From: Steven Long > NRC
To: Jin Chung
Date: 9/27/01 10:01AM
Subject: "Adequate Protection" insert for Medoff's CRDM White Paper

Jin,

In your absense, I was assigned to assist the CRDM effort by writing several sets of slides (untimately passe) and a section on the "adequate protection" approach to insert into Jim's "white paper" on legal bases for orders. A copy of the white paper insert is attached.

I will be out of the office from 9/28 through 10/8 and then again from 10/10 to 10/15. So, the task is yours, again.

Steve

CC: F. Mark Reinhart

D-18

This situation constitutes a "special circumstance" in which compliance with the Commission's regulations does not address a safety issue that may have significant risk implications. Regulatory Information Summary (RIS) 01-002, "Guidance on Risk-Informed Decisionmaking in License Amendment Reviews," provides a process for the staff to consider whether a "special circumstance" rebuts the presumption that compliance with the regulations provides adequate protection of public health and safety. Although developed for staff reviews of license amendment requests, the process in RIS 01-002 is appropriate for other regulatory decisionmaking purposes because it addresses the fundamental requirement for operation of a nuclear reactor, that there is reasonable assurance of adequate protection for the public health and safety.

Application of the RIS 01-002 process to this issue has three steps:

1. identification of a "special circumstance" involving a risk factor not addressed by regulations;
2. assessment of the factor with respect to the five safety principles of risk-informed decisionmaking to establish whether its effect is sufficiently large to rebut the assumption that adequate protection is achieved by compliance with existing regulations; and
3. identification of an adequate basis for establishing reasonable assurance of adequate protection when the factor is considered.

The current regulation requires inspections to be performed in accordance with ASME Code requirements. However, the Code specifies procedures which are inadequate to detect the subject degradation because it cannot detect the amount of leakage that is expected to occur before CRDM housing failure and LOCA results. So, a "special circumstance" exists with respect to this issue, satisfying step one in the RIS-01-002 process..

The second step is to evaluate the issue with respect to the safety principles and integrated decisionmaking process described in Regulatory Guide 1.174 "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis" (RG 1.174). The five safety principles are that the circumstance is acceptable if it:

1. meets current regulations,
2. is consistent with "defense-in-depth philosophy,"
3. maintains sufficient margin,
4. results in only a small increase in core damage frequency, and
5. the basis for the risk estimate is monitored using performance measurement strategies.

With respect to these criteria, the "special circumstance" of CRDM nozzle inspections that are inadequate to detect degradation that could result in failure satisfies only the first. These inspections do meet the current regulations because the regulations only reference the inadequate ASME Code requirements. This circumstance is inconsistent with the second principle, maintaining the "defense-in-depth philosophy," because the regulations are not adequate to prevent the failure of the reactor coolant pressure boundary, which is one of the barriers to release of radioactive materials from the reactor core. Thus, one barrier is potentially lost. The third principle is not met because margins are not maintained by the ASME Code inspection requirements. Pressure boundary leakage can remain undetected and minimum wall thickness requirements can be violated without detection before gross failure

occurs. The fourth principle is not met because core damage frequency can eventually increase to the relatively high numerical value for the conditional core damage probability (CCDP) for the loss-of-coolant accident (LOCA) that would result from gross CRDM nozzle failure. The CCDP values for the subject plants are on the order of 5×10^{-3}/reactor-year for a medium-to-small LOCA. This is well above RG 1.174 guidance value of 1×10^{-5}/RY for CDF increments that would be considered only when total CDF is shown to be below 1×10^{-4}/RY. Finally, the circumstance cannot meet the fifth principle because the basis for any licensee analysis that shows risk levels below RG 1.174 numerical guidelines must be based on assumptions that cannot be verified without performing the inspections that are adequate to detect teh form of degradation being modeled. Therefore, assessment with respect to these safety principles rebuts the assumption that compliance with the regulations in this "special circumstance" is sufficient to provide reasonable assurance for adequate protection of the public health and safety.

The third and final step for application of the RIS 01-002 process involves establishing an alternative basis for reasonable assurance. The General Design Criteria (GDCs) in 10CFR50 Appendix A establish a general statement of the Commission's perspectives on the factors that are sufficient to achieve "adequate protection." Three GDCs are relevant to this case. GDC 14 states that "The reactor coolant pressure boundary shall be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage or rapidly propagating failure, and of gross rupture." Criterion 30 states that "Means shall be provided for detecting and, to the extent practical, identifying the location of the source of reactor coolant leakage." Criterion 32 states that "Components of the reactor coolant pressure boundary shall be designed to permit (1) periodic inspection and testing of important areas and features to assess their structural integrity and leaktight integrity, and (2) an appropriate material surveillance program for the reactor pressure vessel." Taken as a whole, these GDCs make it clear that the reactor coolant pressure boundary is to be maintained in a leaktight and structurally sound condition, with extremely low probability of gross failure.

Clearly, failure to inspect a portion of the reactor vessel in a manner that is sufficient to detect the extent of degradation caused by a mechanism known to be degrading other plants in that portion of the vessel is inconsistent with these GDCs. The level of degradation that has been found in other plants, if left undetected and uncorrected, would result in a gross failure of the reactor coolant pressure boundary Therefore, the staff does not have reasonable assurance that adequate protection is achieved by plants that do not perform inspections that are sufficient to detect this type of degradation.

On that basis, the Commission may issue an order to require licensees with highly susceptible plants to perform inspections adequate to detect the CRDM nozzle degradation before margins are lost and gross rupture is possible.