Consumers Power Company

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Director, Nuclear Reactor Regulation
Att Mr Dennis M Crutchfield, Chief
Operating Reactors Branch No 5
U S Nuclear Regulatory Commission
Washington, DC 20555

DOCKET 50-155 - LICENSE DPR-6 -
BIG ROCK POINT PLANT - REVIEW
OF GENERAL ELECTRIC RESPONSES
TO ACRS CONSULTANT CONCERNS

General Electric Company (R Buckholz) letter to NRC (D Ross) dated February 21, 1980, discussed concerns raised by an ACRS consultant regarding post-accident operating conditions at light water reactors. GE's discussion was on a generic basis addressing these concerns for all boiling water reactors. NRC letter dated May 7, 1980, requested Consumers Power Company to specifically evaluate the applicability of GE's discussion to Big Rock Point.

Consumers Power Company has completed the evaluation requested by the May 7, 1980, NRC letter. The attachment to this letter discusses the applicability of each concern addressed in GE's February 21, 1980, letter and provides information specific to Big Rock Point where appropriate.

David P Hoffman (Signed)

David P Hoffman
Nuclear Licensing Administrator

CC JGKeppler, USNRC
NRC Resident Inspector - Big Rock Point

Attachment (8 pages)

Question 1

Pressurizer level is an incorrect measure of primary coolant inventory.

Response

This concern is not applicable to Big Rock Point. BRP measures primary coolant inventory directly using differential pressure sensors attached to the primary vessel and primary steam drum.

Question 2

The isolation of small breaks (e.g., letdown line, PORV) not addressed or analyzed.

Response

At BRP automatic isolation only occurs for steam line breaks outside of containment. Such breaks are addressed in Section 3.1.1.1.2 of NEDO-24708.

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

The GE response is applicable to BRP. BRP has no geometry equivalent to a pressurizer surge line and pressurizer, and ECCS water is injected at low pressure into the vessel rather than into pipes, hence this concern is not applicable to BRP.

Question 4

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

Response

BRP has no steam generators, and no credit is taken in Appendix K LOCA analysis for heat removal through the emergency condenser, therefore this concern is not applicable to BRP. The GE modeling of break flow is discussed in NEDO-20566.

Question 5

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

Response

BRP does not rely on feedwater to remove decay heat following a LOCA, therefore, this concern is not applicable to BRP. BRP has an essentially infinite supply of emergency core cooling water (Lake Michigan). However, once the containment has been filled to the 590 ft. elevation, the operator is directed to switchover to the recirculation mode of long term cooling. In this mode, water from containment is pumped through the core spray heat exchanger and back to the reactor, and no further makeup water is required (although it would be available if required).

Question 6

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

Response

BRP does not have a high pressure injection system that can be used for recirculation, therefore this concern is not applicable to BRP. The core spray pumps used in the long term cooling recirculation mode at BRP are low head pumps with design requirements based specifically on that service.

Question 7

Are 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 (i.e., are any NPSH requirements violated, etc.?).

Response

The BRP "RHR" pumps, or shutdown cooling pumps, are not, and presently cannot, be used for long term cooling after a LOCA. Further, the shutdown cooling pumps do not share piping or suction with the established means of long term cooling, i.e. the core spray pumps. Therefore, this concern is not applicable to BRP.

Question 8

Mechanical effects of slug flow on steam generator tubes needs to be addressed (transitioning from solid natural circulation to reflux boiling and back to solid matural circulation may cause slug flow in the hot leg pipes).

Response

BRP does not have steam generators therefore this concern is not applicable to BRP. BWR post-LOCA cooling modes are addressed in NEDO-24708. The only component at BRP which is similar to a steam generator is the emergency condenser. The emergency condenser is a steam condensing device which is located above the highest point on the BRP primary coolant loop. Transition to solid natural circulation will never occur unless the operator inadvertantly overfills the primary coolant loop after a small LOCA or other transient and the primary system safety valves fail to lift. This is considered highly unlikely.

Question 9

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

Response

As noted in response to Question No. 6, BRP does not have a high pressure injection system that can be used for recirculation, and therefore this concern does not apply to BRP. Minimum flow protection for BRP safety injection pumps (i.e. fire pumps and core spray pumps) is provided by relief valves on the fire system piping and on the core spray piping inside of containment.

Question 10

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

Response

BRP does not utilize accumulators to mitigate LOCAs. Therefore, this concern does not apply to BRP.

Question 11

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

Response

The impact of continued running of the recirculation pumps has been addressed in Sections 3.3.2.2, 3.3.2.3, and 3.5.2.1.5.1 of NEDO-24708.

Question 12

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

Response

The seals of the BRP fire pumps and core spray pumps are cooled by the pump primary process water. No external cooling from auxiliary support systems, such as service water or room air coolers, is required for the pump seals.

Question 13

During 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 BRP's case. In addition, water level measurements in the vessel (within the "shroud") and in the primary steam drum (downcomer region) are incorporated into the operator guidelines. Consequently, this concern does not apply to BRP.

Question 14

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

Response

The effect on non-condensable gas accumulation is addressed in Section 3.3.1.8.2 of NEDO-24708. For BRP non-condensable gases would collect in the top of the primary steam drum where they would have no significant effect on natural circulation within the primary coolant loop. However, non-condensable gases collecting in the top of the steam drum could incapacitate the emergency condensor. To mitigate this effect Consumers Power Company has committed to provide the capability to remotely vent the emergency condensor tube bundles.

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

BRP has an automatically actuated enclosure (drywell) spray system. Essential equipment in the enclosure has been qualified for the environment that would exist after a LOCA.

Question 16*

This concern relates to the possibility that 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. For example, if a BWR should experience a LOCA from a pressure boundary failure somewhere between the pump suction and discharge valve for either reactor recirculation pump, it would be possible for the operator to close these valves following the reactor blowdown to low pressure and thereby isolate the break, stop the blowdown, and repressurize the reactor coolant system. 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. Otherwise, such isolation action should be explicitly forbidden in the emergency operating instructions.

Response

If a BWR should experience a LOCA from a pressure boundary failure somewhere between the recirculation pump suction and discharge valves, it is possible for the operator to close these valves following the reactor blowdown to low pressure and thereby isolate the break. In reference 2, the NRC concluded based on information provided by GE that recirculation break isolation is not a problem.

In order for the BRP primary coolant system to repressurize following isolation of a recirculation line break, the isolation would have to occur prior to RDS actuation. RDS actuation occurs on coincident low steam drum water level, low

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* Excerpt from Reference 1.

reactor water level, and high fire header pressure. Containment pressure is not included in the RDS actuation logic. If break isolation were to occur prior to reaching low reactor water level, the vessel would repressurize to normal operating pressure if the main steam line was not isolated, and to the emergency condenser actuation setpoint if the steam line was isolated. If sufficient high pressure makeup was available, the primary system would refill and the plant would be returned to a stable mode of operation with no further loss of inventory to the containment. Without sufficient high pressure makeup (either CRD pumps or main feedwater pumps) levels would continue to fall, resulting in automatic RDS actuation. This would depressurize the vessel and allow the low pressure core spray system to function. Thus isolation of a recirculation line break has no adverse effect on the course of the accident. In fact, it would favorably preclude RDS actuation given the availability of adequate high pressure injection flow for decay heat removal.

References

1. Memo, C. Michelson to D. Okrent, "Possible Incorrect Operator Action Such as Pipe Break Isolation," June 4, 1979.

2. Letter, D. G. Eisenhut to R. L. Gridley, "Potential for Break Isolation and Resulting GE-Recommended BWR/3 ECCS Modifications," June 14, 1978.

3. "Additional Information Required for NRC Staff Generic Report on Boiling Water Reactors," NEDO-24708, August 1979.