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Considerations for "Adequate Protection" Arguments on CRDM Nozzle Cracking Issue

1. To base "adequate protection" on risk, we need to define adequate protection in a quantitative manner.

   Suggest $CDF_{fleet} < 1 \times 10^{-4}$/reactor-year (RY)

   [based on previous work relating this value to quantitative safety goal objectives]

2. Use plant-specific conditional core damage frequencies (CCDPs)for CRDM LOCA, which range from low-10^{-2}/RY to high-10^{-4}/RY, to compute the CRDM LOCA frequencies that would produce CDF values greater than 1×10^{-4}/reactor-year (RY).

   For plants with CCDP $\approx 1 \times 10^{-2}$ CD/LOCA, this means that CRDM LOCA frequency must be $< 10^{-2}$/RY.

   For plants with CCDP $\approx 1 \times 10^{-3}$ CD/LOCA, this means that CRDM LOCA frequency must be $< 10^{-1}$/RY.

3. If DE does not have reasonable assurance that the CRDM LOCA frequencies are below these values for the appropriate plants, then the agency does not have reasonable assurance of adequate protection on a risk-informed basis.

4. ***Note that this quantitative definition is potentially difficult to justify to the public.*** Assuming about 50 reactor units with CCDPs for CRDM LOCAs at about the 10^{-3} level, that means that 50 RY x 0.1 LOCA/RY = 5 CRDM LOCAs could occur each year without violating this definition for "adequate protection." So, our other criteria, such as the GDCs, appear to be more restrictive for this issue. (Similarly, a steam generator tube rupture could occur each year at every plant without violating this definition, since the CCDP for SGTR is already 10^{-4}.) ← actually, due to LERF considerations, make that 10% of plants

5. 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."

   Clearly, a fleet of 50 units that has 5 CRDM LOCAs per year is *not* consistent with the intent of the GDCs to have an "extremely low probability of gross rupture." Also, failing to provide an *effective* inspection of an "important area and feature" of the reactor coolant pressure boundary for a known form of degradation is not consistent with the criteria for providing means for detecting and identifying the location of coolant leakage and assessing structural integrity. There are "practical" methods available to perform the CRD nozzle inspections. The licensee's objections are that they are costly. When a specific licensee has knowledge that the nozzles are cracked, then the inspection is not prohibitively expensive. It is unacceptable to argue that the cost of inspection can be saved by *not* knowing *whether* a unit has the degradation by never performing any meaningful inspection.