ENCLOSURE 3

OAK RIDGE NATIONAL LABORATORY
OPERATED BY
UNION CARBIDE CORPORATION
NUCLEAR DIVISION

POST OFFICE BOX X
OAK RIDGE, TENNESSEE 37830

50-269
50-270
50-287

15 September 1982

Dr. T. Huang
Core Performance Branch
Division of Systems Integration
Office of Nuclear Reactor Regulation
Washington, D. C. 20555

Dear Dr. Huang:

Enclosed are questions which have arisen during our review of the submission of Duke Power Co. describing their proposed water inventory monitoring system. Because of other commitments and an apparent reluctance to supply sufficiently detailed information until recently, our generic review of the B&W proposal has not been completed. Because the staff has adopted the position that the hot leg monitor alone is insufficient to monitor coolant inventory, the system described in this submission is not satisfactory.

Very truly yours,

Richard L. Anderson

RLA:rla

RLA:rlb

cc: J. L. Anderson
G. N. Miller
File-NoRC

X003

XA

XA Copy Has Been Sent to PDR

Reference: "Design Proposal in Response to NUREG-0737, Sect. II.F.2: Instrumentation to Detect Inadequate Core Cooling," submitted with letter dated 25 May 1982 from William O. Parker, Jr. to Harold F. Denton

Some responses to this request for additional information related to the referenced document may be satisfied by citing previously supplied documents. Such references should include: the document title, number, section and page number and any further clarifying comments.

In Sect. 1.0, the applicant recognizes that NUREG-0737 requires that the ICC instrumentation system must cover the full range of operation. During a SB LOCA or loss of heat sink, initial indication of approach to ICC is decreasing subcooling margin. After system reaches saturation, the applicant claims that loss of the RCS coolant voiding can be detected by a decrease of the level in the upper 19 ft of the hot leg. This position, which does not include the reactor vessel level, has not been accepted by the staff (SECY-81-582A).

1. Is this where voiding first occurs in the system? The analysis shown in Document No. 77-1126635-00 for a 0.01 ftlsf2llhf-1l2lhf1llsf6l LOCA appears to show voiding in the reactor vessel before the hot leg.

2. Where are the pressure and temperature sensors located for the subcooling margin monitor (SMM)?

3. Does the SMM use temperatures sensed at more than one location, e.g., hot leg RTD or core exit thermocouples?

The definition of ICC in Sect. 1.1 is consistent with other definitions accepted by staff.

4. On the page following Sect. 1.1, the last line states, "ONSET OF ICC INDICATED BY: EXCESSIVE FUEL CLAD TEMPERATURES". Please define "excessive temperatures".

5. With reference to paragraph 3 of Sect. 1.2, please compare the symptoms of an over cooling transient with those of a SB LOCA transient and point out similarities and differences.

6. It is stated in paragraph 3 of Sect. 1.2 that the operator must not proceed with ICC actions until ICC is confirmed. If ICC is confirmed then according to the previous definitions, the core cladding has reached "excessive temperatures". Similarly, under operator action No. 4 below. Show how this is consistent with the NUREG-0737 requirement for detection of the ibulapproachieul to ICC.

7. In the last paragraph under Operator Actions During Approach to ICC under Sect. 1.2, what is the "predetermined temperature" at which further operator actions are required? How was this value chosen?

8. Similarly, under Operator Actions Once ICC is Indicated what it the value of the "higher predetermined temperature" and how was it chosen?

9. Under Sect. 3.1, how much of the core can be uncovered before the clad temperatures indicated by the CETs begin to rise? Does this depend on the rate of uncovery? In the recent L2-5 test at LOFT, following the recovery from a large break LOCA, the slow uncovery of the core along with the heat up of the cladding was not sensed by the core exit thermocouples until the operators manually initiated the ECCS after the clad thermocouples had reached almost 1100 K (1450°F). Please provide an analysis to determine if such an event could occur in a B&W reactor. Relevant pages from the L2-5 quick look report are attached.

10. List the "spectrum of LOCA events ...that will not proceed to core uncovery or ICC.

11. Provide a representative list of non-LOCA events that proceed to saturation, but not to ICC.

At the end of the 2nd paragraph on the second page of Sect. 3.1, the SMM is stated not to provide an unambiguous indication that ICC conditions could occur. As pointed out above, NUREG-0737 requires an unambiguous indication of an approach to ICC. Loss of subcooling margin is stated elsewhere to be a necessary condition for ICC, so that this would be an unambiguous indication of approach to ICC - necessary, but not sufficient.

12. In the third paragraph of the second page under Sect. 3.1, it is stated that continued inventory loss would lead to voids at the high points in the system, e.g. the reactor head and the upper U of the hot leg piping. Provide an analysis to show where the voids would first appear under any scenario that could lead to ICC.

13. Describe the conditions under which it is possible for voids to appear at one location and not the other.

14. The paragraph under Sect. 3.1 beginning, "As the SB LOCA scenario continues....., describes the use of the core exit thermocouples to monitor continued progression towards ICC. (also see comments under question 9., above.)

15. Describe the non-LOCA transients where the HLLMS would indicate a level in the hot leg, but not proceed to ICC. Describe how the HLLMS indications are similar to those in a LOCA event.

16. Are the power sources described under Sect. 3.3, 1E power sources?

17. 3.4 Describe how the ICC instrumentation will be integrated into the control room instrumentation. Will all ICC indications be grouped together? Describe the displays of SMM, HLLMS and CETs. Will any of these indications be displayed elsewhere?

18. Describe how the operator is informed to ignore the HLLMS indications when the pumps are running or the system should not be used.

19. It has been suggested that monitoring the pump motor current could give an indication of RCS voiding while the pumps are running. Please provide

an analysis showing the relation between RCS pump motor current and RCS void fraction.

20. Suppose an impulse line on one hot leg was broken that would tend to drive the Dp transducer full scale. How would this condition be detected? When would a level be detected in the other leg?

21. In light of the failure of the Dp instrumentation used for level measurement in the pressurizer at TMI-2, justify locating the HLLMS Dp transducers in containment.

22. Please provide specifications for the proposed Dp transducers.

23. Please provide an analysis to show the effects of flashing or dissolved gases in the impulse lines.

24. Describe the methods propose for signal isolation in the ICC instrumentation.

25. Describe the alarm set points and how selected.

26. Describe the modifications that would be required to install a reactor vessel level monitoring system across the vessel using an existing in-core instrument guide tube and an upper head vent.

27. A secondary requirement of NUREG-0737 is for the ICC instrumentation system to monitor recovery from transient events. If the event were a large break of a hot leg, how would the ICC system monitor recovery?

28. Under Sect. 5.0, describe the confirmatory actions the operator would take to prevent an ICC event.

29. Please provide a detailed analysis of the level measurement uncertainties associated with the HLLMS. This analysis should include not only an overall estimate of the measurement uncertainty, but estimates of each contributing factor, i.e. temperature of the impulse lines, common mode pressure effects on the differential pressure transducer, and uncertainties associated with the transducer.

FROM:
Commissioner Ahearne

TO:
Dircks

ACTION CONTROL	DATES	CONTROL NO.
COMPL DEADLINE	1/28/83	12697
INTERIM REPLY		DATE OF DOCUMENT 1/20/83
FINAL REPLY	FI Drufs 2/7/83	PREPARE FOR SIGNATURE OF: ☐ CHAIRMAN ☒ EXECUTIVE DIRECTOR OTHER
FILE LOCATION		

DESCRIPTION ☐ LETTER ☒ MEMO ☐ REPORT ☐ OTHER

Req staff inform Duke Power of status of its 5/25/82 submittal concerning a proposed water inventory monitoring system for Oconee

SPECIAL INSTRUCTIONS OR REMARKS

PRIORITY

Telephone is O.K., if appropriate - but confirm to Ahearne by memo from Dircks.

TARehm

ASSIGNED TO	DATE
Denton, NRR	1/21/83
Eisenhut E	
LAINAS	1/21/83
STOLZ	

INFORMATION ROUTING

Dircks
Roe
Rehm
O'Reilly
DeYoung
GCunningham

Case/Denton
1. PPAS
2. Speis
3. Mattson
4. Vollmer
5. Thompson
6. Check
7. Snyder

NRC FORM 250 (6-80)

EXECUTIVE DIRECTOR FOR OPERATIONS
PRINCIPAL CORRESPONDENCE CONTROL