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6 RISK INFORMED DECISION MAKING

In Reg Guide 1.174, we proposed five principles of risk-informed regulation These principles are:

"1. The proposed change meets the current regulations unless it is explicitly related to a requested exemption or rule change, i.e., a "specific exemption" under 10 CFR 50.12 or a "petition for rulemaking" under 10 CFR 2.802.

2. The proposed change is consistent with the defense-in-depth philosophy.

3. The proposed change maintains sufficient safety margins.

4. When proposed changes result in an increase in core damage frequency and/or risk, the increases should be small and consistent with the intent of the Commission's Safety Goal Policy Statement

5. The impact of the proposed change should be monitored using performance measurement strategies."

While the focus on Reg Guide 1.174 was decision-making with respect to changes to the licensing basis of an operating plant, the same risk-informed philosophy can be applied to rulemaking for decommissioning plants, as discussed below. However, principles 2, 3, and 4 need to be interpreted within the decommissioning context. The purpose of this section is to discuss this interpretation and to identify areas that need clarification.

Defense-in-Depth

The defense-in-depth philosophy applies to the operation of the spent fuel pool, whether at an operating plant or in a decommissioning plant. However, its implementation is different from that applied to nuclear reactors because of the different nature of the hazards. Because the essentially quiescent (low temperature, low pressure) initial state of the spent fuel pool and the long time for taking corrective action associated with most release scenarios provide significant safety margin, a containment structure is not considered necessary as an additional barrier to provide an adequate level of protection to the public. Modifying the acceptance guidelines in Reg Guide 1.174, consistency with the defense-in-depth philosophy is maintained if the following are all satisfied:

1. A reasonable balance is preserved among prevention of loss of spent fuel pool cooling, mitigation of a loss of cooling, and consequence mitigation (by emergency planning).

2. Over-reliance on programmatic activities to compensate for weaknesses in plant design is avoided.

3. System redundancy, independence, and diversity are preserved commensurate with the expected frequency, consequences of challenges to the system, and uncertainties (no risk outliers).

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4. Defenses against potential common cause failures (CCFs) are preserved (where applicable) and the potential for new CCF mechanisms is assessed.

5. Defenses against human errors are preserved.

Items 1, 2, 3, and 5 are addressed in the commitments made by NEI. Item 4 would only be required for the case of a redundant system being used as a back-up system. The fact that the spent fuel pool cooling system is a normally operating system minimizes the possibility of a catastrophic CCF.

In item 1, emergency planning was given as an example of a means of achieving consequence mitigation. The degree to which it may be required as an additional barrier is a function of the uncertainty associated with the prediction of the frequency of the more catastrophic events, such as beyond design basis earthquakes. There can be a trade off between the formality with which the elements of emergency planning (procedures, training, performance of exercises) are treated and the increasing safety margin as the fuel ages and the time for response gets longer.

Safety Margins

Apart from the safety margins incorporated in the design of the fuel pool itself, the most significant safety margin with respect to the risk to the public is the very long time available to take action to correct or mitigate a loss of fuel pool cooling, for all but the catastrophic events, such as a beyond design basis earthquake. This is primarily because of the extremely large heat sink provided by water in the pool in the event that the fuel pool cooling is temporarily lost, and, to a lesser extent, the time for the fuel heat up to a zirconium fire condition.

Evaluation of Risk Impact

Reg Guide 1.174 provided guidance on the performance of an appropriate risk analysis and also provided acceptance guidelines against with which the assessed risk could be compared. The metrics core damage frequency (CDF) and large early release frequency (LERF) were used as surrogates for public risk. These metrics do not have direct equivalents in the case of the spent fuel pool. However, the ACRS in its letter dated November 12, 1999, has suggested that the frequency of uncovery of the top of fuel be compared with the LERF acceptance guidelines. This may be a pragmatic approach for assessing the likelihoods of the significant accident sequences for which having or not having emergency planning in place is likely to have an impact on consequences. However, when considering consequences, it has to be remembered that there is a considerable additional time after the onset of fuel uncovery before there would be a release. In addition, there is some concern that taking the endpoint of the analysis as onset of fuel uncovery may take away some of the incentive for making changes or commitments that facilitate the mitigation of accidents once fuel uncovery has begun (e.g., a remote water addition system).

A risk assessment has been performed that has demonstrated that, if the operation of the facility is carried out in accordance with certain commitments proposed by NEI, the guidelines for LERF can be met. While there are uncertainties associated with the analysis, the analysis does show the value of the voluntary commitments in establishing a low risk.

Implementation and Monitoring Program

Since there are uncertainties associated with this evaluation, particularly in the evaluation of human performance, it is prudent to expect that licensees establish a performance monitoring program to ensure that the performance of both hardware and facility personnel remains at the level assumed in the risk analysis. In the case of human performance in particular, since a very high level of reliability is credited, a direct measure of the reliability is not feasible.

Thus, it is necessary that we develop regulatory guidance regarding an acceptable method of implementing such a program to control plant design, control plant configuration, ensure system performance and ensure personnel performance. Alternatively, We could endorse an industry guide. The guidance would need to address those design and operational features which the analysis contained in this report has shown to control risk of spent fuel pool accidents, and would address performance measures and associated performance criteria.

Important considerations would include spent fuel pool seismic design; control of heavy load movements; procedures and other provisions to ensure human reliability; capability, reliability and availability of safety systems; and effectiveness of onsite emergency response, and the plans for communication with offsite authorities. Examples of such features are contained in the NEI commitment letter dated November 12, 1999.