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PROJECT TITLE: Severe Accident Sequence Analysis (SASA)

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A meeting was held at ORNL during January to discuss the use of the ORNL-developed BWR-LTAS code by the SNL SASA program in support of the RMIEP program at SNL. As a result and with the concurrence of the NRC technical monitor, one additional month of effort will be devoted now to improvements to [redacted] The implementation of all existing ORNL-developed BWR models into MARCON 2.0B will be completed during February and transmitted to SNL. Subsequently, [redacted] and tested and calculations will be made for the degraded core portion of the Browns Ferry ATWS accident sequence. Checkout and testing of the MELRPI code on the ORNL computer system continues. (This code permits study of the core response after significant degradation of the original geometry.) In the fission product transport analyses group, an analysis of the effect of consideration of radioactive decay upon fission product transport calculated results continues. Also, first results from the ongoing tests of Browns Ferry HEPA filter loading by aerosols are now available.

The personnel contributing to the SASA effort at ORNL are divided into three working groups. The individual group reports for progress during January are presented below with a brief initial statement of the purpose of each group.

Group I: (R. M. Harrington) Determines and analyzes the events of the accident sequence that would occur prior to core uncovery, using the ORNL-developed simulation program BWR-LTAS to study the plant response to operator actions.

During January, the La Salle FSAR was reviewed to determine the characteristics of the safety relief valves, the ECC injection systems, and the primary containment (drywell and wetwell). The purpose was to determine the additions that would have to be made to the BWR-LTAS coding to accurately simulate the long-term response of La Salle to severe accident conditions and to maintain the ability to study the plant response to operator actions.

The general coding changes that must be made to accommodate the BWR MK II containment are:

1. Primary containment heat sinks. Some small modifications in the drywell models, [redacted] (The MK I wetwell is a torus contained in an uninsulated steel liner,

located within a large concrete room. [redacted]

2. Coding improvements to the Residual Heat Removal (RHR) heat exchanger effectiveness model to permit study of system designs other than that particular to Browns Ferry.

3. The addition of equations and models to permit the study of small-break LOCAs within the primary containment.

These three changes are applicable to the general MK II containment design and are also necessary for the future SASA studies of severe accident sequences at the Limerick MK II containment plant. That an effort is made to make these changes now instead of later only constitutes a rearrangement of schedule, not additional work. It should be noted that some plant-specific changes to models will be necessary to support application of the code to La Salle; for example, [redacted] thus the feedwater flow for this specific plant must be described by an algorithm instead of a constant. It has been agreed that these plant-specific models will be provided as necessary by SNL SASA Program personnel.

[redacted] We have been directed to mimic the IDCOR interpretation of this accident to see if we come to the same conclusions regarding the significance of the accident. Although the 1981 published study of the [redacted].

GROUP II: (L. J. Ott) Determines and analyzes the events of the accident sequence that would occur following core uncovery, including core melt and containment failure.

Implementation of MARCON-2.0B at ORNL (C. R. Hyman, L. J. Ott, T. L. Heatherly) Work is continuing to complete the incorporation of the [redacted] (essentially [redacted]). This code will be designated MARCON-2.0B upon incorporation of all currently existing ORNL-developed BWR response models.

[redacted] The tables of information that describe the required input for MARCON-2.0B have been placed on the ORNL word processing system and modified as necessary to

include the new input necessary for the BWR models and to eliminate the requirement for [redacted]

A tape of the modified coding and a copy of the modified input description will be transmitted to the SASA program personnel at SNL as soon as possible. Subsequently, one final modification will be developed and implemented into the code; this [redacted] Group III in previous work. Local fission product transport calculations both before and after the incorporation of the B_4C reaction models are planned for the purpose of demonstrating the importance of consideration of this reaction in BWR fission product transport studies.

The MARCON 2.0B code will be considered complete from the standpoint of special BWR modeling when it has been modified to include the B_4C reaction models. A tape of the coding and a copy of the associated input description will also be provided to the SNL SASA program at that time. Locally, the code will be first applied to the Browns Ferry ATWS accident sequence degraded core response studies.

BWR Containment Response Under Severe Accident Conditions (C. R. Hyman) Documentation concerning the CORCON MOD2 code is being reviewed to determine practical methods of dealing with the BWR MARK I containment drywell sumps. These two sumps are directly beneath the reactor vessel and together have a capacity of 1000 gallons ($\sim$134 ft^3).

BWR Degraded Core, ECCS, and Lower Plenum Corium Progression Model Development (A. Sozer) The final version of the report, "The Modeling of BWR Core Meltdown Accidents — For Application in the MELRPI.MOD2 Computer Code," NUREG/CR-3889, and the final version of the modified coding pertinent to this report have been received from RPI. The new coding, which reflects the response to peer review comments of the associated report, has been made operational on the ORNL computer system and is being exercised locally.

Group III: (R. P. Wichner) Determines the magnitude and timing of fission product release from the fuel, establishes the various pathways for fission product release to the atmosphere, and performs the fission product transport calculations for each Severe Accident sequence analyzed.

Fission Product Transport Computation (C. F. Weber) The list of radioactive isotopes tracked during the SASA fission product transport calculations has been expanded to include the additional isotopes that are not important fission products in themselves, but do have significant effect upon the calculated results by their actions as precursors. Thus the final list includes isotopes of Se, Br, Rb, and Te, in addition to isotopes of the standard elements normally considered in such studies: Kr, Xe, I, and Cs.

[redacted] paper concerning the importance of considering [redacted] in BWR fission product transport studies has been [redacted] The paper is based upon the information summarized under this heading in the December 1984 monthly report. The basic argument establishing the necessity for inclusion of radioactive decay considerations for Boiling Water Reactor fission product transport studies depends upon the fact that radioactive isotopes released after reactor vessel failure in the MK I and MK II containment designs are, in many accident sequences, not subject to scrubbing by the pressure suppression pool. Thus, for example, [redacted]. This constitutes an important sneak pathway for radioactive iodine to bypass the pressure suppression pool; this pathway will not be included in calculations unless the radioactive decay of tellurium is modeled.

Standby Gas Treatment System Effectiveness Calculations (S. D. Clinton) The results of recent studies by various organizations have shown that the BWR MK I Primary Containment would fail either by overpressure or overtemperature not long after reactor vessel failure under severe accident conditions. Therefore, it is most important that the capability of the BWR secondary containment to mitigate the concomitant releases of fission products to the atmosphere be assessed.

[redacted]. At Browns Ferry, the system has a very large capacity (21,500 cfm with three blowers) and would be automatically initiated.

Because previous ORNL SASA program studies have shown that the effectiveness of the SGTS system is a major factor in mitigation of fission product releases for postulated severe accident sequences at Browns Ferry, we have sponsored tests at the filter test facility at New Mexico State University to determine [redacted] would perform their function under severe accident conditions. The Reactor Building has an extensive fire protection spray system that would automatically activate (on high temperature) after drywell failure, so it is intended that an examination of the effect of moisture loading of the Browns Ferry HEPA filters be included in the tests.

Because the Browns Ferry SGTS blowers are capable of sustaining a pressure drop equivalent to 16 inches of water across the upstream HEPA filter that would be loaded by aerosols under severe accident conditions, we have required that the New Mexico State University tests demonstrate the effects of this pressure drop across the filters. In response to this requirement, additional in-series axial vane fans have been added to the test facility so as to achieve the required differential pressure.

As of January 23, the pressure drop across the HEPA filter being loaded with aerosols had increased to 10.5 inches of water at an air flow of 1000 cfm and a mass accumulation (latex aerosol) of 1050 grams on the filter. These operating parameters are similar to the assumed conditions for HEPA filter failure used in previous SASA program analyses of SGTS operation during severe accidents (one Kg of latex aerosol is the volume equivalent of three Kg of corium-concrete reaction aerosol).

The air flow for the experiment is presently being maintained between 900 and 1000 cfm by controlling the resistance of the inlet damper to the three axial vane fans. This test is scheduled to continue until either the filter pressure drop increases to 16 inches of water or the HEPA filter medium ruptures. Upon completion of this dry latex test, the filter experiment with water spray (no aerosol) that was discussed in the monthly report for November will be repeated to utilize the additional head capacity now available with the new fan system. The scheduled third filter test will include both latex aerosol and water spray.

MEETINGS AND TRIPS: Greg Kolb and Andy Peterson of SNL and Lanny Smith of SAI visited ORNL on January 16 and 17 for discussions with Mike Harrington concerning the identification of desirable modifications to BWR-LTAS to permit the calculation of accident sequences at La Salle.

S. A. Hodge attended an NRC-sponsored meeting at the Phillips Building, Bethesda, MD on January 30 for discussions concerning the [redacted] hydrogen [redacted] accident conditions.

S. A. Hodge attended an NRC-sponsored meeting at the Air Rights Building, Bethesda, MD on January 31 for discussions concerning the remaining NRC/IDCOR interface issues.

REPORTS, PAPERS, AND PUBLICATIONS: The paper "Tellurium Precursor Effects on Iodine Transport in a BWR Accident" by C. F. Weber was submitted for consideration for presentation at the forthcoming ANS meeting at Boston, MA on June 9–14, 1985.

PROBLEM AREAS: At the current funding level, the fission product transport studies portion of the ORNL SASA program has been significantly curtailed.