February 7, 2003

Analyses of Spent Fuel Pool Accident Consequences Using MELCOR-Predicted Source Term

## Introduction

The first preliminary integral analysis of a severe spent fuel pool event has recently been completed and is documented in "Evaluation of Spent Fuel Pool Accident Response to a Complete Loss of Coolant Inventory," January 2003.

Ex. 5

The first consequence analysis was a comparison of the consequences from the generic spent fuel pool source term used in the NUREG-1738, "Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants," February 2001 with the consequences from the MELCOR predicted source term.

Ex. 2

## NUREG-1738 Consequence Assessment

As part of the effort to develop generic, risk-informed requirements for decommissioning, RES completed an analysis of offsite radiological consequences of beyond-design-basis spent fuel pool accidents (NUREG-1738). In this analysis, RES evaluated the consequences using fission product inventories at 30 and 90 days and one, two, five, and ten years after final reactor shutdown to provide insight into the effect of reductions in nuclide inventories available for release. Some of the main assumptions in the NUREG-1738 analysis are shown below.

**Inventories:** The spent fuel pool nuclide inventories used were those for a small BWR (Millstone 1) given in Appendix A of NUREG/CR-4982, adjusted to represent a large BWR (3441 MWt) during decommissioning. Two adjustments were made to the NUREG/CR-4982 inventories. The first adjustment was to multiply the inventories by a factor of 1.7, because the thermal power of the large BWR is 1.7 times higher than that of Millstone 1. The second adjustment was made because NUREG/CR-4982 was for an operating reactor and the NUREG-1738 analysis was for a decommissioning reactor. In this adjustment, the inventories of the entire final core offload were added to the spent fuel pool.

**Fission Product Release Fractions:** Two set of release fractions were used in the NUREG-1738 analysis. These two sets were a) the release fractions of NUREG-1465 and b) the release fractions of NUREG-1465 modified to assume the ruthenium release fraction is that for a volatile fission product and the fuel fines release fraction is that from the Chernobyl accident. These two sets are shown in Table 1.

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~~Ex 2 entirely~~

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| Source Term | Release Fractions | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Xe | I | Cs | Te | Sr | Ba | Ru | La | Ce |
| NUREG-1465 | 1 | .75 | .75 | .31 | .12 | .12 | .005 | .0052 | .0055 |
| NUREG-1465 (modified) | 1 | .75 | .75 | .31 | .12 | .12 | .75 | .035 | .035 |

Table 1. NUREG-1738 release fractions to the environment

**Fission Product Release Timing:** The release timing was that for a large, early release from the Surry NUREG-1150 consequence assessment. In this case, the release occurred over the period of approximately 1 to 1.5 hours after the start of the accident.

**Plume Heat Content:** The plume heat content of 3.7 MW was that for a large, early release from the NUREG-1150 consequence assessment.

**Evacuation Timing and Fraction:** The evacuation timing was that from the Surry NUREG-1150 consequence assessment. The evacuation begins at 2.4 hours. The fraction of people evacuating is .95.

<u>MELCOR Fission Product Release Fractions and Timing</u>

Ex. 5 [ ]

Ex. 5 [ ]

**Fission Product Release Fractions:** The NUREG-1738 consequence assessment assumed that all of the assemblies in the spent fuel pool heated up and released their fission products. As discussed above, two sets of release fractions were used in NUREG-1738. The first set was from the NUREG-1465 source term. The second set was the NUREG-1465 source term modified to account for uncertainty in release fractions of ruthenium and fuel fines. This second set of release fractions is shown in the first row of Table 2.

Ex. 5 [ ]

| Source Term | Release Fractions | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Xe | I | Cs | Te | Sr | Ba | Ru | La | Ce |
| NUREG-1465 (modified) | 1 | .75 | .75 | .31 | .12 | .12 | .75 | .035 | .035 |

Ex 5

Table 2. MELCOR-predicted release fractions to the environment

Ex 5

Ex 2

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The NUREG-1738 release fractions were the fractions of the total inventory in the spent fuel pool that were released to the environment.

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