

Seven Screening Criteria

A generic issue (GI) is a well-defined, discrete technical safety or security issue, of which the risk or safety significance can be adequately determined. A proposed GI must meet seven specific screening criteria in order to continue in the GI process to the assessment stage. Below is the Panel's evaluation of whether the proposed GI on the effects of downstream dam failures on nuclear power plants meets each criterion.

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

Depending on site characteristics and the design of a nuclear power plant (NPP), the non-recoverable loss of the ultimate heat sink (UHS) as a result of a downstream dam failure could potentially lead to core damage, failure of the reactor coolant pressure boundary, containment failure, or cladding failure of recently irradiated fuel stored in the spent fuel pool. The Nuclear Regulatory Commission (NRC) staff in a recent study estimated the frequency of large dam failures to be approximately 2.9×10^{-4} /year, which is on the same order of magnitude (1×10^{-4} /year) as used by the U.S. Bureau of Reclamations. Using revised seismic hazard estimates and the recent estimates of dam failure frequencies may result in the loss of the UHS as a result of a downstream dam failure being higher than previously estimated.

In support of the panel's evaluation of the proposed GI, the staff used the recent estimate of dam failure frequencies to analyze the change in core damage frequency (CDF). The results of the analysis for the potentially impacted plants indicated a small change in risk [ML15253A402]. Note that this analysis contains sensitive information and is non-public. Through comparing the calculated change in CDF to the chart provided in Figure A2 in the Office of Nuclear Regulatory Research's (RES) Technical Office Instruction TEC-002, "Procedure for Processing Generic Issues," the Panel concluded that the change in risk was acceptable for most NPPs. However, the results for two plants (Farley and North Anna) indicated that the change in CDF was slightly greater than the threshold in Figure A2 for determining whether an issue should continue in the GI program.

Since the calculated risk for Farley and North Anna were close to the threshold, the staff performed a more detailed sensitivity risk analysis of these sites. In addition, the NRC analyzed two additional sites (Catawba and Robinson) due to unique system configurations [ML15253A407]. Note that this analysis contains sensitive information and is non-public. The results of the analysis for Farley, North Anna, and Catawba revealed that each plant has two separate UHS reservoirs. One of the two reservoirs is a safety-related, seismically qualified service water reservoir, and the other is a lake, pond, or river associated with heat removal from normal plant operations. Either reservoir can be utilized by the plant as the UHS in the event that the other UHS is lost. The additional water source at each site provides redundancy, which significantly mitigates the impact of random failure of the other water source. When this additional information was factored into the analysis, the risk was found acceptable for these three plants because they have redundant water supplies for the UHS. The Panel concluded that, for the majority of the NPPs, the risk did not meet the threshold for continuation as defined in Figure A2 of TEC-002.

Using information available to the staff, the sensitivity risk analysis indicated that the Robinson plant did not have two separate independent UHS water sources. The Robinson Lake was credited with supplying the primary source of service water, as well as supplying the backup source via the fire protection system. The sensitivity risk analysis for Robinson indicated that

the change in CDF was above the threshold in TEC-002. Based on the results of the Robinson analysis, the panel focused on identifying whether any other plants had a similar configuration (i.e., reliance on a single downstream dam for the primary and backup water supply for service water). The staff re-assessed all plants that have downstream dams and verified that they had two independent UHS water sources, except for potentially Robinson. The Panel notes that the licensee states in the Robinson Final Safety Analysis Report that it has on-site deep water wells that can be connected to the heat exchangers for the emergency diesel generators and backfed to the service water system. However, sufficient information was not available to the staff on the deep water wells; therefore, the staff did not credit them or other alternate sources in the sensitivity risk analysis.

Based upon the staff's analyses, the risk for the majority of NPPs would be below the threshold for consideration as a GI. Because the potential risk increase for Robinson exceeds the threshold (with no credit for the deep water wells or other sources) in TEC-002, the panel conservatively concluded that Criterion 1 was met.

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

NUREG-0965, "NRC Inventory of Dams", indicates that 13 NPP sites with 21 operating units rely on downstream dams or impoundment reservoirs as their UHS for emergency cooling water. The staff analyzed the risk for the 13 NPP sites, and conducted a more detailed sensitivity risk analysis of 4 NPP sites. The results showed that at 12 NPP sites, the risk was low. These analyses narrowed the scope of potential affected sites to Robinson. Because only one NPP is potentially affected, the panel concluded that Criterion 2 was not met. Regarding Robinson, the Panel recommends that RES provide the results of the Panel's evaluation to Office of Nuclear Reactor Regulation (NRR) so that they can determine whether any additional analysis, modeling, or action is needed regarding the configuration of the UHS.

Criterion 3: The issue is not being addressed through other regulatory programs and processes; existing regulations, policies, or guidance; or voluntary industry initiatives.

In response to the accident at the Fukushima Dai-ichi site in Japan, the NRC is evaluating a range of issues impacting operating NPPs. These issues are discussed in the NRC's report from the Near-Term Task Force (NTTF) Review of Insights from the Fukushima Dai-ichi Accident entitled "Recommendations for Enhancing Reactor Safety in the 21st Century." Several of these issues (i.e., seismic hazards, flooding hazards, and mitigating strategies) impact the evaluation of this potential GI. To understand and consider these impacts, the Panel met with staff from the former NRR Japan Lessons-Learned Project Directorate (now Japan Lessons-Learned Division) (JLD) and the Office of New Reactors (NRO) to discuss the issues and actions being taken. The goal was to determine how the issues and actions affect consideration of the proposed GIs.

Under NTTF Recommendations 2.1 and 2.3, the NRC has programs in place to re-evaluate flooding hazards and seismic hazards, to perform walk downs to confirm the licensing basis has been maintained, and to require the modification of protection features as necessary. The NRC also has a program in place to require licensees to implement mitigation strategies (NTTF Recommendations 4.1 and 4.2) for beyond-design-basis external events. The Panel discussed how those programs encompass the concerns pertaining to this proposed GI.

Regarding flooding hazards, the JLD informed the Panel that the scope of the flooding hazard integrated assessments includes relevant systems, structures, and components important to safety and the UHS. As appropriate, this includes flood-induced loss of the UHS due to failure of a downstream dam. As a result, the Panel concluded that flooding hazards to downstream dams impacting the UHS were out of scope because they are being addressed through an ongoing NRC program.

Regarding seismic hazards, the JLD informed the Panel that potential impacts on the UHS due to failure of downstream dams were being addressed through the mitigation strategies program and the seismic hazard integrated assessment. As a result, the Panel concluded that seismic hazards to downstream dams impacting the UHS were out of scope because they are being addressed through an ongoing NRC program. These efforts by the JLD reduced the scope of the hazards potentially impacting downstream dams to random (sunny day) failures. Because the NRC does not have an ongoing program to address the impact of random failure of downstream dams, the Panel concluded that Criterion 3 was met.

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

For NPPs where a risk assessment shows that downstream dam failure is a significant contributor to overall plant risk, it is possible that the change in risk may be great enough to warrant a regulatory backfit to put new requirements in place to resolve any potential safety issues. Therefore, the Panel concluded that Criterion 4 was met.

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 or safety significance).

The effect of a loss of the UHS on a plant has been modeled in probabilistic risk assessments. In addition, the staff recently provided an estimate of the frequency of large dam failures. This information can be used in risk assessments to evaluate the proposed GI. As a result, the Panel concluded that Criterion 5 was met.

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

After a series of discussions with NRC staff, the panel was able to focus the scope of this potential GI to only a few NPP sites - those sites that had seismically qualified downstream dams containing the UHS. The issue involves a re-assessment of the safety impact due to the potential loss of the UHS from a random "sunny day" failure of seismically qualified downstream dam or impoundment. Therefore, the Panel concluded that Criterion 6 was met.

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

Risk analyses can show the effect on plant safety from a failure of a downstream dam. If the risk of a non-recoverable loss of the UHS as a result of a downstream dam failure was determined to be significantly high, the NRC could impose regulatory requirements, through the backfit process, to require analysis or action by the affected licensees. Therefore, the Panel concluded that Criterion 7 was met.

Conclusions

The Panel concluded that the proposed GI does not meet all seven screening criteria necessary to proceed forward in the Generic Issues program. Specifically, the Panel concluded that the issue does not meet Criterion 2 “The issue applies to two or more facilities and/or licensees/certificate holders, or holders of other regulatory approvals.” Therefore, the Panel recommends that RES process the proposed GI for closure. Additionally, the Panel recommends that RES provide the results of the Panel’s evaluation to NRR so that they can determine whether any additional analysis, modeling, or action is needed regarding the configuration of the UHS at the Robinson site.