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SUBJECT: Forwards description & evaluation of mod to 489 V bus supplying LPCI injection valves.

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June 1, 1989

10 CFR Part 50
Appendix K
TAC No. 71092

Director of Nuclear Reactor Regulation
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MONTICELLO NUCLEAR GENERATING PLANT
DOCKET NO. 50-263 LICENSE NO. DPR-22

DESCRIPTION AND EVALUATION OF THE
MODIFICATION TO THE 480 V BUS SUPPLYING THE LPCI INJECTION VALVES

The attachment to this letter provides a revised design and evaluation of a proposed modification to eliminate the loss of 125 VDC power supply's effect on the Low Pressure Cooling Injection (LPCI) injection valves (See Reference 1). This design is being submitted for your review (See Reference 2) and replaces our February 21, 1989 submittal. The design is preliminary at this time, since 1) review of all aspects of this modification and 2) procurement of the necessary hardware are not complete. We will notify you of any changes to the proposed design described in the attachment to this letter.

Since we are planning to install this modification during the refueling outage beginning in August of this year, we would appreciate your comments on this proposed design as soon as possible.

Please contact us if you have any questions related to this issue.

Thomas M Parker
Manager Nuclear Support Services

c: Regional Administrator-III, NRC
NRR Project Manager, NRC
Resident Inspector, NRC
G Charnoff

Attachment

References:

1. Letter dated October 4, 1988 from David Musolf (NSP) to the Director of NRR titled: "Effect of a DC Supply Failure on ECCS Performance"

2. Letter dated November 28, 1988 from John Stefano (NRC) to D M Musolf (NSP) titled: "Effect of DC Power Supply Failure on Monticello ECCS Performance"

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MONTICELLO NUCLEAR GENERATING PLANT

DESCRIPTION AND EVALUATION OF THE MODIFICATION TO THE 480 V BUS SUPPLYING THE LPCI INJECTION VALVES

DESCRIPTION:

Existing Design

The Low Pressure Cooling Injection (LPCI) System will inject into either recirculation loop A or B. The four Residual Heat Removal (RHR) pumps discharge into a common header. This header is connected to either recirculation loop A by a Division I injection valve or recirculation loop B by a Division II injection valve. The LPCI Loop Selection Logic determines which one of the two injection valves to open. The LPCI injection valves for Loop A and B are powered from Motor Control Center (MCC) 133B and MCC 143B respectively (See Figure 1).

An automatic transfer of power between the two MCCs will occur upon loss of power to either MCC. However, the automatic transfer logic and control power to the transfer breakers is supplied from the 125 VDC batteries. Loss of either of the 125 VDC batteries will inhibit this transfer feature.

During a design basis loss of coolant accident with a loss of offsite power, a loss of one division of 125 VDC power could inhibit the operation of the LPCI system by causing that division to loose AC power (the diesel generator output breaker would not be capable of closing without 125 VDC) and prevent the automatic switchover to the alternate supply for the LPCI injection valve. This could leave only one core spray pump injecting into the reactor vessel if the deenergized division's LPCI injection valve is selected.

An additional concern was expressed by the NRC Staff when reviewing the proposed design submitted on February 21, 1989. An internal fault in breaker cubicle Air Circuit Breaker (ACB) 52-307, for example, could cause a fault on Load Center (LC) 103 and MCC 133B. This would deenerigize the core spray injection valve on Division I, rendering Division I Core Spray System inoperable. In addition, the fault in the breaker cubicle could fault MCC 133B. If the LPCI Loop Selection Logic were to select the Division I LPCI injection valve, no injection of LPCI would occur. This would leave only one low pressure injection system, i.e., the Division II Core Spray system.

Proposed Design Modification

The proposed design will eliminate both of these concerns with the existing design.

Figure 2 identifies the proposed modification to MCCs 133B and 143B. An additional source breaker will be added to MCC 133B and MCC 143B. This will provide two breakers with the capability of separating the load center from the motor control center. MCC 133B and MCC 143B will be "hard" wired together. The breakers that previously could tie MCC 133B and 143B together (ACB 52-3320 and 4320) will be removed and replaced with locked closed maintenance switches. Control power for Division I equipment will remain Division I 125 VDC. Control power for Division II equipment will remain Division II 125 VDC.

MCCs 133B and 143B will normally be fed from LC 103 with ACB 52-307 and 307A closed. The feed from LC 104, breaker ACB 52-407, would be normally closed and breaker ACB 52-407A normally open. The transfer from LC 103 to LC 104 would occur under the following conditions:

> If no voltage is sensed between breakers ACB 52-307 and 307A for ten seconds, then breaker ACB 52-307A would be mechanically tripped open, and
>
> > if the auxiliary contacts on ACB 52-307A indicate the breaker is open and
> >
> > if ACB 52-307A did not trip on overcurrent,
>
> Then ACB 52-407A will receive a signal to close.

Paralleling of the two divisions will not be allowed. If both ACB 52-307A and 407A are closed at the same time, ACB 52-407 will be tripped separating the divisions electrically.

A no-voltage release device will be utilized to trip the ACB 52-307A after a loss of voltage for 10 seconds. This device will trip the breaker mechanically, requiring no control power.

ACB 52-307, 307A, 407 and 407A will have overcurrent trips.

The transfer will only occur from LC 103 to 104. The primary source to MCCs 133B and 143B will be LC 103. There will be no transfer to LC 103.

The loads on MCC 133B and MCC 143B will not change with the proposed design. Loads are limited to those loads associated with the LPCI function. These valves are listed in Table 1.

The Recirc Pump Suction Valve Motor was originally installed as safety-related equipment and received a LPCI signal to close, along with the discharge valve. In 1978, a safety concern was raised. A leak between the Recirc Pump Suction and Discharge Valves could be isolated too quickly, allowing the water inventory to be reduced without decreasing the reactor pressure below the shutoff head of the low-pressure ECCS pumps. As a result of this concern, the "close" signal was removed from the suction valve. Since that time the valve has not been considered safety-related equipment. These valves serve two functions: 1) backing up the function of the discharge valve and 2) isolating leaks between the suction and discharge valves after level is restored with the low pressure ECCS pumps. Leaving the valves powered from MCC 133B and 143B, will maximize their availability. The suction valve motor circuit breaker is electrically coordinated with upstream devices.

The breakers between LC 103 and MCCs 133B (and LC 104 and MCC 143B) will be electrically coordinated to reduce the probability of propagating electrical faults into non-LPCI portions of the electrical distribution system. To reduce the probability of propagating electrical faults between divisions, the bus transfer scheme (circuitry) will meet the applicable portions of IEEE Standard 279, such as the single failure criterion, testability and quality of components.

EVALUATION:

Minimum ECCS Requirements for the Large Break LOCA

Current large break LOCA analysis requires the following ECCS systems as a minimum:

1) 2 Core Spray pumps, or

2) One Core Spray pump and 2 Residual Heat Removal (RHR) pumps injecting through the LPCI injection valve selected by the Loop Selection Logic.

No single failure should make 1) both core spray pumps or 2) a core spray pump and the LPCI system inoperable. In order for the Core Spray pumps to inject into the reactor vessel, the Core Spray injection valves must be powered through MCC 133A and LC 103 for Division I, or MCC 143A and LC 104 for Division II (See Figure 2). Two items become clear. First of all, loss of LC 103 and MCC 133B (or LC 104 and MCC 143B) is not acceptable, since LPCI and one Core Spray system could be inoperable. Second, loss of LPCI is acceptable, if all core spray systems remain operable.

Minimum ECCS Requirements for a Core Spray Line Break

The core spray line inside the drywell is a special case as the break prevents one core spray pump from injecting into the vessel. The core spray line break depressurizes the reactor vessel in roughly 5 minutes. Even though the plant depressurizes rapidly, High Pressure Coolant Injection (HPCI) and Automatic Depressurization System (ADS) provide a safety function in these transients. ADS receives power for the logic from the 125 VDC and for the reactor water level instruments from the 250 VDC batteries but will operate as designed with any one loss of a 125 VDC or 250 VDC division and a loss of offsite power (See letter dated 2/1/89 from D Musolf (NSP) to the Director of NRR).

The availability of HPCI depends upon the availability of Division II 125 VDC and the Division II 250 VDC Batteries.

Past LOCA sensitivities studies have shown that if 2 RHR pumps and one train of ADS are operable for a core spray line break, the peak clad temperature will not exceed 700°F. The case where one core spray pump, HPCI and one train of ADS are operable was not run by General Electric as it was considered to be bounded by the case with 2 RHR pumps and ADS available.

Resolution of Concerns Identified with the Existing Design

Following the installation of the proposed design modification, loss of a division of 125 VDC control power coincident with a loss of offsite power will no longer disable both a core spray system and a LPCI injection valve. Breaker ACB 52-307A will trip independent of 125 VDC control power availability, which will initiate the transfer of power from LC 103 to 104.

Consider a loss of one division of 125 VDC power during a large break LOCA with loss of offsite power. One division's equipment would be lost due to the loss of the associated Emergency Diesel Generator, with the exception that both divisions' LPCI injection valves would remain operable. One Core Spray pump and 2 RHR pumps will be remain operable meeting the minimum ECCS requirements. Therefore, loss of either Division I or II 125 VDC will not disable MCC 133B or 143B or any equipment fed by these buses.

During a LOCA from a Core Spray line break, a single failure could make the other Core Spray pump or the LPCI injection valve inoperable, but not both. Thus, either 2 RHR pumps and one train of ADS are available or one Core Spray Pump, HPCI and one train of ADS are available insuring that the minimum ECCS requirements will be met.

Resolution of Additional Passive Electrical Failures

The concern raised by the NRC Staff has also been resolved. Two breakers now separate the load centers and the MCCs supplying the LPCI injection valves (See Figure 2). LC 103 and MCC 133B are separated by ACB 52-307 and 307A. LC 104 and MCC 143B are separated by ACB 52-407 and 407A. Internal failure of a breaker or breaker control circuit will not cause the loss of both a load center and the MCC since the proposed design has backup breakers to sectionalize the failed breaker.

CONCLUSIONS:

The modification eliminates the loss of power to the bus supplying the LPCI injection valve and the loss of a division's ECCS equipment from occurring at the same time. The proposed modification will correct the existing problem with the power supply for the LPCI injection valves without creating additional unacceptable concerns.

A safety evaluation will be prepared as part of the modification process which will address all aspects of this modification.

Table 1

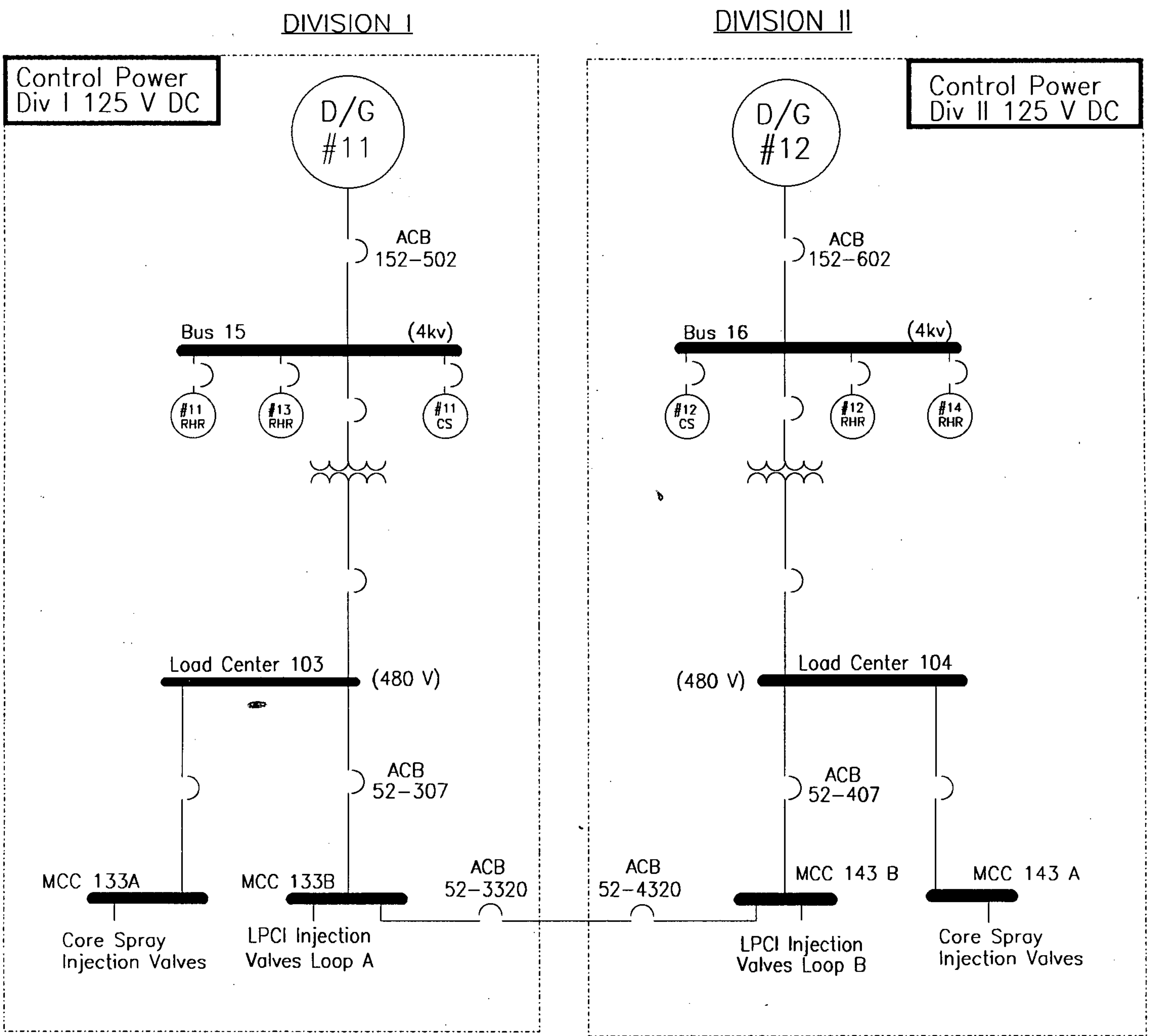
Electrical Loads on MCC 133B and 143B

MCC	Load	Description
133B	MO 2014	LPCI Injection Valve Motor
	MO 2012	LPCI Injection Valve Motor
	MO 2-43A	Recirc Pump Discharge Valve Motor
	MO 2-53A	Recirc Pump Suction Valve Motor
	MO 4085A	LPCI Crosstie Line Isolation Valve Motor
143B	MO 2015	LPCI Injection Valve Motor
	MO 2013	LPCI Injection Valve Motor
	MO 2-43B	Recirc Pump Discharge Valve Motor
	MO 2-53B	Recirc Pump Suction Valve Motor
	MO 4085B	LPCI Crosstie Line Isolation Valve Motor

Note: These valves can be found on USAR Figures 4.4-1b, 6.2-3a and b.

Existing Configuration

Figure 1



Proposed Configuration

Figure 2