Docket

Docket Nos. 50-259, 50-260
and 50-296

JUL 14 1981

Mr. Hugh G. Parris
Manager of Power
Tennessee Valley Authority
500A Chestnut Street, Tower II
Chattanooga, Tennessee 37401

Dear Mr. Parris:

SUBJECT: TMI ACTION PLAN ITEM II.K.3.46, "MICHELSON CONCERNS"

RE: BROWNS FERRY PLANTS UNITS 1, 2 AND 3

Enclosed for your information is our evaluation of the BWR Owners Group response to TMI Action Plan Item II.K.3.46 "Michelson Concerns." We find the response to be acceptable. Since your letter dated June 23, 1980 endorsed the Owners Group response, we consider Item II.K.3.46 to be complete for your facility.

Sincerely,

Vernon Rooney

for Thomas A. Ippolito, Chief
Operating Reactors Branch #2
Division of Licensing

Enclosure:
As Stated

cc w/enclosure
See next page

Distribution
Docket File
NRC PDR
Local PDR
TERA
NSIC
ORB#2 Reading
D. Eisenhut
OELD
IE-3
ACRS (10)
S. Norris
R. Clark
Gray File

8108040664 810714
PDR ADOCK 05000259
P PDR

OFFICE	ORB#2	ORB#2	ORB#2	ORB#2	AD:OR		
SURNAME	SNorris	JVan Vliet	RClark	TIppolito	for Vassallo		
DATE	7/10/81	7/13/81	7/10/81	7/10/81	7/14/81		

Mr. Hugh G. Parris

cc:

H. S. Sanger, Jr., Esquire
General Counsel
Tennessee Valley Authority
400 Commerce Avenue
E 11B 33 C
Knoxville, Tennessee 37902

Mr. Ron Rogers
Tennessee Valley Authority
400 Chestnut Street, Tower II
Chattanooga, Tennessee 37401

Mr. H. N. Culver
249A HBD
400 Commerce Avenue
Tennessee Valley Authority
Knoxville, Tennessee 37902

Robert F. Sullivan
U. S. Nuclear Regulatory Commission
P. O. Box 1863
Decatur, Alabama 35602

Athens Public Library
South and Forrest
Athens, Alabama 35611

Mr. John F. Cox
Tennessee Valley Authority
W9-D 207C
400 Commerce Avenue
Knoxville, Tennessee 37902

Mr. Herbert Abercrombie
Tennessee Valley Authority
P. O. Box 2000
Decatur, Alabama 35602

ENCLOSURE

EVALUATION OF BWR OWNERS GROUP
GENERIC RESPONSE TO NUREG-0660 ITEM II.K.3.46

STATEMENT OF REQUIREMENTS

"A number of concerns related to decay heat removal following a very small break LOCA and other related items were questioned by Mr. C. Michelson of the Tennessee Valley Authority. These concerns were identified for PWRs. GE was requested to evaluate these concerns as they apply to BWRs and to assess the importance of natural circulation during a small-break LOCA in BWRs. GE has not yet responded to the Michelson concerns. A brief description of natural circulation was addressed in NEDO-24708. The submittal was incomplete, however, in that natural circulation for purposes of depressurizing the reactor vessel was not addressed. GE should provide a response to the Michelson concerns as they relate to BWR plants."

SUMMARY AND EVALUATION OF RESPONSE

The concerns related to decay heat removal which were raised by Mr. Michelson were responded to in a letter to D. F. Ross (NRC) from R. H.Buhholz (GE), MFN-041-80, "Response to Questions Posed by Mr. C. Michelson" February 21, 1980. An additional question was issued in June, 1980 and the BWR Owners Group responded in a letter to Darrell G. Eisenhut (NRC) from David B. Waters (BWR Owners Group), BWROG-8117, "BWR Emergency Procedure Guidelines Revision 1, and Responses to Related Questions," January 31, 1981. A summary of our evaluation of the questions is given below:

Question 1: Pressurizer level is an incorrect measure of primary coolant inventory.

Response: BWRs do not have pressurizers. BWRs measure primary coolant inventory directly using differential pressure sensors attached to the reactor vessel. This concern does not apply to BWRs.

Question 2: The isolation of small breaks (e.g., letdown line; PORV) is not addressed or analyzed.

Response: Automatic isolation only occurs for breaks outside the containment. Such breaks are addressed in NEDO-24708. If the high pressure systems are available, no operator actions are required. If all high pressure systems fail, the operator must depressurize to allow low pressure systems to maintain vessel level. Analyses show that the operator has sufficient information and time to perform these manual actions. The required manual actions have been included in the guidelines for small break accidents.

Question 3: Pressure boundary damage due to loadings from (a) bubble collapse in subcooled liquid and (b) injection of ECC water in steam filled pipes.

Response: Because the BWR geometry and injection locations are not the same as for a PWR, this concern is not applicable to a BWR. ECC injection in the BWR at high pressure is either directly into the reactor vessel (BWR/5-6 HPCS, HPCI on some BWR/4) or into the feedwater lines (FWCI, HPCI on most BWR/3-4). The feedwater lines are normally filled with relatively cool liquid (420^{o}F or less). ECC injection in the BWR at low pressure is either directly into the reactor vessel (LPCS, BWR/5-6 LPCI) or into the recirculation pump discharge line (BWR/3, 4 LPCI) near the automatically closed recirculation pump discharge valve.

The concern on collapse of bubbles in subcooled liquid was for steam bubbling upward through the pressurizer surge line and pressurizer. There is no comparable BWR geometry.

Question 4: In determining need for steam generators to remove decay heat, consider that break flow enthalpy is not core exit enthalpy.

Response: Since BWRs do not use steam generators to remove decay heat, this concern does not apply to BWRs.

Question 5: Are sources of auxiliary feedwater adequate in the event of a delay in cooldown subsequent to a small LOCA?

Response: Since BWRs do not need feedwater to remove heat from the reactor following a LOCA, this concern is not applicable to BWRs. The ECCS sub-systems which are available are adequate. For breaks which are too small to remove all of the decay heat, the reactor coolant system pressure will increase to the relief valve setpoint. The high pressure systems are capable of pumping against the relief valve opening pressure.

Question 6: Is the recirculation mode of operation of the HPCI pumps at high pressure an established design requirement?

Response: All recirculation modes of the high pressure systems in BWRs are established design requirements.

Question 7: Do the HPCI pumps and RHR pumps run simultaneously? Do they share common piping/suction? If so, is the system properly designed to accommodate this mode of operation?

Response: On some BWRs the RCIC/HPCI and RCIC/HPCS systems share a common suction line from the condensate storage tank. Also, many of the BWR LPCI pumps and LPCS pumps share common suction. It is an established design requirement to size the suction piping, including shared piping, such that adequate NPSH is available to RCIC, HPCI, HPCS, RHR/LPCI and CS pumps for all simultaneous operating modes. Pre-operational and/or startup tests are conducted that demonstrate that this requirement is met.

Question 8: Mechanical effects of slug flow on steam generator tubes needs to be addressed.

Response: Since BWRs do not have steam generators, this concern does not apply to BWRs.

Question 9 : Is there minimum flow protection for the HPCI pumps during the recirculation mode of operation?

Response: BWR/1 and BWR/2 units do not have special purpose HPCS or HPCI systems. For BWR/3-6, the RCIC, HPCI, HPCS, RHR and CS/LPCS pumps all contain valves, piping and automatic logic that bypasses flow to the suppression pool as required to provide minimum flow protection.

Question 10: The effect of the accumulators dumping during small break LOCAs is not taken into account.

Response: Since BWRs do not use accumulators to mitigate LOCAs, this concern does not apply.

Question 11: What is the impact of continued running of the RC pumps during a small LOCA?

Response: Analyses in NEDO-24708 show that continued running of the recirculation pumps results in little change in the time available for operator actions and does not significantly change the overall system response.

Question 12: During a small break LOCA in which offsite power is lost, the possibility and impact of pump seal damage and leakage has not been evaluated or analyzed.

Response: The RCIC, HPCI, HPCS, RHR, CS/LPCS pumps are provided with mechanical seals which are cooled by the pump primary process water. No external cooling from auxiliary support systems is required for ECC pump seals. Should seal failure occur, it can be detected by room sump high level alarms. The RCIC, HPCI, HPCS, LPCS and RHR individual pumps are arranged, and motor operated valves provided, so that a pump with a failed seal can be shutdown and isolated without affecting other redundant equipment. The recirculation pump seals are cooled by service water and control rod drive flow. On most BWRs, at least one of these sources of cooling water is powered by emergency power; either source is capable of preventing damage to the pump seals. While pump seal damage would be expected if both sources of cooling water are lost, leakage past the failed seals is calculated by GE to be less than 50 GPM, a value within the normal makeup capability.

Question 13: When transitioning from solid natural circulation to reflux boiling and back again, the vessel level will be unknown to the operators and emergency procedures and operator training may be inadequate. This needs to be addressed and evaluated.

Response: There is no similar transition in the BWR case. In addition, since the BWR has water level measurement within the vessel and the indication of the water level is incorporated into the operator guidelines, this concern does not apply to BWRS.

Question 14: The effect of non-condensible gas accumulation in the steam generators and its possible disruption of decay heat removal by natural circulation needs to be addressed.

Response: For a BWR, vapor is present in the core during both normal operation and natural circulation conditions. Non-Condensibles may change the composition of the vapor but would have an insignificant effect on the natural or forced circulation itself, since the non-condensibles would rise with the steam to the top of the vessel. The natural circulation process would be expected to continue since the upper vessel head area is well above the circulation paths through the jet pumps.

Question 15: Delayed cooldown following a small break LOCA could raise the containment pressure and activate the containment spray system. Impact and consequences need addressing.

Response: A. Mark I and II Containments: Except for a few early plants, most plants with Mark I and Mark II containments do not have an automatically initiated drywell or wetwell spray. Only one of the newer plants has an automatic wetwell spray. All essential equipment in the drywell has been qualified for the steam and temperature environment that would exist following a LOCA. There is no equipment in the wetwell that is adversely affected by wetwell sprays.

B. Mark III Containments:

There is no drywell spray in a Mark III Containment. There is an automatic spray system in the wetwell. All essential components have been qualified for this condition.

Question 16 : An operator may be inclined and perhaps even trained to isolate, where possible, a pipe break LOCA without realizing that it might be an unsafe action leading to high pressure and short-term core bakeout. Before such isolation should be permitted it is first necessary to show by an appropriate analysis that the high pressure ECCS is adequate to reflood the uncovered core without assistance from the low pressure ECCS which can no longer deliver flow because of the repressurization.

Response: In order for the reactor vessel to repressurize following isolation of a recirculation line break, the isolation would have to occur before initiation of ADS due to a high drywell pressure in concurrence with low water level 1 condition. Isolation of a recirculation line break prior to obtaining a high drywell pressure signal might occur for very small breaks (area<< 0.01ft^2) which may require several hundred seconds following the break to reach the high drywell pressure setpoint. In this case, it has been shown (NEDO-24708) that the high pressure systems are sufficient to maintain the water level above the top of the core. If isolation of the break were to occur prior to reaching level 1 but after the high drywell pressure setpoint, the vessel would pressurize to the SRV setpoint following isolation of the main steam lines. If no high pressure systems were available, the loss of mass through the SRVs would result in ADS acutation; this would allow the low pressure systems to begin injecting. No adverse consequences result from isolation of a break in the recirculation line.

In summary, we have reviewed the responses given to the 16 concerns expressed by Mr. Michelson and we find the responses acceptable.