TOPICAL REPORT EVALUATION

Report Number & Title: BAW-10095 (Non-Proprietary) Computer Program for Predicting Containment Pressure - Temperature Response to a Loss-of-Coolant Accident (July 1974)
Originating Organization: Babcock & Wilcox, Power Generation Group
Reviewed By: Containment Systems Branch, Directorate of Licensing, January 1975

SUMMARY OF TOPICAL REPORT

Appendix K to 10 CFR 50 of the Commission's regulations requires that the effect of operation of all containment installed pressure reducing systems and processes be included in ECCS evaluations. For the purposes of ECCS evaluation, it is conservative to minimize the containment pressure which increases the resistance to steam flow in the reactor loops and reduces the reflood rate in the core.

The B&W CONTEMPT code as described in BAW-10095 is utilized by Babcock & Wilcox to calculate containment pressures as part of its ECCS evaluation model. Following a loss-of-coolant accident, the pressure in the containment building will be increased by the addition of steam to the containment atmosphere. This steam will be produced by the flashing of the primary coolant at the break and, following the initial blowdown, additional steam will be produced by heat flow from the core, primary metal structures, and steam generators to the ECCS water. This steam together with any ECCS water spilled from the primary system will flow through the break and into the containment. Steam condensation on the containment walls and internal structures serves as a passive energy heat sink that becomes effective early in the blowdown transient.

Subsequently, the operation of the containment heat removal systems such as containment sprays and fan coolers will remove steam from the containment atmosphere. When the steam removal rate exceeds the rate of steam addition from the primary system, the containment pressure will decrease from its maximum value.

The B&W CONTEMPT code calculates the containment pressure both during the blowdown and reflood phases of the loss-of-coolant accident. Mass and energy to the containment is provided by the CRAFT-2 computer program during the blowdown period as described in BAW-10092 and during the reflooding period by the REFLOOD code as described in BAW-10093. The flow of steam through the reactor loops and into the containment during the reflooding period is sensitive to the steam density as determined from the containment pressure. For this reason, iterations may be required between REFLOOD and CONTEMPT to establish consistent reflooding and containment pressure analyses. The Babcock & Wilcox CONTEMPT code considers heat absorption from the containment atmosphere by the action of the passive heat sinks, containment spray systems and ventilation fan coolers.

SUMMARY OF REGULATORY EVALUATION

We have evaluated the Babcock & Wilcox containment pressure model in accordance with Appendix K and have concluded that the model is acceptable provided that conservative input assumptions to the CONTEMPT code are selected. BAW-10095 describing the B&W CONTEMPT code is a general code description only and specific input assumptions are not presented. Babcock & Wilcox has provided the specific input assumptions within BAW-10091 for the 177 fuel assembly plants with lowered-loop arrangement. These assumptions lead to a reduction in the calculated containment pressure to more than 50% of the maximum pressure calculated for the containment design basis accident. Some of these assumptions are listed below:

1. The containment-free volume used is 5% larger than the largest building of the plants in Category I.

2. All heat removal systems are actuated and the sprays are assumed to be 100% efficient.

3. Steam injected into the containment during the reflooding period is assumed to be mixed in thermodynamic equilibrium with the spilled ECCS water. This assumption acts to quench steam that would otherwise increase the containment pressure.

4. Heat transfer to the containment heat sink structure during blowdown is based on an assumed heat transfer coefficient of four times that calculated by the Tagami correlation which is used in analyses of the containment design basis accident. Subsequent to blowdown a coefficient of 1.2 times the Uchida correlation is used.

5. The heat sink structures are calculated by a method that should envelope the actual structures. Verification of the actual heat sinks for each plant will be provided at a later date.

We have reviewed these input assumptions as outlined above and found them acceptable. We have also conducted a confirmatory analysis using our CONTEMPT-LT code and have calculated the same containment backpressure as Babcock & Wilcox.

For plants other than the 177 fuel assembly plants with lowered-loop arrangement, Babcock & Wilcox will provide and justify the specific input assumptions at a later time. This information will include the assumptions made regarding the containment heat sinks containment volume, operation of the active heat removing systems and mass and energy release to the containment.

REGULATORY POSITION

We conclude that the B&W CONTEMPT code is an acceptable method for calculation of containment pressure for ECCS analysis and that BAW-10095 may be

referenced for analysis of Emergency Core Cooling Systems provided the code input is selected as described in BAW-10091, "B&W's ECCS Evaluation Model with Specific Application to 177 FA Class Plants with Lowered Loop Arrangements." For plants other than those described in BAW-10091, we will require additional information as discussed above.

Should Regulatory criteria or rules change, such that our conclusion concerning this topical report is invalidated, you will be notified and given the opportunity to revise and resubmit the report for recalculation should you so desire.