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May 23, 1985

2CAN058507

Director of Nuclear Reactor Regulation
ATTN: Mr. James R. Miller, Chief
Operating Reactors Branch #3
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, DC 20555

SUBJECT: Arkansas Nuclear One - Unit 2
Docket No. 50-368
License No. NPF-6
Post-LOCA Status of
RCP - Trip Versus No Trip
NUREG-0737 Item II.K.3.5

Gentlemen:

In response to your letter of April 23, 1985 (2CNA048503) pertaining to the post-LOCA status of reactor coolant pumps, trip versus no trip, the attached response is provided.

Very truly yours,

J. Ted Enos
Manager, Licensing

JTE/DEJ

Attachment

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ATTACHMENT

Prior to responding to your specific questions pertaining to RCP services availability, it is important to point out the goal of the trip two/leave two (T2/L2) RCP trip strategy is to trip all RCPs in the case of a small break loss-of-coolant accident (LOCA), but to have two or more RCPs operating (if available) in the case of non-LOCA events, e.g. steam line break, steam generator tube rupture or an anticipated operational occurrence. The incentive for stopping all RCPs during a small break LOCA is to minimize coolant inventory loss from the reactor coolant system (RCS). Although not required, it is desirable to operate at least two RCPs during non-LOCA depressurization events in order to maintain forced circulation for better heat transfer and to retain main spray flow to the pressurizer for better RCS pressure control. The RCP operation also minimizes voiding of the reactor vessel upper head/upper plenum regions by providing some forced coolant flow through this region and provides better mixing in the reactor vessel downcommer/lower plenum region minimizing pressurized thermal shock concerns.

Question 1.

Does any containment isolation signal result in the termination of systems essential for continued operation of the reactor coolant pumps? If so, identify the signals and systems effected.

Response:

At ANO-2 a containment isolation actuation signal (CIAS) is generated upon detection of high reactor building pressure (18.4 psia). The CIAS results in termination of component cooling water (CCW) to the reactor coolant pumps and their seals. The CIAS actuation setpoint ensures containment isolation for loss of coolant accidents (during which RCP operation is prohibited). A CIAS will also be generated as a result of a steam line break accident inside the containment. If conditions allow continued two pump operation during this transient, the operators are instructed, in the Emergency Operations Procedure (EOP), to take appropriate actions to reestablish CCW services. The operators are further instructed to terminate RCP operation if CCW cannot be reestablished within five minutes.

It should be emphasized that, although the T2/L2 strategy may provide the most effective plant cooldown, plant operations are bounded by FSAR analyses which do not credit RCP operation. Therefore, if cooling services are not restored and RCP operations are terminated, the plant can be shutdown safely.

Question 2.

If essential water services are terminated, provide a description of the operator guidelines, training, and procedures in place (or to be implemented) which assure that these services are restored in a timely manner to prevent seal damage or failure, once a non-LOCA situation has been confirmed.

Response:

Once a non-LOCA situation has been confirmed per the EOP, the operators are instructed to reestablished CCW services to the RCP seal and pump coolers by overriding the isolation signal(s). If following a depressurization transient, the two remaining RCPs have not been tripped and the T2/L2 criteria allows their continued operation, the operators are instructed, per the EOP, to reestablish CCW to the pumps and seals within five minutes or terminate pump operation. If all of the RCPs have been tripped and the T2/L2 criteria allows the operation of two RCPs, these pumps may be restarted once the pump restart criteria is met. The restart criteria considers both pump and seal conditions. If the RCPs are not restarted, the EOP still requires the reestablishment of seal cooling to preserve the RCP seals. Special instructions for component cooling water reestablishment are provided in the EOP. These instructions caution the operator to gradually reestablish CCW to hot RCP seals to avoid thermal shock. AP&L's study of RCP seal integrity indicate that no gross seal failure will result from an extended loss of cooling services. However, these situations should be avoided from a availability standpoint. Further discussion of seal integrity and the reestablishment of seal cooling is contained in AP&L's letter to Mr. Darrell G. Eisenhut dated December 10, 1984 (ØCAN128401).

Training on the EOP, which included discussions of CCW reestablishment, was completed prior to the EOP being implemented on April 11, 1985.

Question 3.

Provide confirmation, including the technical basis, that containment isolation with continued RCP operation will not lead to seal or pump damage or failure.

Response:

AP&L does not contend that the RCPs can be operated for prolonged periods of time without cooling services. The ANO-2 EOP cautions the operator against operating the RCPs in excess of five minutes without cooling services. As previously mentioned, no accident scenario requires RCP operation. AP&L has installed override capability on the CCW services isolation valves, so that cooling services can be reinitiated following verification of non-LOCA conditions.

Question 4.

Since RCP trip will be required for LOCA events, assurance must be provided that RCP trip, when required, will occur. To address this concern, provide the following information:

(a) Identify the components required to trip the RCPs. Include relays, power supplies and breakers. Address reliability and alternate trip methods.

(b) If necessary, as a result of the location of any critical component, include the effects of adverse containment conditions on RCP trip reliability. Describe the basis for the adverse containment parameters selected.

Response:

There are three basic methods for tripping the RCPs. All of these methods are manually initiated. Two of the three methods are implemented from the control room, the third is remotely initiated from the RCP switchgear.

The primary method of terminating RCP operation is the use of the pump's control switch in the control room. The control switch for each pump is a General Electric SBM four position switch with the following positions - Pull to Lock, Start, Stop, and Normal. To trip any of the four pumps, its respective handswitch must be moved to the "Stop" or "Pull to Lock" position. This action actuates a 125 volt DC relay which opens the RCP power breaker at the respective switchgear (2H1 or 2H2). The SBM switches used for the RCP operation are the same as qualified models used in safety related application at ANO. The switchgear itself was manufactured by General Electric and is similar to the switchgear used in safety related applications at ANO. These switches and switchgear have a demonstrated high reliability.

The DC power supply used to remotely trip the A and D RCPs is separate from the DC power supply used to trip the B and C RCPs. Both of these power supplies are non-safety related, however, they receive their power feed from separate safety related DC power sources. This redundancy provides an added assurance that at least two pump can be remotely tripped from the control room given a loss of one train of DC power. A loss of DC power will not preclude the operator from remotely tripping the RCP breakers at the switchgear.

In the unlikely event that the above method for tripping the RCPs proves to be unsuccessful the operators could terminate RCP operation by tripping the 2H1 and 2H2 bus feeder breakers. The A and D RCPs (located in separate loops) are fed from the 2H1 bus and the B and C RCPs are fed from the 2H2 bus. The control switches for these bus feeder breakers are also General Electric SBM switches and are located in the control room. These switches activate the 6.9 Kv bus feeder breakers via a 125 volt DC non-safety control circuit. The switches

and switchgear associated with this method are also similar to safety related equipment currently in use at ANO.

A third method of tripping the RCP motors is for the operator to go to the RCP motor switchgear, located in the turbine building and manually trip the pump motor breakers. This can be accomplished with or without DC power available.

The components described above, used to trip the RCP motors, are all located in areas outside containment that would not be adversely affected by a LOCA.