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Attachment 4

Abnormal Procedure AB 1203.06

Inadequate Core Cooling Guidelines

ıvis-Besse Nuclear Power Station

Unit No. 1

ABNORMAL PROCEDURE AB 1203.06

Inadequate Core Cooling Guidelines

NUCLEAR SAFETY RELATED

Record of Approval and Changes

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Recommended by [signature] — SRB Chairman — 12-20-79 Date

QA Approved N/A — Manager of Quality Assurance — Date

Approved by T O Murray — Station Superintendent — 12/20/79 Date

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INADEQUATE CORE COOLING GUIDELINES

An inadequate core cooling situation is one in which an insufficient volume of water is available in the Reactor Coolant System (RCS) to remove reactor heat. More specifically, inadequate core cooling occurs when the core is uncovered. When the core is uncovered, superheated steam conditions will develop at the top of the core and in the hot legs. The incore thermocouples and/or the hot leg RTDs are used to monitor the steam conditions at the top of the core and depending on how much the steam is superheated, various action levels apply.

This procedure is referenced by EP 1202.06, Loss of Reactor Coolant - Reactor Coolant Pressure. The initial conditions are that superheated steam conditions have already been reached, and all actions of EP 1202.06 have been taken. Those actions are discussed again in Section I. Guidance on monitoring core steam conditions (with references to the appropriate actions) is also provided in Section I.

No assumptions have been made on how the inadequate core cooling condition was reached. Obviously the condition could only be the result of a series of equipment failures and operational errors. Nevertheless, the condition is assumed to have occurred and this procedure provides guidelines on what steps should be taken to correct the problem. Note that some of the equipment called upon by these guidelines is the same equipment which would probably have to have failed in order to reach this condition. Therefore, completion of all of the steps in the guidelines may not be possible, but those steps that can be completed, should be.

NOTE: SOME DIRECTIONS GIVEN IN THESE GUIDELINES ARE NOT IN AGREEMENT WITH DIRECTIONS IN OTHER PROCEDURES. IF AN INADEQUATE CORE COOLING SITUATION EXISTS, THE DIRECTIONS OF THIS PROCEDURE SUPERSEDE ALL OTHERS.

SECTION 1 - INITIAL ACTIONS

1. Verify that the HPI systems are functioning properly with maximum flow.
2. Verify that both makeup pumps are running with maximum injection flow.
3. Verify that the level in the operable steam generator(s) is being maintained at 96 inches or higher on the startup range.

NOTE: If containment temperatures are substantially above normal, reference leg density changes could give false level indications and increased levels should be maintained.

4. Steam generator pressures should be decreased to establish a 100°F/hr decrease in secondary temperature.
5. Verify that the core flood tank isolation valves are open.
6. Verify that the low pressure injection systems are actuated with SFAS incident level 3 at 400 psig RCS pressure.
7. If RCS pressure increases to 1500 psig, open the pressurizer electromatic relief valve (open the pressurizer electromatic relief block valve too, if it is closed). Hold it open until RCS pressure falls to 100 psig above secondary side pressure. Repeat if necessary.
8. Monitor the incore thermocouple readings and the hot leg temperatures along with RCS pressure and determine which section of actions to follow from Figure 1. Continuously monitor incore thermocouples and TDI - 4950 or TDI - 4951, RCS TSAT Meters until saturation conditions are re-established.

NOTE: Incore thermocouple readings should be taken from computer group 37. Scan the group and obtain a representative value (approximate average of several of the highest readings) of core outlet temperature. If the computer is inoperable, refer to IC 2001.07, Manual Measurement of Incore Thermocouple.

SECTION 2

NOTE: Continue to monitor core steam conditions and proceed to Section III if so directed by Figure 1.

1. Start one RCP per loop if possible. Do NOT bypass normal pump interlocks. Containment isolation for seal injection and component cooling water may be blocked and opened if necessary.

2. Create a step decrease in secondary side temperature of approximately 100°F by decreasing secondary side pressure as quickly as possible. Use the following table for guidance on how far to drop pressure.

Initial Pressure (psig)	1000	800	600	400
↓	↓	↓	↓	↓
Final Pressure (psig)	400	300	210	125

3. Open the pressurizer electromatic relief valve (and the block valve if it is closed) as necessary to maintain RCS pressure within 50 psi of secondary pressure.

   NOTE: If secondary side depressurization was not possible, open the electromatic relief valve and leave it open.

4. Continue the secondary side cooldown at a rate of approximately 100°F per hour until RCS pressure reaches 150 psig.

   NOTE: Do NOT decrease secondary side pressure less than that required to provide steam to the auxiliary feedwater pump turbine (approximately 50 psig).

5. When RCS pressure reaches 150 psig, go to EP 1202.06, Section 2.5.

SECTION 3

1. Start all four pumps if possible. Starting interlocks should be defeated if necessary. Attachment 1 provides the information necessary to bypass the pump start interlocks. If interlocks must be bypassed, complete the work on one pump and proceed to the next, starting each pump as soon as the interlocks are bypassed.

   NOTE: If CCW is not available to the pumps, trip each pump after 30 minutes of operation.

2. Depressurize the operable steam generator(s) to about 50 psig as quickly as possible. Do NOT drop pressure lower than that required to maintain steam to the auxiliary feedwater pump turbines (approximately 50 psig).

3. Open the pressurizer electromatic relief valve (and the block valve, if it is closed) and hold it open to reduce RC pressure enough to allow LPI to start.

4. When Incore thermocouple readings or TDI-4950 or TDI-4951, RCS TSAT meters return to the saturation temperature for the existing RCS pressure, and low pressure injection is established, proceed as follows:

   A. Close the pressurizer electromatic relief valve; re-open if RCS pressure increases above 150 psig.

   B. Decrease the number of RCPs running to one per loop.

   C. Proceed to Step 2.5.4 of EP 1202.06, Loss of RC, RC Pressure. (Note: This section refers to operation without RCPs or natural circulation. If pumps are running, ignore the references to the pumps being off).

DISCUSSION:

For the case where core exit thermocouple indications reach the bottom curve Figure 1, superheated steam exists at the core outlet and this is proof that the core is partially uncovered. However, the degree of uncovery is not severe enough to cause core damage. As long as the reactor core is kept covered with a mixture of water and steam, core damage will be avoided. However, continued operation in a steam cooling mode will result in elevated core temperatures and subsequent core damage. Operator actions are directed toward depressurization of the RCS to a pressure at which ECCS water input exceeds core steam generation. The alignment of other sources of cooling water is in recognition that the injection of the HPI System alone is not sufficient to exceed core boil off.

If the incore thermocouple indications reach the middle curve of Figure 1, the peak fuel cladding temperature has reached approximately 1400°F. Above this temperature level there is the potential for cladding rupture. Also the zircaloy cladding water reaction will begin to add significant amount of heat to the fuel cladding thereby increasing the possibility of core structural damage unless adequate core cooling is restored. Non-condensible gas formation will increase rapidly above this level of fuel clad temperature. Operator actions are to restore RCPs to provide forced flow cooling and reduce clad temperatures. The rapid depressurization of the OTSG will help to depressurize the primary system to the point where the core flood tanks will actuate. Stopping depressurization at a reduction in saturation temperature of 100°F will maintain OTSG tube-to-shell 4 Δ T within design limits. The continued cooldown to 150 psig will reduce RCS pressure to the point where LPI can supply cooling. Closing the electromatic relief valve when primary pressure is within 50 psi of secondary pressure will minimize loss of water from the system through the electromatic relief valve.

If the incore thermocouples reach the top curve on Figure 1, the peak cladding temperature is approximately 1800°F. This is a very serious condition and extreme measures are required by the operator. The goal of these actions is to rapidly depressurize the RCS to a level where the core flood tanks will fully discharge and the LPI System can be actuated thus providing prompt core recovery.

CORE OUTLET CONDITIONS

Plot core outlet temperature vs. RCS pressure and refer to the section or procedure indicated.

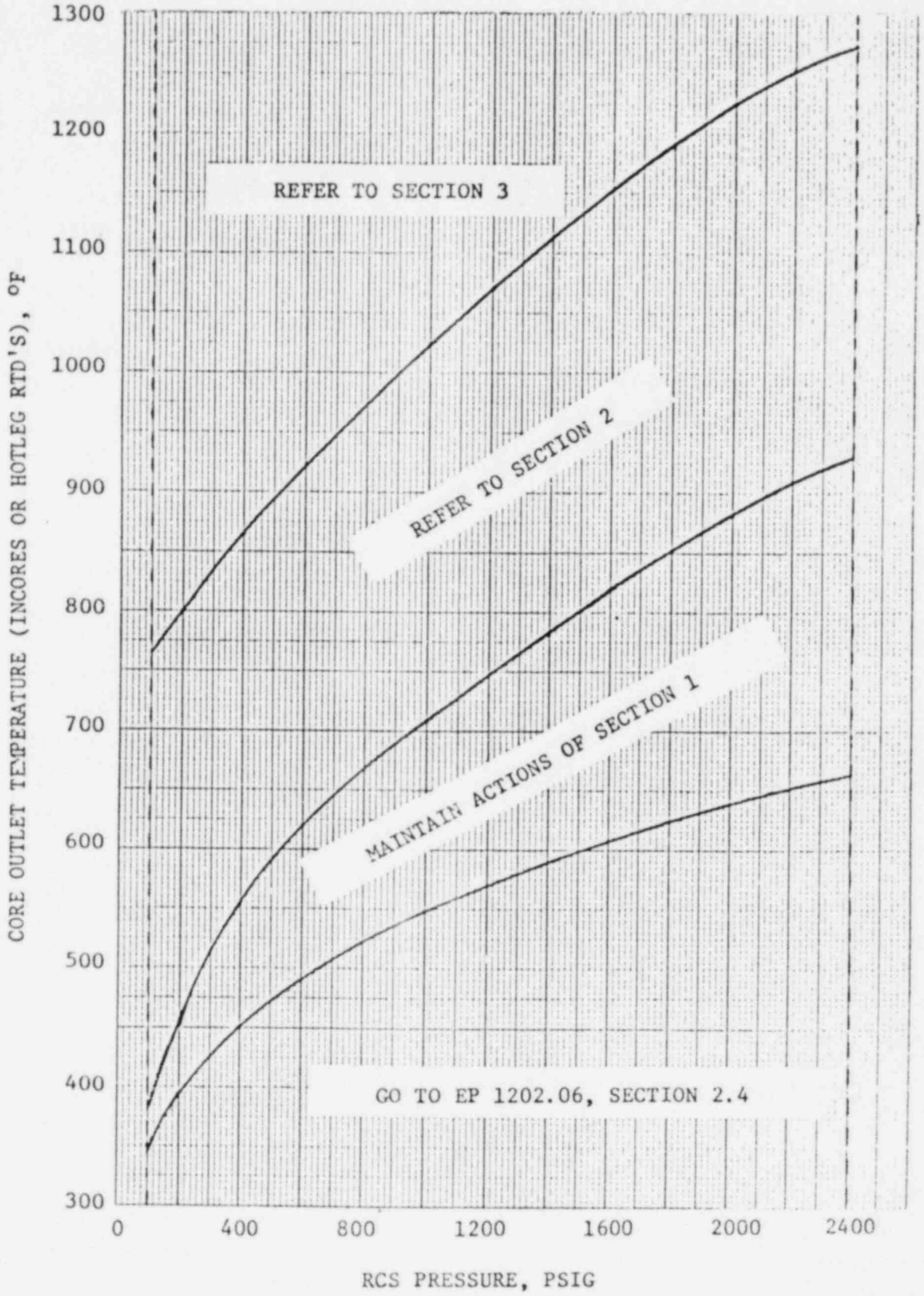

FIGURE 1

ATTACHMENT 1

PROCEDURE FOR BYPASSING PUMP START INTERLOCKS

4 Performing the following will defeat the RCP starting interlocks. All overload protection will be available.

RCP 1-1-1 (HA03)

At RC3717, install jumper on scheme 27X/FS-MU30C, TB20L, Terminal 12 to scheme TSX/RC4B, TB13L, Terminal 11.

4

RCP 1-1-2 (HB03)

At RC3718, install jumper on scheme 27X/FS-MU30D, TB20R Terminal 12 to scheme TSX/RC4B, TB13R, Terminal 11.

4

RCP 1-2-1 (HB01)

At RC3718, install jumper on scheme 27X/FS-MU30A, TB9R, Terminal 12 to scheme TSX/RC4, TB3R, Terminal 11.

4

RCP 1-2-2 (HA01)

At RC3717, install jumper on scheme 27X/FS-MU30B, TB9L Terminal 12 to scheme TSX/RC4A, TB3L, Terminal 11.

4

END