF) conditions. On May 6, 2016, the staff in the Office of Nuclear Regulatory Research (RES) submitted the proposed GI, available in the Agencywide Documents Access and Management System (ADAMS) under Accession No. ML16126A096. This proposed GI has been entered into the Generic Issues Management Control System as PRE-GI-018 for tracking purposes. The GI staff has performed an initial review of the proposed issue and determined that there is no obvious reason that the issue would not meet any the seven screening criteria. Therefore, the GI staff has determined that the proposed issue should continue in the screening process. The next step in the screening process is to form a generic issues review panel (GIRP).

Brief Description of Proposed Issue

The RES staff has identified a potential vulnerability for electrical equipment that include components made of aluminum when subjected to HEAF conditions. The presence of aluminum can create a more energetic plasma arc that, under some circumstances, can cause larger damage scenarios to electrical enclosures and transport high energy gas, particles, and plasma farther than previously assumed. Recent testing confirms that the area damaged around the equipment, referred to as "zone of influence", may be larger than postulated in the current methodology used for HEAF analyses. Therefore, existing analytical models supporting plant specific safety analyses may be non-conservative. The current methodology supports plant specific safety analyses that were performed by licensees using the National Fire Protection Association Standard 805 (NFPA 805) to meet fire protection regulations, e.g., Title 10 of the Code of Federal Regulations (10 CFR) Part 50.48, "Fire Protection".

CONTACT: Stanley Gardocki, RES/DE/RGGIB
301-251-7409

Initial Assessment of Immediate Safety Concern

The Office of Nuclear Reactor Regulation (NRR) evaluated the proposed GI to determine if the issue presents an immediate safety concern that would require licensees to take action. Based upon the available information, the NRR staff concluded that the proposed issue did not present an immediate safety concern. Therefore, the NRR staff did not recommend any immediate actions for nuclear power plant licensees. The NRR assessment can be found in ADAMS under Accession No: ML16064A250.

The staff determination of no immediate safety concern provides the basis for ongoing plant operations while the staff evaluates the proposed GI in accordance with Management Directive and Handbook 6.4, “Generic Issues Program.”

Initial Review of Screening Criteria

The GI Program addresses only those issues that meet all of the below seven screening criteria that are discussed in MD 6.4:

1. The issue affects public health and safety, the common defense and security, or the environment.
2. The issue applies to two or more facilities and/or licensees/certificate holders, or holders of other regulatory approvals.
3. The issue is not being addressed using other regulatory programs and processes; existing regulations, policies, or guidance.
4. The issue can be resolved by new or revised regulation, policy, or guidance.
5. The issue’s risk or safety significance can be adequately determined in a timely manner.
6. The issue is well defined, discrete, and technical.
7. Resolution of the issue may involve review, analysis, or action by the affected licensees, certificate holders, or holders of other regulatory approvals.

The GI Program staff has performed an initial assessment of the proposed issue against the seven screening criteria, and concluded that there is no obvious reason that the proposed issue would not meet any of the seven screening criteria.

Literature Search

The GI program staff performed a literature search to assess any related work and whether the issue has been previously addressed. The most significant event affecting fire safety in the history of nuclear power was the fire at Browns Ferry nuclear power station on March 22, 1975. Since then, the NRC staff has directed a number of significant improvements to the standards for fire protection through the publication of 10 CFR 50.48 and 10 CFR Part 50, Appendix R, “Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979”.

The staff worked with the NFPA to develop a performance-based, risk-informed fire protection standard for NPPs titled NFPA 805, “Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants.” This standard was issued in January 2001 and was incorporated by reference into 10 CFR 50.48(c). The RES staff and the Electric Power Research Institute (EPRI) have developed much of the technical basis for implementation of the rule under a Memorandum of Understanding by developing tools critical to performing fire probabilistic risk analysis and fire modeling (reference: " Develop and Apply Methods for Assessing Fire Safety in Nuclear Facilities," Adams Accession No.: ML112780121).

The literature search revealed there have been several GIs related to fires and fire protection.

- Generic Safety Issue (GSI): Issue 57 - Effects of Fire Protection System Actuation on Safety-Related Equipment
- Generic Safety Issues: Issue 147 - Fire-Induced Alternate Shutdown/control Room Panel Interactions
- Generic Safety Issues: Issue 148 - Smoke Control and Manual Fire-fighting Effectiveness
- Generic Safety Issues: Issue 149 - Adequacy of Fire Barriers
- Generic Safety Issues: Issue 181 - Fire Protection
- Chernobyl Issues- Task CH2: Design - Fires aggravated the accident and complicated its management and consequences

The GI staff found that the staff has used a cost-benefit approach to disposition several of these generic issues relating to fire safety. For example, GSI-149, “Adequacy of Fire Barriers,” evaluated whether the rapid energy released from a fire could generate a pressure differential that results in the premature failure of a fire barrier. Based on calculations by Pacific Northwest Laboratories, the total public risk reduction was estimated to be 500 man-rem. When comparing the cost estimates for modifications of $14M to the 500 man-rem benefit in risk reduction, the value/impact score was 36 man-rem/$M. Using guidelines in NUREG-0933 Appendix C, “Priority Ranking Numerical Thresholds Used in Prioritizations Completed Before June 30, 1993,” GSI-149 was given a low priority ranking.

The GI program staff concluded that, based on the literature search, the proposed GI has not been previously addressed. The staff also notes that NRC and industry have conducted extensive work related to fire protection, and that there are ongoing activities for current plants and the NRC in this area. In addition, the GI staff notes that a cost benefit approach may be useful in further evaluation of the proposed GI.

Conclusion

Based upon the results of the initial review and literature search, the GI Program staff concluded that the proposed GI has the potential to affect current plants, and should continue in the GI process for a more detailed evaluation in accordance with MD 6.4. The next step in the process is to form a GIRP in order to conduct a more detailed determination to decide if the proposed GI meets each of the seven screening criteria to continue in the GI program into the assessment stage. The staff determination of no immediate safety concern provides the basis for ongoing plant operations while the staff evaluates the proposed GI.

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M. Weber, RES	E. Hackett, RES	R. Correia, RES	M. Case, RES
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OFFICE	RES/DE/RGGIB	RES/DE/RGGIB
NAME	S. Gardocki	T. Boyce
DATE	05/16/16	05/17/16

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