JUN 12 1992

MEMORANDUM FOR: Robert C. Jones, Chief
Reactor Systems Branch
Division of Systems Technology
Office of Nuclear Reactor Regulations

FROM: Mark A. Cunningham, Chief
Probabilistic Risk Analysis Branch
Division of Safety Issue Resolution
Office of Nuclear Regulatory Research

SUBJECT: ABRIDGED LEVEL 2 AND 3 LOW POWER AND SHUTDOWN RISK ANALYSES

We recently completed two studies of risk during low power and shutdown operations, a study at Sandia National Laboratories (SNL) of the Grand Gulf plant and a study at Brookhaven National Laboratory (BNL) of the Surry plant. Results were presented to your staff on May 6, 1992, and to a steering group on May 28, 1992.

Enclosed are draft reports of both studies. Since our presentations, some of the graphs in these reports reflect numerical corrections, but these corrections do not alter our conclusions. Enclosure 1 is the SNL report of the Grand Gulf study. Enclosure 2 is the BNL report of the Surry study.

At the May 6th meeting your staff requested additional calculations described in a note from M. Caruso to C. Ryder dated May 21, 1992. Below I have indicated our response in italics under each item of the request. The information regarding Grand Gulf is in Enclosure 3 and regarding Surry is in Enclosure 4.

1. Plots of mass (lbs/hr) and energy (btu/hr) release rates from the reactor vessel as a function of time following initiation of boiling.

   The energy release plots were not made because of time constraints. Grand Gulf: The plot of mass as a function of time was not made because of time constraints. Surry: The plot of mass as a function of time is Item 1-S.

2. Plots of pressure (psig) versus time in the auxiliary building and location of maximum pressure for cases where the containment is open.

   Grand Gulf: The plot is Item 2-GG. Surry: The plot is Item 2-S.

3. Plots of pressure (psig) in containment as a function of time and locations of maximum pressure for cases when the containment fails.

   Grand Gulf: The plot of the containment pressure is Item 3a-GG and of the auxiliary building pressure is Item 3b-GG. Because the pressure rise in the containment is slow, the pressure in the various volumes are close to one another; we provided a pressure trace only of the containment dome region. Surry: The plot of containment pressure as a function of time is Item 3-S.

4. Temperature and humidity versus as a function of time and the times of such maxima in auxiliary building rooms which house electrical and mechanical equipment vital to restoration of cooling for cases when the containment is open.

   Grand Gulf: The plot of temperature as a function of time is Item 3a-GG. The contents of the rooms are not associated with the rooms of which these calculations represent. Humidity is indicated as mole steam fraction in a plot as a function of time in Item 3b-GG. Surry: The request is not applicable.

5. Plot of the activity release rate as a function of time from the reactor vessel.

   Grand Gulf: The plot was not made because of time constraints. Surry: Two plots are as Items 5a-S (one set of radionuclides) and 5b-S (another set of radionuclides).

6. Plots of the rate of activity entering the auxiliary building as a function of time for the containment open cases.

   Grand Gulf: The plot was not made because of time constraints. Surry: The request is not applicable.

7. Mass in the reactor vessel at the time of an accident.

   Grand Gulf: A table of the information is Item 7-GG Surry: A table of the information is Item 7-S.

8. A brief description or reference to a description of the codes termed PRA MODEL in the Grand Gulf study and SURSOR in the Surry study.

   The codes to which you refer are parametric models used in the risk analysis in the determination of uncertainty in the source terms. The codes are simple fast-running mass-balance equations that <u>mimic</u> MELCOR, a more robust code which actually <u>calculates</u> source terms and predicts accident progressions given a set of initial conditions.

9. Diagrams of model nodes showing volumes and heat sinks for containment and auxiliary building model used to compute pressure in these structures during an accident.

The heat sinks listed in MELCOR printouts are in a rather cryptic form that would take us awhile to convert into something more readily useable by your staff; hence, that information is not included here. Grand Gulf: A diagram of the containment nodes is Item 9a-GG. Other diagrams could not be produced at this time because the contractors have been working on their reports. Surry: A diagram of the containment nodes is Item 9a-S and a list of the volumes is in Item 9b-S.

In applying the MELCOR calculations to your work, you should keep in mind the following: (1) The calculations are not a direct part of our risk analyses, but are used in developing the event tree, (2) The calculations represent only the accident scenario for which MELCOR was configured as the NRR staff requested and are not necessarily representative of dominant sequences, (3) There is much variability in the calculations because of uncertainty in parameters and models. Taken together, these points mean that requested calculations represent a limited number of accident scenarios without an accounting of uncertainty.

Uncertainty is not expressed in these calculations because of difficulties in performing the necessary calculations. We typically express the uncertainty in the context of the risk analysis. Even the event times and pressures which we present to you, determined with MELCOR calculations, contain the same uncertainty. We implicitly acknowledge this uncertainty in our interpretation of the results. In essence, the calculations are *deterministic*, not *stochastic*. Your staff may wish to discuss these notions with us.

If you and your staff have questions regarding this information, please call Christopher Ryder at 492-3959.

/S/

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Enclosures:
As stated

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