From: Jason Schaperow RES
To: Charles Tinkler
Date: Thu, Apr 20, 2000 4:31 PM
Subject: Plan for SFP Consequence Assessment

Attached is a one-page plan I prepared for SFP consequence assessment, in accordance with Farouk's request. I also put a hard copy of it in your in-basket.

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April 20, 2000

Research Plan for Spent Fuel Pool Accident Consequence Assessment

As part of the agency's effort to develop a rule for decommissioning reactors, RES performed an assessment of the effect of one year of decay and early evacuation of spent fuel pool accident consequences. This assessment also investigated the effect of potentially large ruthenium releases in air. The assessment was based on earlier BNL assessments for 12, 30, and 90 days of decay. Following the presentation of the results of the RES assessment to the ACRS on April 5, 2000, a number of issues were raised on the earlier BNL assessments. These issues are in the areas of source term, plume, and protective measures. In the source term area, the issues are the amount of fuel releasing fission products and the release fractions of cesium, ruthenium, and fuel fines. In the plume area, the issues are the energy and spreading. In the protective measures area, the issues are the evacuation fraction, the effect of short-term relocation criterion (25 rem/50 rem for plume passage) and long-term relocation criterion (4 rem for groundshine). In addition, other issues were raised by the recent expert elicitation on MACCS uncertainties.

The consequence analysis uses a release of fission products from 3.5 cores. Thermal-hydraulic analysis done using the SFUEL code indicates that about 1 core would release its fission products. Therefore, a sensitivity was performed releasing fission products from 1 core. An updated thermal-hydraulic analysis could give a more accurate estimate of the amount of fuel releasing fission products. Also, the consequence analysis uses cesium, ruthenium, and fuel fines release fractions of 1, 2×10^{-5}, and 6×10^{-6}, respectively. The revised source term in NUREG-1465 provides a more accurate estimate for cesium (i.e., .75). The ruthenium release fraction could be bounded by the range of 2×10^{-5} to .75. CODEX or VERCORS data may provide a more accurate estimate of the fuel fine release fraction in air. In addition, rubbling will limit fission product releases, particularly ruthenium and fuel fines releases which occur after cladding oxidation. ACE testing of core-concrete interactions indicates that the effect of rubbling is to prevent ruthenium release. The PHEBUS-FPT5 air ingression test may provide another indication of the extent of the effect of rubbling on fission product release. Also, future PHEBUS tests using high burnup fuel may provide a more accurate indication of the release fractions for ruthenium and fuel fines for high burnup fuel. (As a result of fuel management, the fuel in the spent fuel pool that releases its fission products may not all be high burnup fuel.)

The consequence analysis uses the plume heat content of the large-early release for Surry from NUREG-1150, that is, 3.7×10^{6} watts. An updated thermal-hydraulic analysis could give a more accurate estimate. Also, the consequence analysis uses the default plume model in MACCS. Results of a recent expert elicitation include a conclusion that a more realistic model would result in more plume spreading. Repeating the consequence analysis with a more realistic plume model could provide a better estimate of consequences. However, to provide perspective on the relative risk of spent fuel pool accidents compared with reactor accidents, the consequence calculation for the large-early release for Surry from NUREG-1150 also should be repeated with the more realistic plume model.

The consequence analysis uses the protective measures modeling for the large-early release for Surry from NUREG-1150. As a sensitivity case, it also uses an early evacuation start time of three hours before the release begins. It has been suggested that, for ad hoc protective measures, an evacuation fraction of .95 is more likely than the NUREG-1150 evacuation

fraction of .995. Therefore, additional sensitivities using an evacuation fraction of .995 have been requested. Also, because of the issue raised of the use of the early fatalities versus cancer fatalities for decision making, the sensitivity of the results to short-term and long-term relocation criteria should be assessed.