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August 30, 1982

MR HAROLD DENTON
DIRECTOR OF NUCLEAR
REACTOR REGULATION
U S NUCLEAR REGULATORY COMMISSION
WASHINGTON D C 20555

ATTENTION MARK PADOVAN

DOCKET 50-312
RANCHO SECO NUCLEAR GENERATING STATION, UNIT NO. 1

Please attach the following pages to my letter to you dated August 12, 1982 regarding NUREG-0737, Item II.K.3.30, "Revised Small Break LOCA Methods to Show Compliance with 10CFR50, Appendix K". These pages were inadvertently not attached to the letter.

John J. Mattimoe

John J. Mattimoe
Assistant General Manager
and Chief Engineer

Enclosures

A046

References

1. "B&W's Post Test Evaluation of LOFT Test L3-1", Document No. 51-1125988-00, May 1981.

2. "B&W's Best Estimate Prediction of the LOFT L3-6 Nuclear Small Break Test Using the CRAFT 2 Computer Code", Document No. 12-1124993-01, March, 1981.

3. "B&W's Post Test Analysis for Semiscale Test S-07-10D", Document No. 86-1125888-00, May, 1981.

4. Summary of Meeting with the B&W Owners Group Concernig the Abnormal Transient Operating Guidelines (ATOG) Program and TMI Action Item II.K.3.30 Small Break Loss of Coolant Accident Models (December 16, 1980).

5. Letter from Eisenhut to Mattimoe, March 25, 1982, Docket No. 50-312, Subject: Need for Model Verification.

ATTACHMENT #1

Nine areas of concern for II.K.3.30 were identified in the meeting of December 16, 1980 between the Staff and B&W Owners. These concerns are repeated below as found in the minutes of that meeting prepared by Mr. Throm of the Reactor Systems Branch. Owner responses to each concern are also included.

1. NEED TO VERIFY THE CURRENT NON-CONDENSIBLE MODEL AND THE CONSERVATISM OF THE CONDENSATION HEAT TRANSFER RATE IN THE STEAM GENERATOR.

   a) Report has been prepared describing a method to predict the amount of non-condensible gases in the primary system, including gas produced via radiolytic decomposition which may be released during a SBLOCA. This report will be submitted to the NRC in August 1982.

   b) A non-condensible gas heat removal model has been prepared and incorporated into the CRAFT code. This model is described in the revision to the CRAFT Topical Report scheduled for submittal to the Staff in September 1982.

2. NEED TO VERIFY THE NON-EQUILIBRIUM MODEL AND TO JUSTIFY THAT THE AMOUNT OF ECCS WATER INJECTED IS CONSERVATIVE.

   a) Report has been prepared and will be submitted to the Staff in August which justifies the current B&W ECCS evaluation model which utilizes CFT injection into the lower downcomer region.

   b) This work was discussed with the Staff in the technical presentations on December 16, 1981.

3. NEED TO DISCUSS THE PRESSURIZER MODEL AND THE EFFECTS OF A NON-EQUILIBRIUM MODEL.

   a) A non-equilibrium pressurizer model has been incorporated into the CRAFT code. This model will be addressed in the revised CRAFT Topical Report to be submitted to the Staff in September 1982. This model was discussed with the Staff on December 16, 1981.

   b) The surge line model was discussed with the Staff on December 16. The open question from the Staff will be addressed in a written response in September 1982.

4. NEED TO ADDRESS THE FORMATION OF A STEAM BUBBLE IN THE HOT LEG "CANDY CANE". (IS IT A REAL OR CALCULATED PHENOMENON?) EXPERIMENTAL VERIFICATION BELIEVED NECESSARY.

   a) This is addressed in several parts of the SBLOCA Methods Program:

      - System modeling study (steam generator, hot leg, and reactor vessel head)
      - Steam generator and pressurizer model changes

b) The joint NRC/Owners testing evaluation task concentrated on this issue. Documents described in Attachment #2 support the evaluation of this concern, and the report on "Bubble Dynamics" specifically addresses this concern.

5. THE STAFF INDICATED THAT A MECHANISTIC MODEL OF THE STEAM GENERATOR HEAT TRANSFER SHOULD BE DEVELOPED. A BEST ESTIMATE OR VERIFIED CONSERVATIVE MODEL WOULD BE ACCEPTABLE.

a) The steam generator model has been upgraded and will be described in the revision of the CRAFT Topical Report to be issued to the Staff in September 1982.

b) Steam generator model was presented to the Staff in the December 16, 1981 meeting.

6. AS PART OF THE ADDITIONAL SYSTEMS VERIFICATION NEEDED, THE FOLLOWING SEMISCALE AND LOFT TESTS SHOULD BE CONSIDERED: SEMISCALE S-07-10D, LOFT L3-1, L3-5, AND L3-6.

a) The Owners considered the above tests and provided the Staff post test evaluations of L3-1, L3-6, and S-07-10D (References 1, 2, and 3 to this letter).

7. THE OVERALL THERMAL-HYDRAULIC BEHAVIOR OF THE CORE DURING UNCOVERY SHOULD BE VERIFIED AGAINST APPLICABLE EXPERIMENTAL DATA, PARTICULARLY THE RECENT ORNL DATA.

a) ORNL data has been used to show that the current application of the Ditters-Boelter correlation is conservative. Data was discussed with the Staff on December 16, 1981, and a report will be provided to the Staff in August 1982.

8. THE INFLUENCE OF METAL HEAT ON THE SYSTEM PRESSURE RESPONSE, PARTICULARLY ON THE TIME OF ECCS INJECTION, WAS IDENTIFIED AS AN AREA OF CONCERN AND SHOULD BE SHOWN TO BE PROPERLY CONSIDERED IN THE ANALYSIS MODELS.

a) The B&W ECCS Evaluation Model currently accounts for metal heat and no change needs to be made.

9. THE BREAK FLOW MODEL NEEDS TO BE CONFIRMED. THE USE OF COMBINED MODELS WITH VARIOUS DISCHARGE COEFFICIENTS APPLIED TO THEM NEEDS TO BE COMPARED TO A BEST ESTIMATE MODEL TO DEMONSTRATE CONSERVATISMS.

a) The existing leak discharge model has been found to produce results which are similar to yet still conservative with respect to those obtained with the best estimate model.

b) The work was discussed with the Staff on December 16, 1981 and the report will be provided to the Staff in August 1982.

ATTACHMENT #2

Documents prepared and submitted to the Staff from the B&W Owners' participation in the joint test evaluation task with the NRC.

"The GERDA Test Facility"

This report was prepared in fulfillment of the October 23 commitment by B&W.

"CRAFT 2 Prediction of ARC Loss-of-Feedwater Test", 12-1132544-00, April 1982

This report shows that the revised steam generator model adequately predicts the temporal response of key once-through steam generator parameters after a complete loss of feedwater.

"Auxiliary Feedwater Penetration", 12-1132513-00, April 1982
"Auxiliary Feedwater Axial Flow Distribution", 12-1132543-00, April 1982

The first report describes the calculation model and testing basis for the penetration of the auxiliary feedwater in the OTSG, and the second report uses this model and shows how the axial flow distribution was derived from FOAK testing at Oconee 1.

"Benchmarks for AFW Models", 12-1132555-00, April 1982

This report contains the benchmark results of the AFW models against actual plant data from four plant transients. The ability to predict plant response following loss of offsite power for the extreme conditions under which the AFW system will function is demonstrated in this report.

"Bubble Dynamics", 12-1132565-00, April 1982

This report is focused on the main phenomenological aspects of steam in the hot leg "U" bend and addresses test data and engineering evaluation used to understand "bubble dynamics". Based upon the focused Staff concern on the dynamics of a trapped steam bubble in the inverted U-bend of the hot legs, two issues were identified:

1. During the blowdown portion of the transient, does the code properly predict the formation of the steam bubble and its resultant interruption in natural circulation?

2. During the system refill phase of the transient, how does the trapped steam bubble behave?

In addressing these issues, a review of the calculated plant response was performed in order to assess the controlling phenomena. As a result of that review, it was determined that the governing phenomena were:

1. Interruption in Natural Circulation

   - Spatial heat transfer in the steam generator
   - Distribution of steam flow from the core
   - Phase slip within the hot leg
   - Steam condensation in the steam generator

2. System Recovery Phase

   - Steam condensation on steam-liquid interface

Test data supporting the modeling of these phenomena has been evaluated and reported in the documents listed above. Further understanding of the plant response is provided in a qualitative assessment of plant behavior to various input and modeling assumptions contained in this report. It is clear that the concern on the interruption of natural circulation is a byproduct of the Appendix K assumption on HPI flow. Using the single failure assumption of Appendix K, it is shown in this report that phase slip modeling is important to the development of the plant response. Phase slip modeling is a part of the current SBLOCA Methods Program. The adequacy of current phase slip modeling was shown in the evaluation of test data discussed in the April 16 meeting with the Staff and summarized in this report.

ATTACHMENT #3

Responses to the Eisenhut to Mattimoe letter of March 25, 1982.

1. Interruption of Natural Circulation

   - Branch Flow

     The effect of preferential steam flow to the hot leg or the RV head has been addressed in the "Bubble Dynamic" report (see Attachment #2). Branch flow was discussed with the Staff in the April 16, 1982 meeting.

   - Hot Leg Flow Regime

     This was addressed in the Slip model presentation to the Staff on April 16, 1982 and is discussed in the report "Bubble Dynamics" (see Attachment #2).

2. Cold Leg Thermal Shock

   The concern over cold leg thermal shock was derived, as we understand, from TRAC computer calculations performed by LASL for the Staff wherein significant cyclic temperature variations were shown in the vicinity of the cold leg ECC injection. We encourage the Staff to have an independent QA performed on these calculations by an organization familiar with the hardware and components of the B&W designed system If the cyclic behavior is confirmed, programs are already in place to address thermal shock and this item would be included in that effort.

3. Hydraulic Stability Following Accident Recovery

   This concern is addressed in the report "Bubble Dynamics" and was discussed with the Staff on April 16, 1982. In addition, the presentation given in that meeting, "Steam Condensation on Steam-Liquid Interface", also addresses the governing phenomenon in the recovery phase.

Other concerns in the March 25 letter were: break isolation, steam generator tube rupture, and cooldown and depressurization following a SBLOCA. These concerns are covered by the ATOG Guidelines and some are specific per plant type. Further discussion on these items is expected but not as a part of 11.K.3.30.