

ACCEPTANCE REVIEW OF THE PROPOSED GENERIC ISSUE, “EFFECT OF EXTERNAL FLOODING ON INDEPENDENT SPENT FUEL STORAGE INSTALLATIONS CAUSED BY UPSTREAM DAM FAILURE”

DESCRIPTION AND BACKGROUND

An acceptance review of the proposed issue related to the adverse effect of external flooding on Independent Spent Fuel Storage Installations (ISFSI) has been performed as required for admission into the Generic Issue Program (GIP).

The proposed issue considers the risk of flooding effects from postulated failure of upstream dams on ISFSIs. Regulatory guidance for ISFSIs regarding consideration of dam failures has evolved over time. For example, some older power plants did not need to consider a dam failure that a newer plant would have to consider.

ISFSIs are often located above ground on unsheltered concrete pads or in underground storage vaults. Depending on site and environmental characteristics, there is a potential for inundation of these facilities by flood waters. The potential adverse effects of flooding might include changes in the thermal performance of the dry cask storage system, structural effects from sliding or overturning, and, in the unlikely event of a breach to the confinement system, the release of radioactive materials or in-leakage of flood water.

The issue has been proposed, in part, because estimates of the likelihood of dam failure may be higher than previously estimated. The GI Program staff performed the acceptance review in accordance with NRC MD 6.4, “Generic Issues Program.” There are seven specific criteria outlined, none of which can result in a negative response if the proposed issue is to be accepted as a GI in the program. The purpose of an acceptance review is to provide an initial evaluation as to whether the proposal clearly does not meet any one of the criteria.

ACCEPTANCE REVIEW EVALUATION

Management Directive (MD) 6.4, “Generic Issues Program,” provides criteria for issues to be accepted into the GIP. A proposed GI should not be accepted into GIP if it clearly fails any of the seven criteria discussed below. At the Acceptance Review stage, the proposed GI is evaluated against each criterion and is rated either “Fail,” or “Further Evaluation May Be Warranted.” A “Fail” rating (on any criterion) will cause an issue not to be accepted for further evaluation. Such issues may be handled by processes outside the GIP.

The discussion below provides the staff’s evaluation of the proposed issue in comparison to the seven criterion.

Criterion 1: The issue affects public health and safety, the common defense and security, or the environment.

Assessment: **Fail**

Discussion: The NMSS staff provided a preliminary evaluation of the effects of external flooding on ISFSIs caused by Upstream Dam Failure (ADAMS Accession No. ML12234A580), which assessed impacts in the category of materials, structural, confinement, criticality, thermal and shielding performance. The potential phenomenon and associated consequences are summarized below.

Materials: There is no expected safety-significant risk resulting from damage or degradation to the components important to safety (e.g., canister confinement boundary) from debris-carrying flooding. Given current knowledge, materials damage and degradation are not a significant safety issues in an external flooding event.

Structural: There is no expected safety-significant risk from structural damage (or tip over) given the low possible material damage. The structural damage is not a significant safety issue in an external flooding event.

Confinement: There is no expected release of materials from the confinement boundary, given no material and structural damage or degradation **and** no change in orientation (e.g., the cask does not tip over).

Criticality: There is no risk of criticality during a flood scenario of this magnitude given no breach of the cask canister (i.e., water in-leakage) as a result of flood conditions described herein given the following conditions: (1) there is no damage to the shielding structure, (2) no loss of confinement as a result of corrosion or degradation, and (3) no change in orientation (e.g., the cask does not tip over).

Thermal: There is no credible thermal risk to public health and safety, given no structural damage or degradation and no confinement degradation. The heat removal capability is not a significant safety issue in the external flooding event.

Shielding/Radiation Protection: There are no safety-significant shielding concerns as a result of flood conditions described herein given the following conditions: (1) there is no damage to the shielding structure, (2) no loss of confinement as a result of corrosion or degradation, and (3) no change in orientation (e.g., the cask does not tip over).

Therefore, based on the above discussions, external dam-failure-induced flooding is unlikely to cause breach to the confinement systems, corrosion to the structural components, release of radioactive materials, or in-leakage of flood water.

Criterion 2: The issue applies to two or more facilities and/or licensees/certificate holders, or holders of other regulatory approvals.

Assessment: Further Evaluation May Be Warranted

Discussion: The effect of external flooding on ISFSIs caused by the upstream dam failure, if credible, appears to apply to two or more facilities and/or licensees/certificate holders.

Criterion 3: The issue cannot be readily addressed through other regulatory programs and processes; existing regulations, policies, or guidance; or voluntary industry initiatives.

Assessment: **Fail**

Discussions: Many elements of the issue are already addressed in the current regulatory framework in the form of rules regarding natural phenomenon includes earthquake, water waves, flooding, tsunami, and beyond-design-basis events.

Regulatory Framework of 10 CFR Part 50, Appendix A, GDC 2:

The NRC has established several requirements addressing natural phenomena in “Design Bases for Protection against Natural Phenomena,” of Appendix A to 10 CFR Part 50. GDC 2 requires, in part, that SSCs important to safety be designed to withstand the effects of natural phenomena such as floods, tsunamis, and seiches without loss of capability to perform their safety functions. GDC 2 also requires that design bases for these SSCs reflect (1) appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding region, with sufficient margin for the limited accuracy and quantity of the historical data and the period of time in which the data have been accumulated, (2) appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena, and (3) the importance of the safety functions to be performed.

Regulatory Framework of 10 CFR Part 72:

§ 72.48 The licensee and certificate holder shall maintain and provide the record of changes, test, and experiments regarding to the facility or spent fuel storage cask design, as appropriate.

§ 72.92 (a) Design basis external natural events: Natural phenomena that may exist or that can occur in the region of a proposed site must be identified and assessed according to their potential effects on the safe operation of the ISFSI or in a Monitored Retrievable Storage (MRS). The important natural phenomena that affect the ISFSI or MRS must be identified.

§ 72.103 (f)(2)(iii) Determination of design bases for seismically induced floods and water waves. The size of seismically induced floods and water waves that could affect a site from either locally or distantly generated seismic activity must be determined.

Regulatory Framework of 10 CFR Part 100, Appendix A:

Appendix A, “Seismic and Geologic Siting Criteria for Nuclear Power Plants,” to 10 CFR Part 100 was established to provide detailed criteria to evaluate the suitability of proposed sites and the suitability of the plant design basis established in consideration of the seismic and geologic characteristics of the proposed sites.

Regulatory Framework of Regulatory Guides:

The staff has also published number of regulatory guides (RGs) that address specific technical issues related to protection from natural phenomena. These documents provide guidance to licensees on implementing specific parts of the NRC’s regulations, techniques used by the NRC staff in evaluating specific problems or postulated accidents, and data needed by the staff in its review of applications for permits or licenses. These guides include but not limited to the following:

- RG 1.29, “Seismic Design Classification,” issued in 1972 and updated in 1973, 1976, 1978, and 2007
- RG 1.59, “Design Basis Floods for Nuclear Power Plants,” issued in 1973 and updated in 1976 and 1977

- RG 1.60, “Design Response Spectra for Seismic Design of Nuclear Power Plants,” issued in 1973
- RG 1.102, “Flood Protection for Nuclear Power Plants,” issued in 1975 and updated in 1976
- RG 1.125, “Physical Models for Design and Operation of Hydraulic Structures and Systems for Nuclear Power Plants,” issued in 1977 and updated in 1978 and 2009
- RG 1.208, “A Performance-Based Approach To Define the Site-Specific Earthquake Ground Motion,” issued in 2007

Criterion 4: The issue can be resolved by new or revised regulation, policy, or guidance.

Assessment: Further Evaluation May Be Warranted

Discussion: The GIP is intended to provide a way to fix identified potential weaknesses, deficiencies and vulnerabilities in existing safety requirements and guidance. As such, the NRC would likely need to establish a policy and/or rulemaking regarding that specific flooding. Such guidance would necessarily follow and result from findings provided by the GIP.

Criterion 5: The issue’s risk or safety significance can be adequately determined (i.e., it does not involve phenomena or other uncertainties that would require long-term studies and/or experimental research to establish the risk safety significance).

Assessment: Further Evaluation May Be Warranted

Discussion: See evaluation for Criterion 1, the safety or risk significance of this issue is low. However, estimating the initiating event frequency may be difficult to reliably quantify.

Criterion 6: The issue is well-defined, discrete, and technical.

Assessment: Further Evaluation May Be Warranted

Discussion: It appears the issue lends itself to scientific inquiry and resolution via datasets and analyses.

Criterion 7: Resolution of the issue may potentially involve review, analysis, or action by the affected licensees, certificate holders of other regulatory approvals.

Assessment: Further Evaluation May Be Warranted

Discussion: Resolution of the issue could involve actions by affected licensees.

CONCLUSION

Based on a review of the existing regulatory requirements and technical basis of the issue, as described above, the staff determined that existing regulatory processes can, and are, addressing the risk and safety significance of flooding at ISFSIs from failure of upstream dams. Therefore, the proposed issue does not meet Generic Issue Criterion 1 and 3. As a result, the proposed issue is not accepted into the GIP.