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| CLASS: UNCLASS XXXXXXXXX; PROP INFO | INPUT | NO CYS REC'D 1 | | DOCKET NO: 50-313 | | |

DESCRIPTION:

Ltr re our 3-14-75....furnishing info with regard to ECCS boron precipitation following LOCA.....

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April 21, 1975

Mr. A. Giambusso, Director
Division of Reactor Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Subject: Arkansas Nuclear One-Unit 1
Docket No. 50-313
License No. DPR-51
ECCS Boron Precipitation

Dear Mr. Giambusso:

Mr. D. L. Ziemann's March 14, 1975, letter requested that we review our system capabilities and operating procedures to assure that boron precipitation would not compromise long-term core cooling capability following a LOCA.

We feel that this question has adequately been addressed in Babcock & Wilcox's response to Question 120 in Supplement 1 to Topical Report BAW-10091. However, we understand that the NRC staff has expressed doubt as to the reliability of the opening of the leakage gaps between the outlet nozzles and the core support shield during the cooldown period following a LOCA.

In the event tht the leakage gaps do not open, the actions described in Attachment 1 will eliminate any potential for unacceptably high boric acid concentrations during longterm cooling following a LOCA. If these actions meet your approval, they will be incorporated into operating procedures. A 90 day period for administrative implementation will be required following your approval.

These actions can be followed without any additional equipment or changes to the existing systems. However, due to radiation levels, initial investigations indicate a possible access problem to some of the manual valves that must be used in the valve alignment for actions described in Attachment 1. If it is determined to be expedient, steps will be taken to decrease the dose to personnel implementing these actions. The radiation levels in question, though not yet completely quantified, are not sufficient to preclude operator action but may be sufficient to warrant some reduction.

We should point out that these actions are necessary only for cold leg breaks or high elevation hot leg breaks. Low pressure injection in conjunction with a low elevation hot leg break will automatically establish normal decay heat flow paths through the core. Therefore, though a hot leg break at the right location could preclude the implementation of all three steps of Attachment 1, the failure to perform any or all of those three steps is of no consequence. No other single failure can preclude implementation of all three steps. As a result, we feel that our ECCS is being subjected by analysis to a double failure; i.e., failure of the leakage gaps to open and any other single failure.

Due to natural recirculation (downcomer-core-upper head-vent valves-downcomer-) the boron concentration buildup is slow enough to allow in excess of 30 days for alignment and operation of the flow paths established by the actions in Attachment 1 even for the limiting conditions of a large break in a cold leg pipe. However, we plan to initiate the additional actions within 24 hours unless waiting for just another day or two will eliminate radiation level access problems to the manual valves being aligned.

Steps one and two of Attachment 1 will limit boron concentration to a factor of 2 or less if initiated within 24 hours. Step 3 will limit the boron concentration to a factor of 11 for an auxiliary spray flow of 40 gpm, the maximum concentration coming at about 60 days, at which time the core flow reverses and the auxiliary spray flow provides sensible heat removal instead of just dilution as it had previously. Expected flow through the auxiliary spray line has been calculated to be 80 gpm. Solubility curves show that a concentration ratio of 30:1 is needed before precipitation will occur.

We are awaiting your concurrence with the above plan of action.

Very truly yours,

William Cavanaugh III

William Cavanaugh III
Manager, Nuclear Services

WC:lt

Attachment

# ATTACHMENT 1

## OPERATING METHODS TO ELIMINATE ANY POTENTIAL FOR UNACCEPTABLY HIGH BORIC ACID CONCENTRATIONS DURING LONG-TERM COOLING

I. General

The method of operation to be used in long-term cooling to eliminate any potential for unacceptably high boric acid concentrations in the core region is listed below.

1. If both Low Pressure Injection (LPI) strings are operable, try to establish suction from the reactor vessel outlet pipe through the decay heat (DH) drop line with one LPI string. This will force the LPI string flow to flow through the core.

2. If Step one is not successful, open the DH drop line to the LPI string used in Step one to establish gravity draining from the hot leg to the reactor building emergency sump. This will pull injection flow through the core at a rate equal to the drain flow rate.

3. If Step two is not successful, open the auxiliary spray to the pressurizer. This will route dilute injection to the area above the core. The flow path is through the auxiliary spray line into the pressurizer, out of the pressurizer through the surge line into the hot leg and then into the reactor vessel.

The flow paths for these steps are shown on Figure 1. Valve numbers shown on Figure 1 are arbitrary numbers for identification purposes and do not correspond to any actual numbering systems.

The flow path for Step one is from the hot leg down through the DH drop line (Valves V12, V13, V17, and V5A or V5B) through the LPI pump through Valves V10A (or V10B), V6A (or V6B), V8A (or V8B) and into the reactor vessel through the CFT nozzle.

The flow path for Step two is from the hot leg down through the DH drop line (Valves V12, V13, V17, and V5A or V5B) into the sump - BWST header and backwards through the sump outlet line (Valve V4A or V4B) and into the sump. A temperature sensor located at the pipe tee where the DH drop line connects to the LPI pump suction line will be used to detect the presence of flow for Step two. This DH drop line is located in the auxiliary building with a normal temperature of less than 100 F. If flow exists in Step two, the temperature at the sensor will change.

The flow path for Step three is from LPI injection line A, at the cooler outlet, through the pressurizer auxiliary spray line (Valve V14) into the pressurizer and through the pressurizer surge line into the hot leg. This flow path will be able to achieve a minimum of 80 GPM into the hot leg.

II. Single Failure Analysis

The three steps are necessary because of single failure criteria. Operations must be designed for a single failure in either the short-term or long-term cooling period but not a single failure in the short term and then another single failure in the long-term period.

Since the operator may not be able to determine the location of the break, Step one is attempted first (if both LPI strings are operable) to determine if the normal decay heat removal path can be established. It can be established if the break location is high enough in elevation so that the DH suction nozzle on the hot leg is sufficiently flooded to prevent gas or steam entrainment at the LPI pump flow rate. Even if there is no single failure during the attempt, success is not ensured because of possibility of gas or steam entrainment in the DH suction nozzle. If Step one fails because LPI pump flow is erratic or loses prime, then Step two is attempted. A temperature sensor in the DH drop line flow path will indicate success or failure. Step two could fail if one of the two valves (V12 or V13) fails to open. If Step two fails due to single failure, then Step three is performed. The above was for a single failure in the long term. The single failure could occur in the short term with the single failure being such that only one LPI string is operable. Step one then cannot be attempted because prime could be lost on the only LPI pump operating. So, Step two would then be performed.

III. Equipment Qualification

All valves located within the reactor building, that must be operated in any of the three steps, are electric motor operated (EMO) and located outside of the secondary shield wall. All of these valve EMO's are qualified for the LOCA environment. If power is not available to any of the EMO's required to implement any of the three steps, electrical jumper cables will be used to connect power to the EMO controller.

IV. Operating Procedures for Long-Term Cooling

Operating procedures for long-term cooling will be modified to include the procedures described in detail below.

The ECCS systems will be placed in one of the following three operating modes within twenty-four hours after the accident. Injection flow to the RC Systems should be maintained through two paths while attempting to place the systems in one of the three operating modes. Operation of only one LPI string in the injection mode will accomplish this because of the cross connects between the LPI lines inside the reactor building.

Mode 1 - Attempt to Establish Suction from Hot Leg with one LPI String

a. This mode will only be attempted if both LPI strings are operable. If successful, it is indicative that the RC System is filled to above the hot leg elevation. Assume LPI string A to be used for the attempt.

b. Open DH drop line EMO Valves V12 and V13.

c. Shut off the LPI pump in String A and the building spray pump connected to the same suction line.

d. Close LPI String A EMO Control Valve V4A. Open Manual Valve V5A and EMO Valve V17 in the DH drop line.

e. Start LPI pump in String A and slowly increase flow using EMO Control Valve V6A. Observe pump flow indication and pump noise for symptoms of cavitation and entrainment of vapor or gas. LPI pump in String A is now taking suction from the hot leg only. LPI pump in String A is taking suction from the RB sump and both pumps are discharged to the reactor vessel.

f. An additional step may be taken, when convenient, to determine if the break location is high enough in elevation to operate only one LPI string with the suction being from the hot leg. Slowly decrease the flow rate in LPI String B and then shut off the LPI pump in String B; continuously observe LPI String A indicated flow rate for erratic behavior. Coolant from the sump is not being pumped to the reactor vessel now; i.e., not providing an overflow out the break. If suction to LPI Pump A is not lost, it is indicative that: (1) the RC System is filled to above the hot leg elevation, (2) the break in the RC System is above this elevation, and (3) the LPI String A injection line is intact. LPI String B may now be placed back in operation (taking suction from sump) or operated periodically to make up for volume contraction as LPI String A reduces the reactor coolant temperature.

Mode 2 - Open the DH Drop Line to the RV Sump

a. If Mode 1 is not successful, maintain injection flow to reactor vessel through two injection flow paths by operation of one LPI string taking suction from the RB sump and discharging to the reactor vessel. This string provides injection through both core flood nozzles on the vessel because of the cross connects between the two LPI lines located inside the RB.

b. LPI String A is shutdown from the unsuccessful Mode 1 attempt. Valves V12, V13, V17, and V5A are open. Close EMO Valve V6A (LPI Control Valve). The temperature measurement at the tee connection of the DH drop line to the LPI pump suction line will be used to determine whether the drop line is draining by gravity to the sump or not because it is possible that a valve in the flow path is not actually open. A change in the indicated temperature would indicate that gravity flow from the hot leg exists. At this point, if String A temperature is indicating a temperature different from String B, String A should be placed in operation for a few minutes taking suction from the sump until String A indicates about the same temperature as String B which is sump temperature. Now line up String A for gravity draining to the sump; Valves V12, V13, V17, V5A and V4A open, close Control Valve V5A. If flow exists, the indicated temperature will change within a few minutes (transit time in flow path and response time of instrument).

If Mode 1 was not attempted because both LPI strings were not available, then the inoperable LPI string would be used for the gravity draining attempt. In this case, the temperature indication would be the auxiliary building ambient temperature before the attempt is made. If gravity draining is successful, the temperature indication would increase within a few minutes.

c. Maintain injection flow to reactor vessel through two injection flow paths per Item a, above.

Mode 3 - Open Auxiliary Spray Line to Pressurizer

a. This operating mode will be used if Mode 2 is not successful.

b. Close main pressurizer spray line EMO Valve V1 or V2 or both.

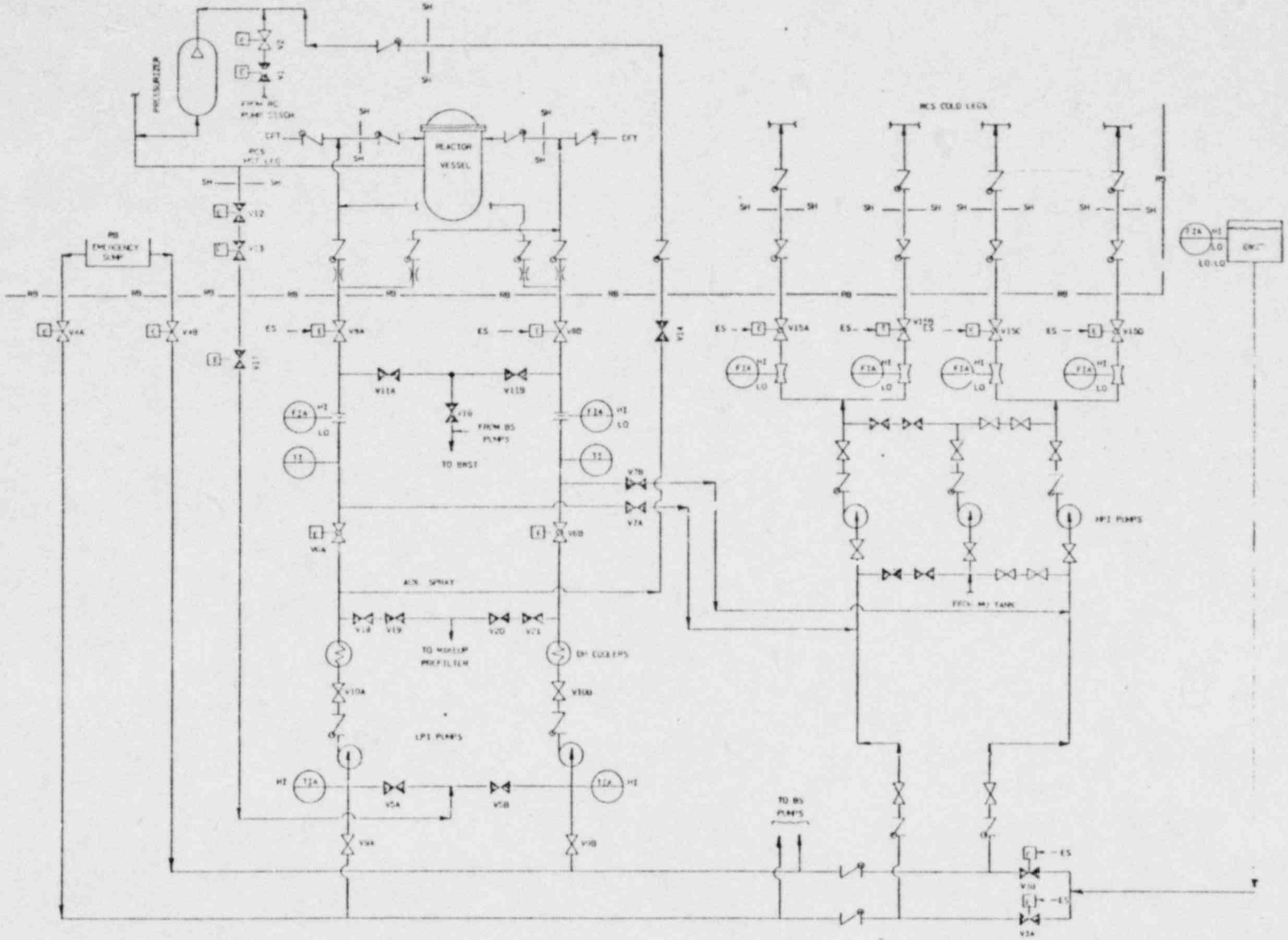
c. If LPI String A is operating, open auxiliary spray line manual valve V14 (located in the auxiliary building). Spray flow will produce a slight decrease in the indicated flow rate for LPI String A.

d. If LPI String A is not operating (String B will be operating), a cross connect from String B to String A must be opened because the auxiliary spray line originates from String A. Close injection line EMO Valves V6A and V8A in String A to force cross connect flow into spray line. Open cross connect Valves V18, V19, V20 and V21 in the auxiliary building.

e. Maintain injection flow to reactor vessel through two injection flow paths per Item a of Mode 2.

V. Procedures to be Effected Promptly

All three operating modes can be implemented now. No additional equipment or changes to the existing systems are required.




ECCS SCHEMATIC DIAGRAM FOR AP&L LONG TERM COOLING

Figure 1