Monthly Highlights

for

April 1984

Application of RAMONA-3B to BWR ATWS*
(FIN No. A-3273)

P. Saha, Group Leader
LWR Code Assessment and Application Group
Department of Nuclear Energy
Brookhaven National Laboratory
Upton, New York 11973

* Work performed under the auspices of the U.S. Nuclear Regulatory Commission.

Application of RAMONA-3B to BWR ATWS

This project provides detailed, best-estimate, BWR ATWS analyses for the NRC Severe Accident Sequence Analysis (SASA) Program. In particular, several Browns Ferry Unit 1 MSIV closure ATWS analyses are being performed using the RAMONA-3B code with three-dimensional neutron kinetics. These calculations will not only improve understanding of the BWR behavior during an ATWS, but they can also be used for benchmarking similar calculations performed elsewhere by using the point kinetics codes such as RELAP5 and BWR-LACP.

The major activities performed during April 1984 are noted below.

1. Browns Ferry MSIV Closure ATWS Calculation
(G. Slovik, E. Cazzoli and L. Neymotin)

Two preliminary MSIV closure ATWS calculations have been performed using the RAMONA-3B code. These are: (1) MSIV closure ATWS followed by Recirculation Pump Trip (RPT), lowering the downcomer water level to the Top of Active Fuel (TAF), and depressurizing the reactor vessel in accordance with the heat capacity temperature limit curve for the pressure suppression pool, and (2) MSIV closure ATWS with recirculation pump trip (RPT) failure. The first transient is essentially the same as the INEL sequence #439 previously calculated with the RELAP5 code.

The RAMONA-3B results of the first transient (calculated up to 600 seconds) indicate that the core inlet subcooling can be listed as a dominant factor in determining the long term reactor power. This subcooling, which depends on the degree of steam condensation on the cold HPCI and RCIC water jets after the feedwater spargers are uncovered, can range from essentially zero (resulting from a high degree of condensation) to approximately 40°C (corresponding to very little condensation). The resultant reactor powers for these two extreme cases have been calculated to be 14% and 28% of the steady-state value, respectively.

Even the lower bound, i.e., 14%, is higher than the RELAP5 calculated power of approximately 7% of steady-state value. The reasons for this discrepancy are being investigated by both the BNL and INEL staff.

The RAMONA-3B results also showed that during a BWR ATWS, the axial power profile does change quite frequently because of slight variations in the axial void distribution. Thus, the BWR ATWS results obtained by using a point kinetics code such as RELAP5 which assumes a fixed axial power distribution, must be judged very carefully.

The second RAMONA-3B calculation, i.e., ATWS with RPT failure, produced a peak pressure of 8.9 MPa (~1290 psia) and the average reactor power remained below 80% of steady-state value. The total capacity of the safety/relief valves was high enough to maintain the pressure below the pipe/vessel failure pressure. However, the downcomer water level decreased very fast and core uncovery seemed likely. The calculation was run only up to 40 seconds.

2. Generation of Browns Ferry Cycle 5 Nuclear Data
(G. Slovik and P. Konut)

Work has begun in generating the cross sections or nuclear data specific to the Browns Ferry reactor. Data for fuel cycle 5 will be generated for the future RAMONA-3B calculations for the Browns Ferry ATWS study. Information required for this task has been obtained from TVA and other sources.

Distribution

B. Agrawal, NRC/RES
O. E. Bassett, NRC/RES
W. D. Beckner, NRC/RES
R. T. Curtis, NRC/RES
C. N. Kelber, NRC/RES
R. B. Minogue, NRC/RES
F. Odar, NRC/RES
D. F. Ross, NRC/RES
L. M. Shotkin, NRC/RES
T. J. Walker, NRC/RES
N. Zuber, NRC/RES

D. Fieno, NRC/NRR
C. Graves, NRC/NRR
M. W. Hodges, NRC/NRR
L. Lois, NRC/NRR
B. Sheron, NRC/NRR

R. C. Gottula, INEL
D. Majumdar, DOE-ID
S. A. Hodge, ORNL
L. Proctor, TVA
A. Walters, BCL

W. Y. Kato, BNL
H. J. C. Kouts, BNL
DNE Associate Chairman, BNL
NSP Division Heads and Group Leaders, BNL
LWR CAAG Personnel, BNL