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October 11, 1985
Fort St. Vrain
Unit No. 1
P-85363

Director of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. E. J. Butcher, Jr., Acting Chief
Operating Reactors Branch No. 3

Docket No. 50-267

SUBJECT: Technical Specification Upgrade Program

REFERENCE: PSC letter dated September 30, 1985 Brey to Hunter (P-85344)

Dear Mr. Butcher:

Attachment 1 is a re-submittal of the Draft Technical Specifications for the helium circulators, steam generators, and the PCRV liner cooling system, previously submitted for NRC review in the referenced letter. The enclosed Specifications include Surveillance Requirements for Specification 3.5.1.1 and Figures 3.5.1-1, 3.5.1-2, and 3.5.1-3, which were inadvertently omitted from the previous letter.

For completeness, PSC's itemized response to the applicable Action Items that resulted from the July 22-26 meetings between the NRC and PSC, are included as Attachment 2.

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If you have any questions regarding the enclosed Specifications, please contact Mr. M. H. Holmes at (303) 571-8409.

Very truly yours,

H. L. Brey by Milt McBride

H. L. Brey
Manager, Nuclear
Licensing and Fuels

HLB/SWC/ljb

Attachments

Attachment 1
to
P-85363

PRIMARY COOLANT SYSTEM

3/4.5.1 HELIUM CIRCULATORS

LIMITING CONDITION FOR OPERATION

3.5.1.1 At least one helium circulator in each loop shall be OPERABLE with:

a. Emergency circulator drive capable of providing the equivalent of 8000 rpm circulator speed at atmospheric pressure;

b. Two emergency water booster pumps (P-2109 and P-2110) OPERABLE, including two OPERABLE flow paths with the capability to drive the circulator at 3% rated helium flow with firewater supply;

c. The turbine water removal system, including two turbine water removal pumps (P-2103 and P-2103S) OPERABLE;

d. The normal bearing water system, including two sources of bearing water makeup and two bearing water makeup pumps (P-2105 and P-2108) OPERABLE;

e. The associated bearing water accumulators (T-2112, T-2113, T-2114, and T-2115) OPERABLE; and

f. OPERABLE supply and discharge valve interlocks on each associated circulator ensuring automatic water turbine start capability following steam turbine trip.#

APPLICABILITY: POWER, LOW POWER, STARTUP* and SHUTDOWN*

*With calculated CORE AVERAGE INLET TEMPERATURES greater than or equal to 760 degrees F.

#The supply and discharge valve interlocks are only required to be OPERABLE in POWER.

ACTION:

a. With less than one OPERABLE helium circulator in each loop (for reasons other than those identified in ACTIONS b and c below) or with less than the required OPERABLE equipment identified in Specification 3.5.1.1, item e, restore at least one helium circulator in each loop or the inoperable equipment to OPERABLE status within 24 hours, or:

   1. If in POWER, LOW POWER, or STARTUP, be in at least SHUTDOWN within the next 24 hours, or

   2. If in SHUTDOWN, suspend all operations involving CORE ALTERATIONS or positive reactivity changes.

b. With less than the required OPERABLE equipment identified in Specification 3.5.1.1, items a, b, c, d, or f, but with the capability to drive a helium circulator on steam motive power, restore the inoperable equipment to OPERABLE status within 7 days or be in at least SHUTDOWN within the next 24 hours.

c. With no helium circulators OPERABLE and all forced circulation lost, be in SHUTDOWN immediately and restore forced circulation within 90 minutes or depressurize the PCRV in accordance with the applicable requirement below:

   1. As a function of reactor thermal power prior to SHUTDOWN equal to or greater than 25% as delineated in Figure 3.5.1-1.

   2. As a function of CORE AVERAGE INLET TEMPERATURE for reactor thermal power prior to SHUTDOWN less than 25% as delineated in Figure 3.5.1-2.

   3. As a function of time from reactor SHUTDOWN as delineated in Figure 3.5.1-3.

SURVEILLANCE REQUIREMENT

4.5.1.1 The helium circulators shall be demonstrated OPERABLE:

a. At least once per 31 days by testing the bearing water accumulators and verifying accumulator flow to the circulator bearing.

b. At least once per REFUELING CYCLE by:

1. Performing a turbine water removal pump (P-2103 and P-2103S) start test based on a simulated drain tank level to verify automatic actuator and pump start capability.

2. Performing a bearing water makeup pump (P-2105 and P-2108) start test based on a simulated low pressure in the backup bearing water supply line to verify automatic actuation and pump start capability.

3. Testing the water turbine inlet and outlet valve interlocks ensuring automatic water turbine start capability by simulating a steam turbine trip.

4. Monitoring the proper closure of the circulator helium shutoff valves.

c. At least once per REFUELING CYCLE on a STAGGERED TEST BASIS whereby circulators 1B and 1D will be tested during even numbered cycles and circulators 1A and 1C during odd numbered cycles, by demonstrating operation on water turbine drive by:

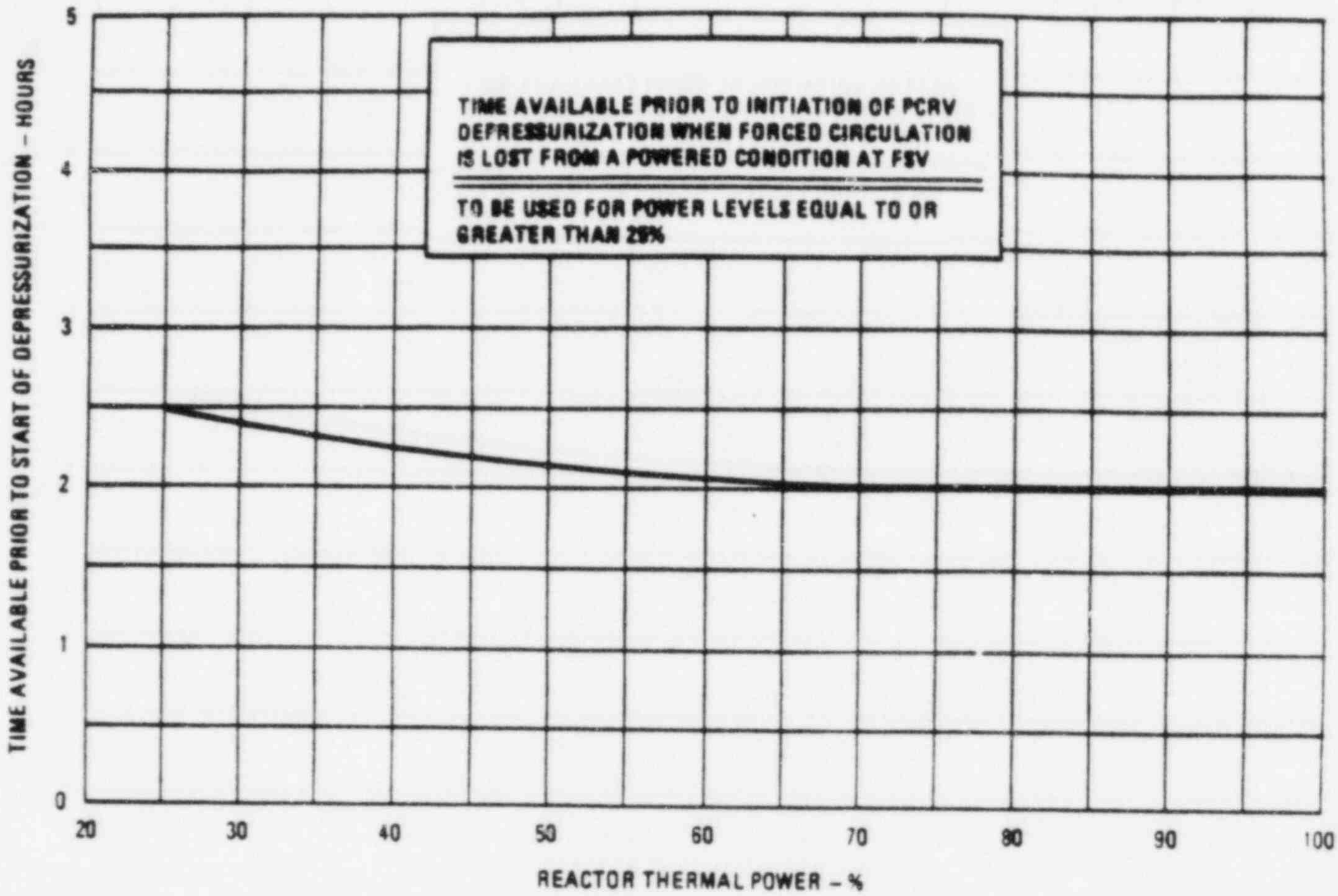
1. Verifying an equivalent 8000 rpm (at atmospheric pressure) on feedwater motive power using the emergency feedwater header, and

2. Testing each circulator by verifying an equivalent 3% rated helium flow on condensate at reduced pressure (to simulate firewater pump discharge) using each emergency water booster pump (P-2109 and P-2110).

d. At least once per 10 years by verifying:

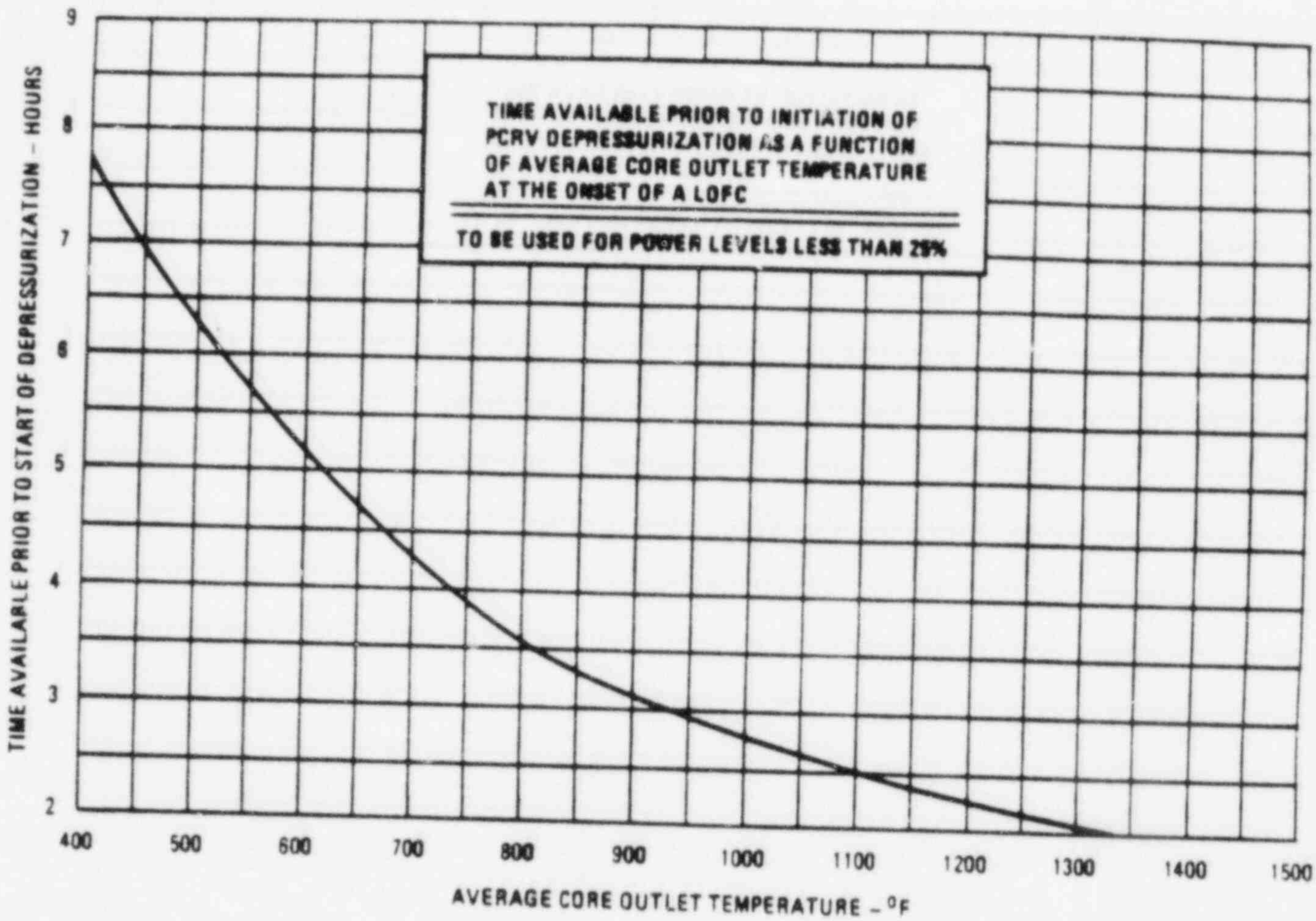
1. Each helium circulator compressor wheel rotor, turbine wheel and pelton wheel are free of both surface and subsurface defects in accordance with the appropriate methods, procedures, and associated acceptance criteria specified for Class I components in Article NB-2500, Section III, ASME Code. Other helium circulator components, accessible without further disassembly than required to inspect these wheels, shall be visually examined.

2. At least 10% of primary coolant pressure boundary bolting and other structural bolting which has been removed for the inspection above and which is exposed to the primary coolant shall be nondestructively tested for identification of inherent or developed defects.



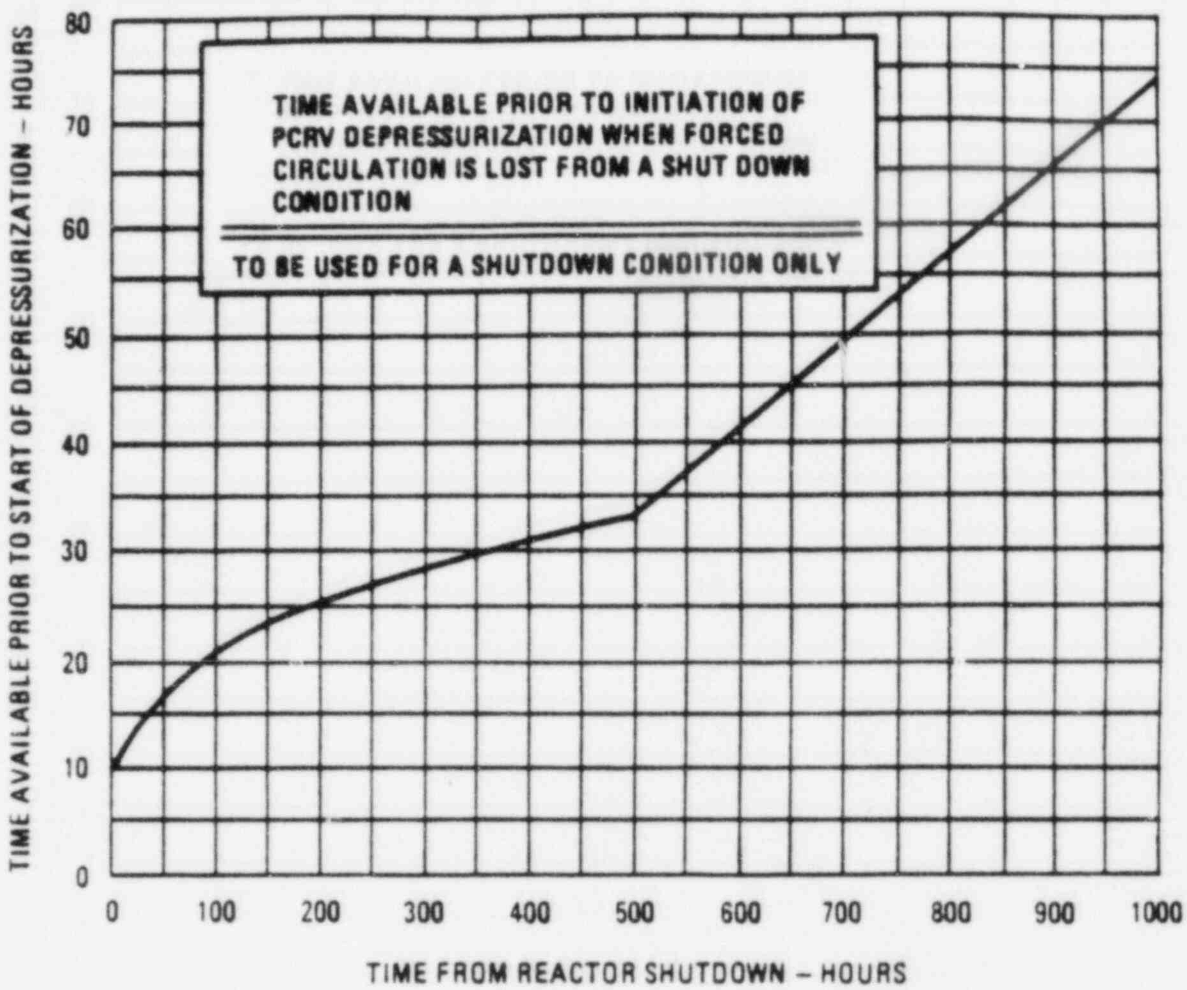
Time Available Prior to Initiation of PCRV Depressurization When Forced Circulation is Lost from a Powered Condition at FSV

Figure 3.5.1-1



Time Available Prior to Initiation of PRCV Depressurization as a Function of Average Core Outlet Temperature at the Onset of a LOFC

Figure 3.5.1-2



Time Available Prior to Initiation of PCRV Depressurization When When Forced Circulation is Lost from a Shut Down Condition

Figure 3.5.1–3

PRIMARY COOLANT SYSTEM

3/4.5.1 HELIUM CIRCULATORS-STARTUP, SHUTDOWN AND REFUELING

LIMITING CONDITION FOR OPERATION

3.5.1.2 At least one helium circulator shall be OPERABLE with:

a. Emergency circulator drive capable of providing the equivalent of 8000 rpm circulator speed at atmospheric pressure;

b. One emergency water booster pump (P-2109 or P-2110) OPERABLE including an OPERABLE flow path with the capability to drive the circulator at 3% rated helium flow with firewater supply;

c. The turbine water removal system, including one turbine water removal pump (P-2103 or P-2103S) OPERABLE;

d. The normal bearing water system, including one source of bearing water makeup and one bearing water makeup pump (P-2105 or P-2108) OPERABLE; and

e. The associated bearing water accumulator OPERABLE.

APPLICABILITY: STARTUP*, SHUTDOWN*, and REFUELING

* With calculated CORE AVERAGE INLET TEMPERATURES less than 760 degrees F.

ACTION:

With no helium circulator OPERABLE, restore the required circulator to OPERABLE status prior to the time calculated for the core to heatup from decay heat to a calculated CORE AVERAGE INLET TEMPERATURE of 760 degrees F or:

1. Suspend all operations involving CORE ALTERATIONS or positive reactivity changes, and

2. Initiate PCRV depressurization in accordance with the time specified in Figure 3.5.1-3.

SURVEILLANCE REQUIREMENT

4.5.1.2 No additional Surveillance Requirements beyond those specified in SR 4.5.1.1.

BASIS FOR SPECIFICATION LCO 3.5.1.1, 3.5.1.2 / SR 4.5.1.1

One circulator, operating with motive power from either:

a. Condensate or Boosted Firewater supplied via the emergency condensate header, or

b. Feedwater or Boosted Firewater supplied via the emergency feedwater header,

provides sufficient primary coolant circulation to assure safe shutdown cooling when the plant is pressurized. One circulator in each loop is specified during POWER, LOW POWER, STARTUP, and SHUTDOWN with calculated CORE AVERAGE INLET TEMPERATURE greater than or equal to 760 degrees F to allow for a single failure in either the heat removal equipment or circulator auxiliary equipment which provides services to one loop. Safe shutdown cooling is discussed in the FSAR Section 10.3.9, single failure considerations in Section 10.3.10 and condensate and boosted firewater cooldown transients in FSAR Sections 14.4.2.1 and 14.4.2.2. One circulator, operating with emergency water drive, supplied via the emergency feedwater header, provides sufficient primary coolant circulation following a postulated depressurization accident.

In the unlikely event that all forced circulation is lost, start of depressurization is initiated as a function of prior power levels, with two (2) hours from full power operation being the most limiting case. Operators will continue attempts to restore forced circulation cooling until such time as the PCRV must be depressurized per the depressurization curves described above. Cooldown using forced circulation cooldown is preferred to a depressurized cooldown with the PCRV Liner Cooling System. Depressurization of the PCRV under extended loss of forced circulation conditions is accomplished by venting the reactor helium through a train of the Helium Purification System and the reactor building vent stack filters to atmosphere. Start of depressurization times from various reactor power conditions are delineated in Figures 3.5.1-1, 3.5.1-2, and 3.5.1-3 and are discussed in the FSAR Section 9.4.3.3 and Appendix D.

The requirements for an OPERABLE circulator specified provide for adequate circulator water turbine supply and circulator auxiliary supplies to assure safe shutdown cooling. With less than two emergency water booster pumps (Boosted Firewater), OPERABLE, coupled with the diverse and redundant means for circulator motive power, a 7 day action statement time is considered sufficient for restoration of these pumps.

The capacity of each helium circulator water turbine drive method is discussed in FSAR Section 14. Effective core cooling has been demonstrated analytically with each water turbine drive method. Additionally, these two pumps are tested by verifying an equivalent 3% rated helium flow by operating the circulators on water turbine drive. Additional tests provide assurance that a circulator can operate at an equivalent 8000 rpm at atmospheric pressure based on calculated helium density, reactor pressure and circulator inlet temperature.

One turbine water removal pump has sufficient capacity to remove the water from two circulator water turbines. Also, the turbine water removal tank overflow to the reactor building sump will be used if the normal pump flow path is lost. Therefore, a 7 day action statement time is considered sufficient for restoration of the pumps, based on the redundant and diverse means of removing water from the circulator water turbines.

Each independent bearing water system provides a continuous supply of bearing water to the two circulators in each primary cooling loop. A backup supply of bearing water is provided from the steam generator feedwater system. Makeup bearing water requirements are also normally obtained from the feedwater system. A separate bearing water makeup pump is provided as a backup to supply makeup water to the bearing water surge tank. The bearing water makeup pump normally takes suction from the deaerator but can also be supplied from the condensate storage tanks. If this pump is inoperative, an emergency bearing water makeup pump can supply water at a reduced capacity from the condensate storage tank to the bearing water surge tank. In an extreme emergency, filtered firewater can be provided to the bearing water surge tank by either the bearing water makeup pump or the emergency bearing water makeup pump.

Each bearing water loop contains a gas pressurizer and bearing water accumulator capable of supplying bearing water for 30 seconds at design flow rate if no other source of bearing water is available. This is adequate for safe shutdown of the affected circulators.

The bearing water system, including the bearing water accumulators and the bearing water makeup pumps are functionally tested at 31 days and REFUELING CYCLE intervals, respectively, to insure proper operation.

Auto water turbine start is prevented if a water turbine trip exists or the auto water turbine start control switch is not in the auto position. The aforementioned interlock circuitry is tested once per REFUELING CYCLE, to insure proper system operation.

SAFE SHUTDOWN COOLING SYSTEMS

3/4.5.2 STEAM GENERATORS

LIMITING CONDITION FOR OPERATION

3.5.2.1 Two steam generators shall be OPERABLE with:

a. Both the reheater Section and the economizer-evaporator-superheater (EES) section OPERABLE (each section consisting of six modules) per steam generator,

b. The steam generator superheater (EES) and reheater safety valves (V-2214, V-2215, V-2216, V-2245, V-2246, V-2247, V-2225 and V-2262) OPERABLE with set points in accordance with Table 4.5.2-1, and

c. The provisions of Specification 3.0.6 are not applicable until 72 hours after reaching 25% RATED THERMAL POWER, to allow testing of the steam generator superheater and reheater safety valves, required following maintenance or per Surveillance Requirements identified in Specification 4.5.2.1 b.1.

APPLICABILITY: POWER and LOW POWER

ACTION:

a. With less than the above required steam generator sections OPERABLE, restore the required sections to OPERABLE status within 72 hours or be in STARTUP within the next 12 hours.

b. With no steam generator section OPERABLE, be in SHUTDOWN immediately and restore at least one inoperable section to OPERABLE status within 90 minutes or depressurize the PCRV in accordance with the times specified in Figures 3.5.1-1 or 3.5.1-2, as applicable.

c. With one or more of the required safety valve(s) inoperable, restore the required valve(s) to OPERABLE status within 72 hours or restrict plant operation as follows:

   1. With one EES safety valve inoperable, reduce THERMAL POWER to less than 50% of RATED THERMAL POWER.

   2. With a reheater safety valve inoperable, be in STARTUP within the next 12 hours.

SURVEILLANCE REQUIREMENTS

4.5.2.1 The steam generators shall be demonstrated OPERABLE:

a. At least once per 18 months by verifying proper flow through the emergency feedwater header and emergency condensate header to the steam generator sections.

b. At least once per five years by:

1. Testing the superheater and reheater safety valves and verifying the lift settings as specified in Table 4.5.2-1.

2. Volumetrically examining the accessible portions of the following bimetallic welds for indications of subsurface defects:

1. The main steam ring header collector to main steam piping weld for one steam generator module in each loop.

2. The main steam ring header collector to collector drain piping weld for one steam generator module in each loop.

3. The same two steam generator modules shall be re-examined at each interval.

The initial examination shall be performed during SHUTDOWN or REFUELING prior to the beginning of Fuel Cycle 5. This initial examination shall also include the bimetallic welds described above for two additional steam generator modules in each loop.

c. <u>Tube Leak Examination</u>

Each time a steam generator tube is plugged due to a leak, specimens from the accessible subheader tubes connected to the leaking inaccessible tubes(s) shall be metallographically examined.

The results of this metallographic examination shall be compared to the results from the specimens of all previous tube leaks.

A study shall be performed to evaluate the size and elevation of the tube leaks to determine if a cause of the leak or a trend in the degradation can be identified.

1. Acceptance Criteria

   An engineering evaluation shall be performed to determine the acceptability of:

   1. Any subsurface defects identified in Specification 4.5.2.1 c.2,

   2. Continued operation considering the condition of the steam generator materials,

   3. OPERABILITY of the steam generator sections considering the number of plugged tubes and their ability to remove decay heat.

2. Reports

   Within 30 days following the completion of each steam generator tube leak study a Special Report shall be submitted to the NRC in accordance with Specification 6.9.2. This report shall include the estimated size and elevation of the leak(s), and the results of the metallographic and engineering analyses performed, the postulated cause of the leak if identified and corrective action to be taken.

TABLE 4.5.2-1

STEAM GENERATOR SAFETY VALVES

VALVE NUMBER	LIFT SETTING
LOOP I	
V-2214	Less than or equal to 2917 psig
V-2215	Less than or equal to 2846 psig
V-2216	Less than or equal to 2774 psig
V-2225	Less than or equal to 1133 psig
LOOP II	
V-2245	Less than or equal to 2917 psig
V-2246	Less than or equal to 2846 psig
V-2247	Less than or equal to 2774 psig
V-2262	Less than or equal to 1133 psig

SAFE SHUTDOWN COOLING SYSTEMS

3/4.5.2 STEAM GENERATORS

LIMITING CONDITION FOR OPERATION

3.5.2.2 The steam generator(s) shall be OPERABLE with:

a. At least two sections (reheater or economizer-evaporator-superheater) in any combination of one or both steam generators OPERABLE, and

b. The steam generator superheater (ESS) and reheater safety valves (V-2214, V-2215, V-2216, V-2245, V-2246, V-2247, V-2225 and V-2262) which protect the operating sections of the steam generator(s) shall be OPERABLE with setpoints in accordance with Table 4.5.2-1.

APPLICABILITY: STARTUP and SHUTDOWN*

* With calculated CORE AVERAGE INLET TEMPERATURES greater than or equal to 760 degrees F.

ACTION:

a. With less than the above required steam generator sections OPERABLE, restore the required sections to OPERABLE status within 72 hours or:

1. If in STARTUP, be in at least SHUTDOWN within the next 12 hours, or

2. If in SHUTDOWN, suspend all operations involving CORE ALTERATIONS or positive reactivity changes.

b. With no steam generator sections OPERABLE, be in SHUTDOWN immediately and restore at least one inoperable section to OPERABLE status or depressurize the PCRV in accordance with the times specified in Figures 3.5.1.-2 or 3.5.1-3, as applicable.

c. With one or more of the required safety valves inoperable, restore the required valves to OPERABLE status within 72 hours or restrict plant operation as follows:

1. With one EES safety valve inoperable, restrict plant operation to a maximum of two boiler feed pumps.

2. With a reheater safety valve inoperable, be in SHUTDOWN within the next 12 hours.

SURVEILLANCE REQUIREMENTS

4.5.2.2 No additional surveillances required beyond those identified per Specification 4.5.2.1.

SAFE SHUTDOWN COOLING SYSTEMS

3/4.5.2 STEAM GENERATORS

LIMITING CONDITION FOR OPERATION

3.5.2.3.

a. At least the reheater section or the economizer-evaporator-superheater (EES) section of one steam generator shall be OPERABLE, and

b. The steam generator superheater or reheater safety valve(s) which protect the operating section of the steam generator shall be OPERABLE with setpoints in accordance with Table 4.5.2-1.

APPLICABILITY: SHUTDOWN* and REFUELING

* With calculated CORE AVERAGE INLET TEMPERATURE less than 760 degrees F.

ACTION:

With no steam generator section or its associated safety valve(s) OPERABLE, restore the required section or safety valve to OPERABLE status prior to the time calculated for the core to heatup from decay heat to a calculated CORE AVERAGE INLET TEMPERATURE of 760 degrees F, or:

1. Suspend all operations involving CORE ALTERATIONS or positive reactivity changes, and

2. Initiate PCRV depressurization in accordance with the time specified in Figure 3.5.1-3.

SURVEILLANCE REQUIREMENTS

4.5.2.3 No additional surveillances required beyond those identified per Specification 4.5.2.1.

BASIS FOR SPECIFICATION LCO 3.5.2/ SR 4.5.2

The requirements for OPERABLE steam generators provide an adequate means for removing heat from the primary reactor coolant system to the secondary reactor coolant system. The helium flow which cools the reactor core enters the steam generator at high temperature and gives up its heat to the reheat steam section and main steam/water section.

Each steam generator consists of six identical individual steam generator modules operating in parallel. Each module consists of a reheater section and an economizer-evaporator-superheater section.

During POWER and LOW POWER, all steam generator sections are required for plant operation. This ensures safe shutdown cooling capability for those transients identified in Chapter 14 of the FSAR.

During STARTUP and SHUTDOWN with calculated CORE AVERAGE INLET TEMPERATURE greater than or equal to 760 degrees F any two steam generator sections are required to be OPERABLE. This allows for a single failure and provides an adequate means for removing decay heat. Additionally, this temperature is the design steady state core inlet temperature.

During SHUTDOWN with calculated CORE AVERAGE INLET TEMPERATURE less than 760 degrees F and REFUELING, either the reheater section or the economizer-evaporator superheater section of one steam generator can be used for shutdown heat removal from the primary coolant.

In the event that no steam generator section is OPERABLE, PCRV depressurization is initiated in accordance with the times required in Figures 3.5.1-1, 3.5.1-2, and 3.5.1-3 as applicable. Operators will continue attempts to restore forced circulation until such time as determined by the curves that depressurization must begin. A cooldown on forced circulation is preferred over a cooldown in a depressurized state with the PCRV Liner Cooling System. This minimizes free convection heat transfer from the central core regions upward to metal components at the core inlet which are limiting in terms of temperature limits.

The steam generator reheater or EES sections can receive water from either the associated emergency condensate header or the emergency feedwater header which are required to be OPERABLE per this Specification. System flow OPERABILITY is determined by verifying flow from each of the aforementioned emergency headers through each steam generator.

The economizer-evaporator-superheater section of each steam generator loop is protected by three spring-loaded safety valves, each with one-third nominal relieving capacity of each loop. The reheater section of each steam generator loop is protected from overpressure transients by a single safety valve. These steam generator safety valves are described in the FSAR, Section 10.2.5.3.

The above valves are required to be tested in accordance (ASME Section XI, IGV requirements) every 5 years or after maintenance. To satisfy the testing criteria, the valves must be tested with steam. Since these valves are permanently installed in steam piping, the appropriate means for testing require plant power to be in excess of 22% RATED THERMAL POWER. Thus, the test must be conducted during LOW POWER. Conditions are specified so as to minimize operation at power until the valves are tested. Due to the infrequent required testing of these valves, the likelihood of an accident occurring without proper valve testing is considered very small and plant safety is not compromised.

During all Modes, with one EES safety valve inoperable, plant operation is restricted to a condition for which the remaining safety valves have sufficient relieving capability to prevent overpressurization of any steam generator section (i.e., one boiler feed pump per operating loop). Conversely, with any reheater safety valve inoperable, plant operation is restricted to a more restrictive Mode. Additionally, these valves are tested in accordance with ASME Section XI requirements.

Seventy-two hour action times associated with restoring steam generator sections to OPERABLE status is sufficient time to identify and correct problems not requiring cooldown and/or removal of the failed components. Other restrictions on power level exist which cause automatic PPS action, such that, the consequences of a total loss of forced convection cooling would be less severe that DBA-1 which is a total loss of forced cooling from 100% power. A 90 minute action time associated with loss of all steam generator sections assures that attempts to restore forced circulation are independent of the need to depressurize in preparation for cooldown with the PCRV Liner Cooling System. Thus, conservative actions keep plant conditions within FSAR analysis. A 72 hour action time for repair or SHUTDOWN due to inoperable safety valves again allows sufficient to identify failures of these safety valves, operation at power for 72 hours does not result in a significant loss of safety function for any extended period.

The setpoints on the safety valves identified in Table 4.5.2-1 are those valves identified in the FSAR with tolerances applied such that the Technical Specifications incorporate an upper bound setpoint. This is consistent with not incorporating normal operating limits in these Specifications.

Bimetallic Weld Examination

The steam generator crossover tube bimetallic welds between Incoloy 800 and 2 1/4 Cr-1 Mo materials are not accessible for examination. The bimetallic welds between steam generator ring header collector, the main steam piping, and the collector drain piping are accessible, involve the same materials, and operate at conditions not significantly different from the crossover tube bimetallic welds. The collector drain piping weld is also geometrically similar to the crossover tube weld. Although minimal degradation is expected to occur, this specification allows for detection of defects which might result from conditions that can uniquely affect bimetallic welds made between these materials. Additional collector welds are inspected at the initial examination to establish a baseline which could be used, should defects be found in later inspections and additional examinations subsequently be required.

Tube Leak Examination

During the lifetime of the plant, a certain number of steam generator tube leaks are expected to occur, and the steam generators have been designed to have these leaking tube subheaders plugged without affecting the plant's performance as shown in FSAR Table 4.2-5. The consequences of steam generator tube leaks have been analyzed in FSAR Section 14.5.

It is important to identify the approximate size and elevation of steam generator tube leaks and to metallographically examine the subheader tube material because this information can be used to analyze any trend or generic cause of tube leaks. Conclusive identification of the cause of a steam generator tube leak may enable modifications and/or changes in operation to increase the reliability and life of the steam generators and to prevent a quantity of tube failures in excess of those analyzed in the FSAR.

Because of the subheader designs leading to the steam generator tube bundles, internal or external inspection and evaluation of a tube leak to establish a conclusive cause is not practical. Metallographic examination of the accessible connecting subheader tube will show the condition of the internal subheader wall, giving an indication of the conditions of the leaking tube internal wall, thereby demonstrating the effectiveness of water chemistry controls. Determining the approximate size and elevation of the tube leak may enable evaluation of other possible leak causes such as tube/tube support plate interface effects.

The surveillance plan outlined above is considered adequate to evaluate steam generator tube integrity and assure that the consequences of postulated tube leaks remain within the limits analyzed in the FSAR.

REACTOR PLANT COOLING WATER/PCRV AND CONFINEMENT SYSTEMS

3/4.6.2 PCRV LINER COOLING SYSTEM

LIMITING CONDITION FOR OPERATION

3.6.2.1 The Reactor Plant Cooling Water (RPCW)/PCRV Liner Cooling System (LCS) shall be OPERABLE with:

a. Two (2) loops OPERATING with at least one heat exchanger and one pump in each loop in service;

b. At least three (3) out of any four (4) adjacent tubes on the core support floor side wall, core support floor bottom casing, PCRV cavity liner sidewalls and PCRV cavity liner bottom head shall be OPERATING;

c. At least five (5) out of any six (6) adjacent tubes on the PCRV cavity liner top head and core support floor top casing shall be OPERATING.

d. Tubes adjacent to a non-operating tube shall be OPERATING

APPLICABILITY: POWER, LOW POWER, STARTUP* and SHUTDOWN*

* Whenever calculated CORE AVERAGE INLET TEMPERATURE is greater than or equal to 760 degrees F.

ACTION

a. With only one (1) RPCW/PCRV Liner Cooling System loop OPERATING, ensure both heat exchangers are OPERATING in the OPERATING loop, restore the second loop to OPERATING within 48 hours or be in SHUTDOWN within the following 12 hours and suspend all operations involving positive reactivity changes. Without both heat exchangers in the OPERATING loop OPERATING or without any liner cooling system loop flow be in SHUTDOWN within 15 minutes and suspend all operations involving positive reactivity changes.

b. With less than the above required number of PCRV Liner Cooling System tubes OPERATING, restore the required tubes to OPERATING status within 24 hours or be in SHUTDOWN within the following 24 hours and suspend all operations involving positive reactivity changes.

SURVEILLANCE REQUIREMENTS

4.6.2.1 The RPCW/PCRV Liner Cooling System shall be demonstrated OPERABLE:

a. At least once per 24 hours, by verifying that each PCRV Liner Cooling System loop is circulating cooling water at a flow rate greater than 1100 gpm.

b. At least once per 31 days, by verifying that liner cooling tube outlet temperature readings and their respective inlet header temperatures (for an operating loop) are within one of the following limits:

1. 30 degrees F temperature rise for tubes cooling top head penetrations;

2. 20 degrees F temperature rise for all other zones except tubes specified below;

3. Exceptions

a) Core Outlet Thermometer Penetrations

Tube	Delta T
7S93	23 degrees F

b) Core Barrel Seal/Core Support Floor Area

Tube	Delta T
F12T46	47 degrees F
F7T43	39 degrees F
F6T44	43 degrees F
F11T45	38 degrees F
F5T47	46 degrees F

c) Peripheral Seal

Tube	Delta T
3S9	23 degrees F
4S188	23 degrees F
4S10	23 degress F
3S187	23 degrees F

If the tube outlet temperature reading for any liner cooling tube is not available due to an instrument failure, the tube may be considered OPERABLE if two tubes on both sides of the tube with an instrument failure (4 tubes total) are within their respective temperature limits as specified above.

PCRV and CONFINEMENT SYSTEMS

3/4.6.2 REACTOR PLANT COOLING WATER/PCRV LINER COOLING SYSTEM

LIMITING CONDITIONS FOR OPERATIONS

3.6.2.2 The Reactor Plant Cooling Water (RPCW)/PCRV Liner Cooling System (LCS) shall be OPERABLE with:

a. One (1) RPCW/PCRV Liner Cooling System loop OPERATING with at least one heat exchanger and one pump in each loop in service.

APPLICABILITY: STARTUP*#, SHUTDOWN*#, and REFUELING#

ACTION: a. With no RPCW/PCRV Liner Cooling System loop OPERATING, restore at least one loop to OPERATING status prior to the time calculated for the core to heatup from decay heat to a calculated CORE AVERAGE INLET TEMPERATURE of 760 degrees F or suspend all operations involving CORE ALTERATIONS or positive reactivity changes.

SURVEILLANCE REQUIREMENTS

4.6.2.2 No additional surveillance requirements other than those identified per Specification 4.6.2.1.

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* Whenever calculated CORE AVERAGE INLET TEMEPRATURE is less than 760 degrees F.

The core support floor zone of the PCRV Liner Cooling System may be valved out when PCRV pressure is less than or equal to 150 psia and calculated CORE AVERAGE INLET TEMPERATURE is less than 200 degrees F.

BASIS FOR SPECIFICATION LCO 3.6.2 / SR 4.6.2

During operation at power, two PCRV Liner Cooling System loops are required to maintain PCRV Liner Cooling System temperatures and stresses within the FSAR design limits (FSAR Section 5.9.2., THERMAL BARRIER and LINER COOLING SYSTEM, DESIGN and DESIGN EVALUATION). Analytical calculations in support of the PCRV Liner Cooling System design (FSAR Section 5.9.2.4) demonstrate that operation at full power with one cooling loop for 48 hours satisfies the criterion which specifies a maximum temperature increase of 20 degrees F in the bulk temperature of the PCRV concrete. Operation on one loop during a loss of forced circulation accident using a PCRV liner cooldown with an increased liner cooling water system cover pressure of 30 psig may result in temperature rises across individual cooling tubes of 240 degrees F (outlet temperature of approximately 340 degrees F). These conditions result in acceptable liner cooling for this analyzed condition and PCRV structural integrity is preserved (FSAR Section D.1.2.1.5).

The liner cooling tubes are spaced in such a manner as to limit local concrete temperatures adjacent to the liner to 150 degrees F. However, potential failures of cooling tubes were analyzed and their limits follow.

PCRV liner cooling tube failures, whether the result of leakage or blocking, do not affect the integrity of the PCRV as long as such a failure is limited to a single tube in any adjacent set of four tubes on the PCRV cavity side walls, PCRV cavity bottom casing, core support floor side wall or core support floor liner bottom head, or a single tube in any adjacent set of six tubes on the PCRV cavity liner top head and core support floor top casing. A failed tube which doubles back on itself is considered a single tube failure. In these cases, the local temperature in the concrete would be less than 250 degrees F (during normal two loop operation), an allowable and acceptable concrete temperature (FSAR 5.9.2.3.).

Operation of the PCRV Liner Cooling System during startup testing disclosed hot spots on the liner. These locations were identified and analyzed in the above FSAR Sections. The engineering evaluation indicated that operation with the hot spots would not compromise PCRV integrity and continued operation is acceptable. The temperature limits of the tubes associated with the hot spots are specified separately as they were analyzed specifically for each hot spot. Only four (4) of the seven (7) hot spots have liner cooling tubes which may have temperature rises greater than 20 degrees F.

The action times specified for recovery of two operating loops comes from analyses described in FSAR Section 5.9.2.4 i.e. 48 hours operation on one loop before temperature of the bulk concrete would rise 20 degrees F. With the number of cooling tubes less than required, a 24 hour action time is sufficient to identify and restore the tube to operating status (if possible) or SHUTDOWN to make permanent repairs.

The surveillance(s) and their respective intervals are specified to verify operability of the Liner Cooling System. Components and features of the Reactor Plant Cooling Water System that are not safety-related do not affect LCS operability. The ISI/IST Program at Fort St. Vrain verifies operability of those barriers that separate safety and non-safety related portions of the system. A 24 hour surveillance on system flow rates provides additional verification of flow as process alarms monitor flow continuously in each liner cooling loop. Individual tube failures would be expected to occur slowly, thus a 31 day surveillance interval will detect tube failures in time to take corrective action.

With calculated CORE AVERAGE INLET TEMPERATURE below 760 degrees F, one operating Liner Cooling System loop is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the limited core cooling requirements.

When the PCRV pressure is less than 150 psia and calculated CORE AVERAGE INLET TEMPERATURE is less than 200 degrees F, the core support floor zones of the liner cooling system may be valved out as concrete temperatures will be less than the 250 degree FSAR limitation. Thus, leaking liner cooling tubes which are awaiting repairs will not contribute to potential moisture ingress into the primary system.

In Surveillance Requirement 4.6.2.1.b., tube outlet temperatures are determined by thermocouple readings. In the event of an instrument failure (i.e. a thermocouple is thought to be failed), the tube with the failed thermocouple may be considered OPERABLE if thermocouple readings for two adjacent tubes on either side of that tube are within their respective temperature limits. If the tube itself failed rather than the thermocouple, then the temperature of adjacent tubes would be expected to rise. Thus, a failed thermocouple can be identified vs. an actual tube failure. Power operation may continue until such time as the thermocouple can be repaired or replaced as long as the total of 4 adjacent tubes (2 on either side of the tube with the failed instrument) are within their respective temperature limits.

PCRV AND CONFINEMENT SYSTEMS

3/4.6.3 REACTOR PLANT COOLING WATER/PCRV LINER COOLING SYSTEM TEMPERATURES

LIMITING CONDITIONS FOR OPERATION

3.6.3 The RPCW/PCRV Liner Cooling System (LCS) temperatures shall be maintained within the following limits:

a. The maximum average temperature difference between the common PCRV cooling water discharge temperature and the PCRV external concrete surface temperature shall not exceed 50 degrees F.

b. The maximum PCRV Liner Cooling System water outlet temperature shall not exceed 120 degrees F.

c. The maximum change of the weekly average PCRV concrete temperature shall not exceed 14 degrees F per week.

d. The maximum temperature difference across the RPCW/PCRV Liner Cooling Water Heat Exchanger (LCS portion) shall not exceed 20 degrees F.

e. The minimum average LCS water temperature shall be greater than or equal to 100 degrees F.

APPLICABILITY: At all times

ACTION:

a. If any of the above conditions can not be restored within 24 hours, be in SHUTDOWN or REFUELING within the next 24 hours and suspend all operations involving CORE ALTERATIONS or positive reactivity changes.

SURVEILLANCE REQUIREMENTS

4.6.3 The RPCW/PCRV Liner Cooling System temperatures shall be demonstrated to be within their respective limits at least once per 24 hours by:

a. Verifying that the maximum temperature difference averaged over a 24 hour period between the PCRV external concrete surface temperature and the common PCRV cooling water discharge temperature in each loop does not exceed 50 degrees F.

b. Verifying that the maximum PCRV liner cooling water outlet temperature does not exceed 120 degrees F as measured by PCRV liner cooling water outlet temperature in each loop.

c. Verifying that the change in PCRV concrete temperature does not exceed 14 degrees F per week as indicated by the weekly average water temperature measured at the common PCRV cooling water outlet temperature in each loop. The weekly average water temperature is determined by computing the arithmetical mean of 7 temperatures, representing each of the last 7 days of common PCRV cooling water outlet temperatures in each loop. Each day results in a new computation of a weekly average water temperature. The new weekly average is then compared to the weekly average water temperature computed 7 days earlier to verify Specification 3.6.3.c.

d. Verifying that the maximum delta T across the RPCW/PCRV Liner Cooling System heat exchanger does not exceed 20 degrees F as measured by the PCRV heat exchanger outlet temperature and the common PCRV liner cooling water outlet temperature in each loop.

e. Verifying that the minimum average water temperature of the PCRV Liner Cooling System is greater than or equal to 100 degrees F as measured by the average of the PCRV Liner Cooling System heat exchanger (LCS side) inlet and outlet temperatures.

BASIS FOR SPECIFICATION LCO 3.6.3/ SR 4.6.3

The temperature limits associated with the Liner Cooling System are not specifically discussed in the FSAR. Various FSAR sections including 5.7, 5.9, 5.12, and 9.7 discuss general design limits of the liner and PCRV concrete. The PCRV liner and its associated cooling system assists in maintaining integrity of the PCRV concrete.

PCRV bulk concrete temperature is not measured directly. The PCRV Liner Cooling System temperatures and their specified frequency of measurement ensure that thermal stresses on the PCRV concrete and liner are within FSAR analyses described above and that PCRV integrity is maintained.

Since the PCRV concrete has a large thermal mass and inertia, temperatures would be expected to respond very slowly to any changes in the specified parameters. A 24 hour action identification and response time is consistent with the expected slow temperature response of the PCRV. As a precaution, the plant would be SHUTDOWN and/or remain in REFUELING mode until temperatures were stabilized.

RESPONSE TO ACTION ITEMS

This attachment addresses the Action Items identified in Reference 2 relevant to the steam generators, helium circulators and the PCRV Liner Cooling System, actions 27, 28, 30, 31, 35 and 36.

In determining what should explicitly be included in the Technical Specifications as far as operability of a system is concerned, PSC has adopted the underlying philosophy of "immediate threat" as stated by the ASLAB as follows:

> The Atomic Safety and Licensing Appeal Board has propagated an "immediate threat" standard for defining what should be included in the Technical Specifications. In ALAB-531, the Board stated that: "___as best we can discern it, the contemplation of both the act and the regulations is that Technical Specifications are to be reserved for those matters as to which the imposition of rigid conditions or limitations upon reactor operation is deemed necessary to obviate the possibility of an abnormal situation or event giving rise to an immediate threat to the public health and safety." (In the matter of Portland General Electric Company, et al. (Trojan Nuclear Power Plant), 9 NRC 263 (1979).)

Action 27a

> PSC is to evaluate the acceptability of operation without buffer He as a circulator shaft seal (i.e., don't require buffer He flow in the Tech Specs).

Response:

> PSC proposes that buffer helium flow not be required in the Technical Specifications for helium circulator operability. The circulators have been satisfactorily tested without buffer helium flow and it is not relied upon per the FSAR. The loss of buffer helium does not pose an "immediate threat" to the public health and safety.

Action 27b

PSC is to evaluate the need to specify maximum circulator bearing water temperature in the Tech Specs.

Response:

Bearing water temperature should not be specified explicitly as high temperature is a condition which would be the result of low bearing water pressure. Since the LCO requirements and surveillances already address the bearing water system, it is not necessary to further specify the temperature of the bearing water. Also, a high bearing water temperature does not pose an immediate threat per ASLAB proceedings. A high temperature may be corrected by adjusting bearing water flow and/or pressure.

Action 27c

PSC is to evaluate the need to require a backup helium buffer gas supply be specified in the Tech Specs.

Response:

As noted in 27a above, neither buffer helium flow nor backup helium buffer gas supply flow is required for circulator operability. Since an immediate threat to the public health and safety is not identified, an explicit requirement is not provided.

Action 27d

PSC is to evaluate the basis for the statements on FSAR pages 4.2-6 and 4.2-22 regarding interlocks which prevent circulator turbine drives from being supplied simultaneously with both water and steam. A recommendation will then be made on whether or not the operability of these interlocks should be required and checked via the Tech Specs.

Response:

PSC considers these interlocks to be required for helium circulator operability and they have been added to Specifications 3.5.1.1 and 3.5.1.2. The circulators will operate satisfactorily while being supplied simultaneously with both water and steam. However, the concern is that if the interlocks fail, they could prevent any source of motive power from being supplied to the circulator drives.

Action 28

PSC is to redraft LCOs 3.5.1.1 and 3.5.1.2 and to propose less redundancy be required when decay heat is low (i.e., long time for recovery).

Response:

PSC has re-written Specifications 3.5.1.1 and 3.5.1.2 to require redundant systems to satisfy single failure criterion whenever calculated core average inlet temperature equals or exceeds 760 degrees F, and no redundancy when it is less than 760 degrees F. In low decay heat conditions, the reactor is in a stable condition with shutdown margin assured through other specifications and core cooling is not of immediate concern.

Action 30a

PSC will evaluate the need to include in this LCO a limit on reheater steam outlet temperature which would be based upon keeping temperatures elsewhere in the S.G. within their design limits.

Response:

Plant Protective System setpoints for high reheat steam temperatures maintain those temperatures within all design criteria for the steam generators.

Action 30b

PSC will reevaluate requirements on relief valve operability including the acceptability of continued plant operation with less than the required number of safety relief valves operable.

Also, the discrepancies between FSAR Table 10.2-2 and Tech Spec Table 4.5.2-1 regarding relief valve setpoints needs to be resolved.

Response:

The specifications as proposed with this attachment reflect operability requirements for safety relief valves relied upon in the FSAR, consistent with the ASME Code requirements.

The discrepancy between the FSAR and Technical Specifications is due to the setpoint tolerance of the valves. The main steam safety valves have a tolerance of plus or minus 2% while the reheat safety valve in each loop has a tolerance of plus or minus 3%. The FSAR Table 10.2-2 does not reflect those tolerances while the Technical Specifications contain the valve setpoint plus the respective tolerance. Thus the Technical Specifications reflect the highest allowable setpoint.

Action 31

<u>LCOs 3.5.2.2 and 3.5.2.3 "Steam Generators"</u> - PSC is to redraft these LCOs to allow less redundancy when decay heat level or primary system temperatures are low.

Response:

As in Action Item #28, the Specifications have been revised to allow less redundancy when the decay heat level is low and the reactor is in a stable condition, shutdown with shutdown margin maintained by other specifications. Decay heat may be dissipated by various combinations of cooling including forced convection, liner cooling and radiation heat transfer dependent upon temperatures and cooling methods in use.

Action 35

LCO 3.6.3 "LCS" - PSC is to redraft this LCO in consideration of NRC comments and will retitle this LCO the Reactor Plant Cooling Water System. PSC will also clarify the allowable number of failed tubes.

Response:

PSC has revised the Specifications to address the NRC comments. The additional system operability requirements do not reveal an mmediate threat if failed. Also, the FSV ISI/IST Program that is currently being developed, will assure that non safety-related system functions of the Reactor Plant Cooling Water System do not interfere with safety-related functions via a well defined surveillance and test program.

Action 36

LCO 3.6.3 "LCS Temperatures" - PSC will better define what 100 degrees F temperature limit applies to in item e.

Response:

This concern is resolved in the revised Specification.