

STAFF ASSESSMENT AND PRIORITIZATION OF ADDITIONAL ISSUES IDENTIFIED IN SECY-11-0137

As directed by Staff Requirements Memorandum (SRM)-SECY-11-0137, "Prioritization of Recommended Actions To Be Taken in Response to Fukushima Lessons Learned," dated October 3, 2011, the staff of the U.S. Nuclear Regulatory Commission (NRC) reviewed the additional issues identified in SECY-11-0137 within the context of the NRC's existing framework and considered whether to recommend any additional regulatory action. A team consisting of NRC senior management representatives and technical experts conducted this review. The staff used the same prioritization process that was used in SECY-11-0137. The staff's prioritization and assessment process generally prioritized the additional issues into either Tier 1 or Tier 3 as defined in SECY-11-0137.

The first tier consists of those additional issues that the staff determined should be started without unnecessary delay and for which there is sufficient resource flexibility, including the availability of critical skill sets. The Tier 1 issues are the following:

- filtration of containment vents
- loss of ultimate heat sink

However, a portion of the loss of ultimate heat sink issue, related to the impact of external natural hazards other than flooding hazards, will be addressed by a new Recommendation 2.1 Tier 2 action. This new Tier 2 action, which will be initiated when sufficient critical skill sets become available, is discussed further in Enclosure 3.

The third tier consists of those additional issues that require further staff study. Depending on the outcome of long-term studies, the staff may recommend additional regulatory actions. The staff has focused its initial efforts on developing the assessment, schedules, milestones, and resources associated with the additional Tier 1 and Tier 2 activities. Hence, information regarding the Tier 3 additional issues is not included in this enclosure. The staff is currently developing an evaluation of the Tier 3 additional issues, which will be included in a paper due to the Commission in July 2012. The Tier 3 additional issues are as follows:

- basis of emergency planning zone size (long-term study)
- pre-staging of potassium iodide beyond 10 miles (long-term study)
- transfer of spent fuel to dry cask storage (long-term study)

The additional issue of "Instrumentation for Seismic Monitoring" has been transferred from the Japan Lessons-Learned process and will be further considered under the ongoing action plan for the August 2011 Central Virginia Earthquake and thus is not being prioritized in this paper.

This enclosure assesses the Tier 1 additional issues in the order listed above. The NRC concluded that the Tier 1 additional issues are of sufficient safety significance that the staff should proceed to consider them without delay, and it has already included them in its ongoing work on Tier 1 activities.

Tier 1 – Filtration of Containment Vents

The staff is considering requiring the filtration of containment vents to reduce the spread of radioactive contamination during a beyond-design-basis event.

Regulations and Guidance

1. General Design Criterion (GDC) 16, "Containment Design," of Appendix A, "General Design Criteria for Nuclear Power Plants," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," requires, in part, that the reactor containment and associated systems "be provided to establish an essentially leak-tight barrier against the uncontrolled release of radioactivity to the environment and to assure that the containment design conditions important to safety are not exceeded for as long as postulated accident conditions require."
2. Under 10 CFR 50.34(f)(3)(iv), "Contents of applications; technical information – Additional TMI-related requirements," requires each applicant for a light-water-reactor construction permit or manufacturing license whose application was pending as of February 16, 1982, must provide one or more dedicated containment penetrations, equivalent in size to a single 3-foot diameter opening, in order not to preclude future installation of systems to prevent containment failure, such as a filtered vented containment system. This requirement only applied to the small number of applications that were pending as of February 16, 1982.

Staff Assessment and Basis for Prioritization

The Fukushima Dai-ichi event highlighted the importance of the primary containment heat removal function in boiling-water reactor (BWR) accident response. In particular, it showed the importance of accessibility of the valves, which are required to open and close the vent independent of alternating current power. As directed by the Commission in SRM-SECY-11-0137, the staff has prioritized the issue of filtration of containment vents as a Tier 1 issue.

The staff has determined that there are technical and policy issues to be resolved before regulatory action can be taken to require licensees to install filtered vents. One policy issue that needs further study is whether containment vents, with or without filters, should be required to operate under severe accident conditions. The staff will also take into consideration regulatory action to require controlled venting of structures other than the reactor building, such as those housing spent fuel pools. The staff plans to provide the Commission a notation vote paper on these policy issues in July 2012.

At this time, the staff is proposing regulatory action to require that all operating BWR facilities with Mark I and Mark II containments have a reliable hardened venting capability, without filters, for events that can lead to core damage. In public meetings, the staff has encouraged licensees to consider the potential for the later addition of filters.

Staff Activities

The staff, as a near-term action, is currently undertaking regulatory activities to consider filtered vents for BWR reactor facilities with Mark I and Mark II containments, and present to the Commission a notation vote paper outlining any policy issues and a recommendation for regulatory action.

Unique Implementation Challenges

The staff recognizes that several technical and policy issues need to be considered before a decision is made on whether filters should be required, such as whether containment vents with or without filters need to be operable in severe accidents, and whether structures other than the reactor building should be required to have controlled venting.

Schedules and Milestones

The schedule and milestones previously described in SECY-11-0137 for ongoing Tier 1 activities are not expected to change with the addition of this item. The staff will provide the Commission with a notation vote paper describing policy issues in July 2012.

Resources

The resources previously described in SECY-11-0137 for ongoing Tier 1 activities are not expected to change at this time. The staff will include in the scheduled July 2012 Commission paper an estimate of any additional resources beyond those provided in SECY-11-0137 needed for regulatory action to address the policy issues described above.

Tier 1 – Loss Ultimate Heat Sink

The staff has evaluated the implications of a loss of ultimate heat sink (UHS) at U.S. nuclear power plants and determined the regulatory actions needed in this area.

Regulations and Guidance

1. GDC 44, "Cooling Water," states that a system shall be provided to transfer heat from structures, systems, and components important to safety, to an UHS. The system safety function shall be to transfer the combined heat load of these structures, systems, and components under normal operating and accident conditions.
2. Regulatory Guide 1.27, "Ultimate Heat Sink for Nuclear Power Plants," Revision 2, issued January 1976, describes a basis acceptable to the NRC staff that may be used to implement GDC 44 and 2, "Design Bases for Protection Against Natural Phenomena," with regard to a particular feature of the cooling water system: specifically, the UHS, including single-failure criteria and the overall capacity of the UHS.
3. Generic Letter (GL) 89-13, "Service Water System Problems Affecting Safety-Related Equipment," dated July 18, 1989, details the possible need for surveillance and control programs to reduce the incidence of service water system fouling, based on an analysis of operating experience.
4. NUREG-1275, Volume 3, "Operating Experience Feedback Report – Service Water System Failures and Degradations," was issued November 1988.
5. GL 91-13, "Request for Information Related to the Resolution of Generic Issue 130, 'Essential Service Water System Failures at Multi-Unit Sites,'" dated September 19, 1991, requested information from seven sites seen as at high risk for a loss-of-service-water initiating event based on their configuration following evaluation of Generic Issue 130.
6. NUREG/CR-5526, "Analysis of Risk Reduction Measure Applied to Shared Essential Service Water Systems at Multi-Unit Sites," was issued June 1991.
7. Under 10 CFR 50.54(hh)(2), licensees must develop and implement guidance and strategies to maintain or restore core cooling capabilities under the circumstances associated with the loss of a large area of the plant caused by explosions or fire.

Staff Assessment and Basis for Prioritization

As a result of the March 11, 2011, Great Tōhoku Earthquake and subsequent tsunami, Fukushima Dai-ichi, Units 1-3, lost the capacity to release decay heat to the ultimate heat sink (the ocean). In many plants, both foreign and domestic, an adjacent body of water is used as a heat sink for main circulating water, providing cooling for steam exiting the main condenser, and also as a heat sink for the service water system. The event at Fukushima Dai-ichi reinforces the need not only to evaluate the capacity to restore an ultimate heat sink promptly under accident conditions, but also to consider, in accident planning, an alternative means for maintaining reactor stability in a hot-standby condition for an extended period of time when normal modes of heat transport to the UHS are unavailable.

Though loss of service water is analyzed in risk models as an initiating event, a complete loss of service water is not considered in accident analysis, and plants are not typically designed to be able to cope with an extended loss of service water or the UHS. Depending on plant-specific emergency response capabilities, failure to recover service water cooling via the UHS has a high probability of leading to core damage, on the order of 10 percent for some plants.

Potential causes for loss of service water have been addressed by the NRC multiple times over the past 30 years, most notably in GL 89-13. Though measures taken by industry to reduce risk exposure, both in response to the GL, and on a voluntary basis, have addressed many potential causes of a loss of UHS, new failure modes continue to present themselves.

Ongoing regulatory activities following the Fukushima Dai-ichi accident are addressing several aspects of the loss of UHS. Tier 1 activities for seismic and flood reevaluations and walkdowns will address protection of the UHS systems (Near-Term Task Force (NTTF) Recommendations 2.1 and 2.3). A new Tier 2 Recommendation 2.1 item on other natural external hazards will also address protection of the UHS systems. Tier 1 activities for station blackout mitigating strategies (NTTF Recommendation 4.1) and mitigation of beyond-design-basis natural phenomena events (NTTF Recommendation 4.2) will also include regulatory actions for licensees to provide strategies for mitigating a loss of access to the normal UHS. The staff has established that the term "UHS systems" is intended to include loss of the cooling media, loss of the ability to pump the cooling media, loss of heat exchangers and combinations of losses, while the access to UHS is all of the above with the exception of the cooling media.

The staff concludes that this issue would improve safety. Since sufficient resource flexibility, including availability of critical skill sets, exists, the staff prioritized this action as a Tier 1 issue.

Staff Activities

The staff, as a near-term action, is currently undertaking regulatory activities to do the following:

1. Request that licensees include UHS systems in the reevaluation and walkdowns of site-specific seismic and flooding hazards using the methodology described in SECY-11-0137, and identify actions that have been taken, or are planned, to address plant-specific issues associated with the updated seismic and flooding hazards in conjunction with the resolution of NTTF Recommendations 2.1 and 2.3.
2. Incorporate the loss of UHS as a design assumption in the resolution of station blackout rulemaking activities in conjunction with the resolution of NTTF Recommendation 4.1.
3. Order licensees to provide mitigating measures for beyond-design-basis external events to also include a loss of access to the normal UHS in conjunction with the resolution of NTTF Recommendation 4.2.
4. Request licensees to include UHS systems in the reevaluation of site-specific natural external hazards, and identify actions that have been taken, or are planned, to address plant-specific issues associated with the updated hazards in conjunction with the resolution of the new Tier 2 Recommendation 2.1 activity described in Enclosure 3, "Other Natural External Hazards."

Unique Implementation Challenges

In order to address the new Tier 2, Recommendation 2.1, activity described in Enclosure 3, "Other Natural External Hazards," the staff recognizes that the NRC and industry have limited, specialized expertise (e.g., physical scientists, hydrologists) to complete the actions associated with this recommendation.

Schedules and Milestones

The schedule and milestones previously described in SECY-11-0137 for ongoing Tier 1 activities are not expected to change with the addition of this item.

Resources

The resources previously described in SECY-11-0137 for ongoing Tier 1 activities are not expected to change with the addition of this item.