March 5, 1986

Docket No. 50-261

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Mr. E. E. Utley, Executive Vice President
Power Supply and Engineering & Construction
Carolina Power and Light Company
Post Office Box 1551
Raleigh, North Carolina 27602

Dear Mr. Utley:

Subject: Report of Conference Call with Carolina Power & Light Regarding H. B. Robinson - 2 Bit Tank Removal (Tac. No. 60301)

In order to expedite your request for deleting the requirements for maintenance of highly borated water inventory and associated heat tracing from your Technical Specifications, we obtained additional information from your staff via a telephone conference call on February 21, 1986. The Enclosure provides documentation of that conference call and contains the following:

1. A brief introduction,

2. Identification of all personnel participating in the conference call,

3. Our understanding of the CP&L response to each of the conference call questing, and

4. A brief statement of whether we consider the information sufficient to continue the review.

Item 3 was discussed with the licensee in a telephone call on February 26, 1986, the purpose of which was to confirm the wording of the CP&L responses.

Please have your staff confirm (or correct as necessary) our understanding of their comments.

Sincerely,

Glode Requa, Project Manager
PWR Project Directorate #2
Division of PWR Licensing-A

Enclosure:
As stated

cc: See next page

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MAR 3 1986

QUESTIONS AND RESPONSE PERTINENT TO H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2 REQUEST FOR LICENSE AMENDMENT BORON INJECTION TANK DILUTION

INTRODUCTION

Carolina Power and Light Company (CP&L) has requested deletion of requirements regarding maintenance of a highly borated water inventory in the Boron Injection Tank (BIT) and the associated heat tracing required to maintain the high boron concentration in solution (Ref. 1). This request was briefly reviewed by the NRC staff, and a preliminary compilation of items where clarification was necessary was prepared on February 19, 1985 (Ref. 2). This was transmitted to CP&L to serve as the basis for a telephone conference call, the intent of which was to determine if the items could be readily resolved and, if so, to do so. The conference call was held between 11:30 AM and 2:00 PM on February 21, 1985. Contained herein are:

1. The material provided in the February 19, 1985 compilation, and,
2. The staff understanding of the CP&L response of February 21, 1985.

The material is organized so that the February 19 compilation is reproduced exactly, with the CP&L responses inserted at the applicable locations. The added staff comments are intended only to provide clarification in regard to the sufficiency of the information, and do not constitute a statement of staff approval or disapproval regarding the content of the information.

A further conference call was held on February 26, 1986, during which the staff compilation of CP&L responses was reviewed with CP&L personnel and assurance was obtained that their position was accurately stated.

THE CP&L REQUEST

Carolina Power and Light stated:

> "Accident analysis has shown that an inventory of highly borated water in the BIT is not necessary to maintain an acceptable margin of safety to

fuel failure during the postulated steamline break event. Furthermore, CP&L has evaluataed the effects of this proposed change on the environmental conditions within the containment during the postulated steamline break (SLB) and determined that the equipment's environmental qualification envelope would not be exceeded. Therefore, CP&L requests removal of the TS (Technical Specification) requirement for this highly borated water supply in order to eliminate the substantial maintenance and surveillance requirements involved in maintaining the inventory. This change will also eliminate the potential to block the Safety Injection (SI) Flow Path due to boron precipitation should the heat tracing fail or become damaged."

Reference is also made to the recommendations of Generic Letter 85-16 (Ref. 3). Copies of the affected TS pages are provided, as is an Exxon Nuclear Company (ENC) report which provides the results of the supporting analyses (Ref. 3).

CP&L continues with discussion of two options:

1. Allow the BIT and associated piping to remain in place, but do not fill with highly borated water, and,
2. Remove the BIT and associated piping.

They have elected to initially pursue Option 1, with the intention that the request for deletion of requirements pertinent to the BIT apply to both options.

Our preliminary review of this request has resulted in several observations and questions which are provided below.

TELEPHONE CONFERENCE CALL RETWEEN THE STAFF AND CP&L

The following personnel participated in the conference:

1. CP&L: Talmage Clements, Jan Kozyra, Merv Marshall, Mark Pope, Steve Floyd (to be the contact for any future calls, 919-836-6901)
2. Exxon Nuclear Corporation: Bob Copeland, Mark Stricker, Brent Fryer
3. NRC staff: Warren Lyon

Each of the Reference 2 comments is reproduced below, followed by the staff understanding of the CP&L (including Exxon) response. Following that is a staff comment regarding whether sufficient information was provided to allow the staff to complete the review.

1. Staff Comment. The Steam Generator (SG) that is affected by an SLB will be depleted in inventory so that the tubes become uncovered on the secondary side. Since these tubes will effectively be at the Reactor Coolant System (RCS) temperature, which will be higher than the SG secondary side temperatue, the potential will exist to superheat steam being generated in the SG. These temperatures can be significantly above the qualification temperature of equipment that can potentially be exposed to steam during a SLB. (Note that equipment inside containment and outside containment can be involved, particulatly if feed is continued to the affected SG, as appears to be the case with Auxiliary Feed Water (AFW) in H. B. Robinson. The phenomenon of superheated steam and its potential effect on safety related equipment (as well as other equipment which may influence the progress of accidents) does not appear to be addressed.

   CP&L Response. Once the steam lines pass through the containment walls, all main steam lines, connecting steam lines of reasonable size (including connections such as the lines to the turbine driven AFW pump), valves, and connections are not contained in a closed building. The only housing provided consists of a roof and floors. There are no walls. This should alleviate concerns relative to steam superheat in rooms housing critical equipment outside of containment, with the possible exception of direct impingement.

Staff Response. This is sufficient information for the review to go forward. Analyses for other plants with large dry containment designs generally establish a greater concern with equipment in "doghouses" which house main steam isolation valves and other sensitive equipment than in the large enclosed volume of the containment. Establishing that there are no enclosed spaces outside containment where superheat from a steam line break can heat the enclosed space leads to a significant reduction of the concern. However, the problem of superheat in general remains, and should be investigated on a schedule that should be established between CP&L and the staff H. B. Robinson project manager.

2. Staff Comment. Reference is made to several computer codes and the application of these codes to analysis of H. B. Robinson. No references are provided. For example, use of RELAP5 is extensive, but the only identification provided is to "RELAP5". The RELAP5 code has been under development for many years, and the number of versions and perturbations is almost unlimited. We require a more precise definition of each code which is applied to analyses of this issue. We also require a statement with respect to prior NRC staff approval or approval status of the spcific codes(s) which are applied to the safety analyses.

The method of application of computer codes can be as important to the realization of meaningful results as the code itself. Thus, the staff generally approves not only the code, but the method of code application (such as nodalization or option selections). A statement should also be provided in regard to this aspect of the analyses.

The response should address the following code versions and their application, as well as any others which were used to support this change request:

a. CONTEMPT/LT28
b. RELAP5
c. XTG
d. XCOBRA-IIIC

CP&L Response. The version of the RELAP5 code used for these analyses is described in EXXON document number XN-NF-84-93(P). It is a modification of RELAP5 MOD1 CYCLE25 and the modification was performed by EG&G Services for EXXON. The major modifications are:

a. Account for steam only out of the break as opposed to a steam-water mixture. Note the flow rate is calculated to be roughly 15% higher than would be calculated by Moody.

b. Modification of the enthalpy transport model to decrease the computation time. This would have allowed a reduction in the number of nodes from the previously used nodalization model, but the reduction was not included in the analyses (i.e., more nodes were used than necessary and the model was not changed).

c. Stack Model, which was used in conjunction with item d to assist in elimination of water packing problems in the steam separators.

d. Separator Model, as mentioned in item c.

The XTG (Rev. 3) and XCOBRA-IIIC codes are staff approved, and the approved application methodology, as described generically, is generally followed. Contempt/LT28 is a "special code" that is maintained under UCCEL Corp. (now PPC) quality control procedures which are audited by EXXON.

Staff Response. This is sufficient information. We understand the RELAP5 code being used by EXXON is presently being reviewed by NRC to establish staff approval.

3. Staff Comment. The assumption has been made that the BIT and the piping between the BIT and the RCS are initially filled with unborated water. Piping between the BIT and the Refueling Water Storage Tank (RWST) is not addressed. Please address this piping with regard to boron concentration and the implications with respect to RCS boration.

CP&L Response. A concentration of 1950 ppm boron was assumed for the pipe between the RWST and the BIT. This is consistent with plant operation. The SI pumps are tested monthly, and this flushes the line between the RWST and the pumps.

For now, valves between the BIT and BAST will be closed and locked. CP&L plans to physically cut and cap the lines if TS changes can be obtained in time to make the changes prior to startup. There are no connections to gas (air or other gases) lines. There are no suction lines. The configuration is such that the BIT constitutes an integral piping component in the piping downstream of the SI pumps. There is a tap-off connection on the top of the BIT which is used for venting to assure the BIT is full if its inventory has been reduced during a plant shutdown. The BIT capacity is 900 gal, and therefore its presence has little influence with respect to volume and operation of the SI system.

Staff Response. Sufficient information.

4. Staff Comment. The proposed TS changes include deletion of BIT level surveillance requirements. The assumption is made that the static head pressure from the RWST is sufficient to assure that the BIT is full at all times. We have the following questions pertinent to this assumption:

   a. Will the BIT and associated piping be full under all plant status conditions, including cold shutdown? If not, what are the implications with respect to injection into the RCS, should this action be initiated? The influence of a gas or vapor in the BIT should be addressed, including both the effect upon injection and the effect upon the RCS.

      CP&L Response. The only time the tank is drained is for maintenance. A vent on the top of the tank is used for venting to assure it is full if its inventory was reduced. See also item 3 response.

b. Are there any sources of gas which are connected to the BIT and, if so, how is one to assure these do not contribute to reduction of the BIT water inventory?

CP&L Response. See item 3.

c. How is outgassing in the BIT addressed with respect to assurance of a full water condition?

CP&L Response. No significant outgassing is expected. The water is no different in this respect than the water in the RWST.

Staff Response. Sufficient information.

5. Staff Comment. Page 4 of Reference 1 contains the following criterion statement with respect to the hazards determination as described in 10 CFR 50.92 (Ref. 5):

"Operation of the facility in accordance with the proposed change would not involve a significant reduction in the margin of safety."

where we have underlined "the" since 10 CFR 50.92 uses the word "a". We are concerned that the wording change may change the meaning and intent of the rule. The rule as worded references a change in the margin of safety pertinent to the item under consideration. The rule as changed in the CP&L statement could be construed to mean the overall margin of safety of the plant. Please confirm that the rule as stated in 10 CFR 50.92 is being applied in the criterion response.

CP&L Response. This was an inadvertent change. CP&L is in full compliance with the correctly worded rule.

Staff Response. OK.

6. Staff Comment. What is the location of the steam line break flow restrictor? If the restrictor is not an integral part of the steam generator, what is the reasoning with respect to not addressing SLB upstream of the restrictor?

CP&L Response. The flow restrictor is an integral part of the SG.

Staff Response. OK.

7. Staff Comment. Page 5 of Reference 4 contains the statement:

"The boron feedback was weighted 100% to the outlet of the affected side of the core to conservatively maximize the boron transport delay and insure that the boron has reached the most reactive core sector."

Please expand upon this statement with respect to its meaning and how this results in a conservative analysis.

CP&L Response. The node in question is furthest removed from the injection point, and hence this maximizes the delay time. (In general, the earlier the injection the better.) In addition, boron injection with respect to regions of the core removed from the high power region are less sensitive since those portions of the core are almost shut down anyway. Finally, note that the boron has not reached the core at the time of attaining maximum power.

Staff Response. Sufficient information at this time. Note we are not convinced the assumptions traditionally applied to SLB analyses to obtain conservative analyses are also the assumptions which provide conservatism with respect to superheat. This remains to be established.

8. Staff Comment. Also on Page 5, we are not clear on the implications of the assumptions pertinent to moderator density distribution and power distribution, including the influence of moderator feedback. Please expand. Include addressing how greater cooldown at this point would not result in a worse condition later in the accident.

CP&L Response. The method of handling reactivity feedback in the RELAP5 calculation is inherently conservative.

Staff Response. (There was considerable discussion on this topic.) Sufficient information for the review to continue.

9. Staff Comment. Page 9 contains a discussion of flow mixing behavior based upon geometry of the upper vessel. What experimental evidence is available to support the flow splits that are determined from the gross vessel geometry? Is there any internal hardware that influences flow and does it have a bearing upon the behavior as described here?

CP&L Response. The core and vessel internal hardware tend to promote non-mixing, and large azimuthal flow fields are not expected. Further, the calculation results are relatively insensitive to thermal and boron perturbations resulting from minor mixing.

Staff Response. (There was considerable discussion of this subject.) Sufficient information for the review to continue.

10. Staff Comment. The nodalization shown in Figure 2.8 (Page 22) does not appear to include heat slabs which describe internal vessel hardware. Is this correct? If so, what are the implications with respect to RCS pressure response and the timing of boron injection?

CP&L Response. The only heat slabs which are modeled are the steam generator tubes and the fuel, as is correctly shown in the figure. In general, one would postulate that the addition of heat slabs to represent other portions of the vessel structure and the SG tube sheets

would decrease cooldown rate. This, in turn, would decrease the maximum power attained upon returning to power. Additional heat slabs would also lead to a slightly slower depressurization rate, with a slight delay in boron initial injection, and a slightly diminished injection rate corresponding to the SI pump response to the increased RCS pressure.

Staff Response. We forgot that for non-LOCA conditions, one generally prefers to keep the reactor coolant pumps (RCP's) running when we posed this question. Further, the traditional SLB generally exhibits more challenge to the core with RCP's operating. Sufficient information received for the review to continue.

11. Staff Comment. Page 30 addresses comparison of reactivity changes with XTG and RELAP5. Were comparisons performed over the entire range of the investigation or at selected points? If the latter, how was the determination made that a non-conservative situation did not exist at some other point in time?

CP&L Response. There is a large conservatism in RELAP5. The purpose of the comparison was to show the extreme conservatism. The referenced comparisons were made either at or close to the maximum power point. CP&L expects similar conservatisms at other times in the transient.

Staff Response. Sufficient information.

12. Staff Comment. Page 32 contains the statement:

"The XCOBRA-IIIC core flow distribution analysis indicates that the flow in the upper elevations of the high power assembly is greater in the closed channel XTG calculation than the open channel XCOBRA-IIIC calculation, thereby verifying that the power distribution and reactivity calculated by XTG are conservative."

Presumably, the XCOBRA calculation is far more accurate with respect to flow behavior. The stated results indicate a movement of fluid from the high power regions to other regions of the core, and a corresponding movement of boron, which then perturbs the prior assumptions in regard to boron distribution and mixing. Please comment.

CP&L Response. As long as the fluid remains as a single liquid phase, the boron will be contained in the water. When voiding does occur, the effect of the void is greater than the effect of removal of boron. A further consideration is that maximum power occurs prior to entry of boron into the core.

Staff Response. We note the influence is one of delay in movement of fluid into the region of high power, with probably only minor perturbations on the results with respect to traditional, non-superheat SLB analyses. Information sufficient.

13. Staff Comment. Figure 3.4 (Page 42) shows pressure in the intact SG as decreasing after approximately 180 seconds. Why? The concern pertains to the location of the steam-water interface in the secondary side with respect to the highest elevation of SG tubes. If there is a significant inventory of water above the tubes, what is the mechanism for cooling the interface, and hence reducing the pressure? Another aspect is behavior of some versions of RELAP5, which exhibited a tendency to calculate liquid water above steam on the secondary side of steam generators in some calculations. Does this occur with the version in use here and, if so, what are the implications with respect to calculation of affected SG behavior?

CP&L Response. CP&L does not expect significant impact on power and RCS response due to this type behavior in the intact SG.

Staff Response. (There was considerable discussion of this subject.) We agree the behavior is unlikely to result in a non-conservatism with respect to non-superheat calculations. The modification previously mentioned to remove water carry-out from the SG is significant to this conclusion. Sufficient information for review to continue.

14. Staff Comment. A potential implication of BIT removal involves overpressure which leads to rod ejection while in a cold shutdown condition. Please address this accident with respect to reduced boron concentration.

CP&L Response. TS's 3.3.1.3 and 3.10.8 are applicable. These require rack-out of SI power supply breakers if the RCS is below 350°F and the RCS is not vented to the containment atmosphere. The only direct path to the RCS is from the RHR pumps to the high pressure SI pumps, and hence through the BIT into the RCS. This is not a normal configuration.

Staff Response. Sufficient information.

15. Staff Comment. Please address whether boron can concentrate in the BIT over an extended time period.

CP&L Response. Previously covered.

Staff Response. Agreed.

16. Staff Comment. Please verify that the main steam isolation valves in H. B. Robinson are of a design that prevents flow in both the nominal forward and reverse directions.

CP&L Response. There is a swing disk isolation valve followed by a swing disk one way valve downstream of the isolation valve which prevents reverse flow.

Staff Response. Verification sufficient.

17. Staff Comment. Please verify that there is no method whereby boron with a significantly higher concentration than exists in the RWST can be injected into the BIT or lines leading into the BIT. Further verify that

concentration gradients cannot form in the RWST which could lead to significant increase in the boron concentration in the BIT. Include consideration of both equipment failures and operator error in your response.

CP&L Response. The maximum concentration of boron in the RWST is 1.4 w%. A concentration of 2.2% is required to reach the solubility limit at $32^{o}F$. The concentrations are well removed from the solubility limits, and concentration stratification is not of concern. With respect to error, plant procedures and the closed and locked valves to the BIT are preventative measures. Note the preferred option is cutting and caping the piping to prevent inadvertent flow of borated water to the BIT.

Staff Response. Sufficient information.

REFERENCES

1. Cutter, A. B., "H. B. Robinson Steam Electric Plant, Unit No. 2, Docket No. 50-261/License No. DPR-23, Request for License Amendment, Boron Injection Tank Dilution, Serial NLS-85-332, Letter addressed to Director of Nuclear Reactor Regulation, Carolina Power & Light Company, Nov. 13, 1985.

2. Lyon, Warren C., "H. B. Robinson Unit 2 Request for License Amendment, Boron Injection Tank Dilution and Removal," Note for G. Requa (NRC, not an official document), Feb. 20, 1986.

3. Thompson, Hugh L., "High Boron Concentrations," Letter addressed to all licensees of operating reactors and applicants for an operating license, Generic Letter 85-16, USNRC, Aug. 23, 1985.

4. "Analysis of the Steamline Break Event with Boron Injection Tank Removal or Dilution to Zero Concentration Boric Acid for H. B. Robinson Unit 2," XN-NF-85-17(P) (Proprietary), Exxon Nuclear Company, Inc., May 1985.