3.4 LIMITING CONDITIONS FOR OPERATION

3.4 STANDBY LIQUID CONTROL SYSTEM

Applicability:

Applies to the operating status of the Standby Liquid Control System.

Objective:

To assure the availability of a system with the capability to shut down the reactor and maintain the shutdown condition without control rods.

Specifications

A. Normal Operation

During periods when fuel is in the reactor and prior to startup from a cold condition, the Standby Liquid Control System shall be operable except as specified in 3.4.B below. This system need not be operable when the reactor is in the cold condition, all rods are fully inserted and Specification 3.3.A is met.

4.4 SURVEILLANCE REQUIREMENTS

4.4 STANDBY LIQUID CONTROL SYSTEM

Applicability:

Applies to the periodic testing requirements for the Standby Liquid Control System.

Objective

To verify the operability of the Standby Liquid Control System.

Specification:

A. Normal Operation

The operability of the Standby Liquid Control System shall be verified by performance of the following tests:

1. Once per month -

Demineralized water shall be recycled to the test tank. Pump minimum flow rate of 50 gpm shall be verified against a system head of ≥ 1,275 psig.

2. Once per 24 months -

Manually initiate the system, except the explosive valves. Pump solution through the recirculation path.

4.4 (cont'd)

Explode one of three primer assemblies manufactured in the same batch to verify proper function. Then install the two remaining primer assemblies of the same batch in the explosive valves.

Demineralized water shall be injected into the reactor vessel to test that valves (except explosive valves) not checked by the recirculation test are not clogged.

Test that the setting of the system pressure relief valves is between 1,400 and 1,490 psig.

3. Once per 24 months -

Disassemble and inspect one explosive valve so that it can be established that the valve is not clogged. Both valves shall be inspected within two test intervals.

B. Operation with Inoperable Components

From and after the date that a redundant component is made or found to be inoperable, Specification 3.4.A shall be considered fulfilled, and continued operation permitted, provided that:

1. The component is returned to an operable condition within 7 days.

B. Operation with Inoperable Components

When a component becomes inoperable its redundant component shall be verified to be operable immediately and daily thereafter.

3.4 (cont'd)

C. Sodium Pentaborate Solution

The standby liquid control solution tank shall contain a boron bearing solution with a minimum enrichment of 34.7 atom percent of B-10 that satisfies the volume- concentration requirements of Fig. 3.4-1 at all times when the Standby Liquid Control System is required to be operable and the solution temperature including that in the pump suction piping shall not be less than the temperature presented in Fig. 3.4-2. Tank heater and the heat tracing system shall be operable whenever the SLCS is required in order to maintain solution temperature in accordance with Fig. 3.4-2. If these requirements are not met, restore the system to the above limits within eight hours or take action in accordance with Specification 3.4.D.

D. If specifications 3.4.A through C are not met, the reactor shall be in at least hot shutdown within the following 12 hours.

4.4 (cont'd)

C. Sodium Pentaborate Solution

The availability of the proper boron bearing solution shall be verified by performance of the following tests:

1. Once per month -

   Boron concentration shall be determined. In addition, the boron concentration shall be determined any time water or enriched sodium pentaborate is added or if the solution temperature drops below the limits specified by Figure 3.4-2.

2. Once per day -

   Solution volume and the solution temperature shall be checked.

3. Once per 18 months -

   The temperature and level elements shall be calibrated.

4. Once per 24 months -

   Enrichment of B-10 (in atom percent) shall be checked.

D. Not Used

ATWS requirements are satisfied at all concentrations above 10 weight percent for a minimum enrichment of 34.7 atom percent of B-10.

Figure 3.4-1 shows the permissible region of operation on a sodium pentaborate solution volume versus concentration graph. This curve was developed for 34.7% enriched B-10 and a pumping rate of 50 gpm. Each point on this curve provides a minimum of 660 ppm of equivalent natural boron in the reactor vessel upon injection of SLC solution. At a solution volume of 2200 gallons, a weight concentration of 13% sodium pentaborate, enriched to 34.7% boron-10 is needed to meet shutdown requirements. The maximum storage volume of the solution is 4780 gallons which is the net overflow volume in the SLC tank.

Boron concentration, isotopic enrichment of boron-10, solution temperature, and volume are checked on a frequency adequate to assure a high reliability of operation of the system should it ever be required. Experience with pump operability indicates that monthly testing is adequate to detect if failures have occurred.

The only practical time to test the Standby Liquid Control System is during a refueling outage and by initiation from local stations. Components of the system are checked periodically as described above and make a functional test of the entire system on a frequency of more than once every 24 months unnecessary. A test of explosive charges from one manufacturing batch is made to assure that the charges are satisfactory. A continuous check of the firing circuit continuity is provided by pilot lights in the control room.

The relief valves in the Standby Liquid Control System protect the system piping and positive displacement pumps, which are nominally designed for 1,500 psig, from overpressure. The pressure relief valves discharge back to the standby liquid control pump suction line.

B. Operation with Inoperable Components

Only one of two standby liquid control pumping circuits is needed for operation. If one circuit is inoperable, there is no immediate threat to shutdown capability, and reactor operation may continue during repairs. Assurance that the remaining system will perform its function is obtained by verifying pump operability in the operable circuit at least daily.

C. Sodium Pentaborate Solution

To guard against precipitation, the solution, including that in the pump suction piping, is kept at least 10°F above saturation temperature. Figure 3.4-2 shows the saturation temperature including 10°F margin as a function of sodium pentaborate solution concentration. Tank heater and heat tracing system are provided to assure compliance with this requirement. The set points for the automatic actuation of the tank heater and heat tracing system are established based on the solution concentration. Temperature and liquid level alarms for the system annunciate in the control room. Pump operability is checked on a frequency to assure a high reliability of operation of the system should it ever be required.

Once the solution is prepared, boron concentration does not vary unless more enriched sodium pentaborate or more water is added. Level indications and alarms indicate whether the solution volume has changed which might indicate a possible solution concentration change. The test interval has been established considering these factors.

Boron enrichment (B-10 atom percent) does not vary with the addition of enriched sodium pentaborate material or water to the SLC tank provided 34.7% enriched (B-10 atom percent) is added. Therefore, a check once every 24 months is adequate to ensure proper enrichment.

ATTACHMENT II to JPN-95-051

Safety Evaluation
For Proposed Changes to Technical Specification
Standby Liquid Control System Surveillance Test Intervals to
<u>Accommodate 24-Month Operating Cycles (JPTS-95-001H)</u>

New York Power Authority

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
Docket No. 50-333
DPR-59

I. DESCRIPTION OF THE PROPOSED CHANGES

1. Page 105, Specification 4.4.A.1, delete "At least" to make the terminology in this section consistent. This is an editorial change and does not change the frequency of the specification. The revised specification reads:

   "Once per month -"

2. Page 105 and 106, Specification 4.4.A.2, change the from "during each operating cycle" to "per 24 months." The revised specification reads:

   "2. Once per 24 months

   Manually initiate the system, except the explosive valves. Pump solution through the recirculation path.

   Explode one of three primer assemblies manufactured in the same batch to verify proper function. Then install the two remaining primer assemblies of the same batch in the explosive valves.

   Demineralized water shall be injected into the reactor vessel to test that valves (except explosive valves) not checked by the recirculation test are not clogged.

   Test that the setting of the system pressure relief valves is between 1,400 and 1,490 psig."

   An editorial change is being made to move the words "pump solution in the recirculation path" from the top of page 106 to the bottom of page 105 to make the specification easier to read. The wording of the specification was changed to clarify the specification. These changes do not change the intent of Specification 4.4.A.2.

3. Page 106, Specification 4.4.A.3, add "Once per 24 months" to the beginning of the Specification and change "in the course of two operating cycles" to "within two test intervals." The revised Specification reads:

   "3. Once per 24 months -

   Disassemble and inspect one explosive valve so that it can be established that the valve is not clogged. Both valves shall be inspected within two test intervals."

4. Page 107, Specification 4.4.C.1, delete "At least" to make the terminology in this section consistent. This is an editorial change and does not change the frequency of the specification. The revised specification reads:

   "Once per month -"

5. Page 107, Specification 4.4.C.2, delete "At least" to make the terminology in this section consistent. This is an editorial change and does not change the frequency of the specification. The revised specification reads:

   "Once per day -"

6. Page 107, current Specification 4.4.C.3.a, change "per operating cycle" to "per 18 months." The numbering of the Specification will change to 4.4.C.3 because the current Specification 4.4.C.3.b will be changed as described below. The revised specification reads:

   "3. Once per 18 months

   The temperature and level elements shall be calibrated."

7. Page 107, current Specification 4.4.C.3.b, renumber Specification to 4.4.C.4 and revise the Specification to "Once per 24 months." The revised Specification reads:

   "4. Once per 24 months

   Enrichment of B-10 (in atom percent) shall be checked."

8. Bases page 109, second sentence of the fourth paragraph in the first column, change "each refueling outage" to "every 24 months." The revised text reads:

   "Because components in the system are checked periodically as described above, a functional test of the entire system on a frequency of more than once every 24 months is unnecessary."

9. Bases page 109a, last sentence of the second paragraph, change "per operating cycle" to "every 24 months." The revised text reads:

   "Therefore, a check once every 24 months is adequate to ensure proper enrichment."

II. PURPOSE OF THE PROPOSED CHANGES

This application for amendment to the James A. FitzPatrick Nuclear Power Plant Technical Specifications proposes to extend the surveillance test intervals for the Standby Liquid Control (SLC) System to accommodate 24 month operating cycles. These changes will eliminate the need to shut the plant down mid-cycle to conduct these surveillances. Extended surveillance intervals are identified in the proposed Technical Specifications as being performed "once per 24 months." SLC system temperature and level instrument calibrations, currently performed "at least once per operating cycle," are identified as performed "once per 18 months." These changes follow the guidance provided by Generic Letter 91-04 (Reference 1).

SLC system surveillance tests conducted once per operating cycle were evaluated to confirm that the surveillance frequencies could be safely extended. The evaluation (Reference 2) included a detailed study of SLC system surveillance history and operational occurrences. Surveillance test data was analyzed, where applicable, for components affected by the extended operating cycle. The evaluation concluded that all SLC surveillance tests can be safely extended to accommodate a 24 month operating cycle except the SLC system temperature and level instrument calibrations that will remain on an 18 month frequency.

Standby Liquid Control System Objective and Description

The design objective of the SLC system is to provide a backup method, independent of the control rods, to bring and maintain the reactor subcritical from the most reactive condition as the reactor cools. The system would be used in the unlikely event that a sufficient number of control rods could not be inserted into the core to accomplish reactor shutdown in the normal manner. The system is sized to counteract the positive reactivity effect from a full power to a cold shutdown condition, at any time in core life, by the injection of high pressure borated water into the reactor vessel.

The SLC system consists of a tank of neutron absorber solution (sodium pentaborate), two 100% capacity positive displacement pumps, two explosive actuated injection valves, a test water tank, and associated local valves and controls mounted in the reactor building outside the primary containment. The injection point for the SLC system is a standpipe located in the lower plenum of the reactor pressure vessel. The system is remote manually initiated from the control room. The SLC system satisfies the requirements of the Anticipated Transient Without Scram (ATWS) Rule (10 CFR 50.62(c)(4)).

The SLC system, with the exception of the injection valves and associated downstream piping, is designed to allow testing of major components during reactor operation. Once per month, demineralized water is recycled to the test tank to demonstrate operability of the SLC system pumps and valves. The only practical time to test the injection portion of the system, and to perform functional testing of the system by manual initiation, is during refueling outages. This precludes inadvertent injection of borated water into the reactor coolant system during plant operation. Since the major system components are checked on a monthly basis, functional testing of the entire SLC system on a frequency of more than once per operating cycle is not necessary.

The availability of proper boron bearing solution is verified periodically. The solution temperature and volume is checked once per day. Boron concentration is determined once per month, any time water or enriched sodium pentaborate solution is added, or if the solution temperature drops below Technical Specification limits. Storage tank and pump suction piping heat trace instrumentation are currrently calibrated, and the B-10 enrichment (in atom %) is checked, once per operating cycle.

III. SAFETY IMPLICATION OF THE PROPOSED CHANGES

Once per operating cycle surveillance requirements (SRs) for the SLC system are provided in Technical Specifications 4.4.A.2, 4.4.A.3, 4.4.C.3.a and 4.4.C.3.b. Surveillance requirement 4.4.A.2 includes four component operability checks. The purpose of these tests and the potential safety implications of the extended surveillance interval are discussed below.

Surveillance Requirement 4.4.A.2

This Surveillance requires that the following once per cycle testing be performed on the SLC system to verify operability:

1. *Manually initiate the system, except for the explosive valves, and pump solution in the recirculation path.*

During the performance of this test, each SLC pump is operated to pump solution from the SLC storage tank through the test line and back into the storage tank. This test verifies that the piping between the SLC storage tank and the pump inlets is not blocked. A potential source of blockage is the precipitation of sodium pentaborate in the tank and suction piping. This is avoided by maintaining temperature of the tank and suction piping at least 10°F above saturation temperature for the concentration of the solution by use of tank heaters and heat tracing on the pump suction lines. These heating systems, along with Technical Specification required daily checks of tank temperature, ensure that sodium pentaborate remains in solution and does not result in blockage of the flowpath. In addition, a review of surveillance test results from 1983 to 1995 shows no failures.

2. *Explode one of three primer assemblies manufactured in the same batch to verify proper function. Then install the two remaining primer assemblies of the same batch in the explosive valves.*

The purpose of this test is to establish that the valve explosive charge will function properly. The system utilizes two squib activated shear explosive valves in parallel as a means of isolating both pumps from the reactor vessel. The valves are maintained in the closed position and are activated only in an emergency to provide a flow path to the reactor vessel. The firing circuit continuity for each valve is continuously monitored by pilot lights, ammeters, and an annunciator signaling loss of continuity in the control room to alert plant control room operators of any problems with the circuit. The proposed testing interval of 24 months (+25%) is within the manufacturers recommended service life for the explosive charges. Evaluation of surveillance test results from 1983 to 1995 show no test failures.

During the 1992 performance of this surveillance, the testing was stopped because it was noticed that the squib valve continuity circuit was not functioning properly. Upon investigation, several electronic components were found to be defective. The test was concluded following repair of these components and the explosive charges functioned properly. Further investigation into the cause of these component failures led to implementation of a modification to install surge suppression varistors to protect the squib valve continuity circuit electronics. These failures do not preclude extension of this surveillance interval because the failed components are outside the scope of this surveillance requirement and would not have prevented the squib valves from operating.

3. *Demineralized water shall be injected into the reactor to test that valves (except explosive valves) not checked by the recirculation test are not clogged.*

The SLC system is remote manually initiated from the main control room to demonstrate the capability of the SLC system to inject demineralized water into the reactor vessel. The firing of the explosive valves is simulated and the system pumps and valves are flushed with demineralized water prior to the test to preclude entry of sodium pentaborate solution into the reactor vessel. The pumps and valves in the flow path, up to the injection valves, are tested monthly. The only practical time to test the injection portion of the system is during plant shutdown for refueling. Evaluation of surveillance test results from 1983 to 1995 has identified no test failures.

4. *Test that the setting of the system pressure relief valves is between 1400 and 1490 psig.*

This test demonstrates that the SLC pump discharge safety valves lift between 1400 and 1490 psig. These valves protect the system from overpressure. The valves are only used and pressurized during brief periods for system testing. Therefore, the possibility of valve degradation is very low. The SLC system is designed with two redundant loops. If one relief valve lifted at too low a pressure, the check valve in that discharge line would prevent the other pump flow from recycling back to the storage tank. Relief valve failure due to setpoint drift in the low direction would be detected during monthly and quarterly pump testing. The proposed 24 month testing frequency is more frequent than the American Society of Mechanical Engineers (ASME) Section XI testing requirements for relief valves. The current edition of the ASME code for the FitzPatrick Plant (1980 Edition through 1981 Winter Addenda) requires testing of this type of valve at five year intervals. Surveillance test results from 1983 to 1995 identified no test failures.

Conclusion SR 4.4.A.2

Based on a review of past surveillance history, on-line testing performed on major SLC system components, and engineering evaluation that the longer operating cycle length will not increase the probability of test failure, extension of this surveillance requirement to support a 24-month operating cycle is acceptable.

<u>Surveillance Requirement 4.4.A.3</u>

This surveillance requires disassembly and inspection of the internals of one explosive valve so that it can be established that the valve is not clogged. Both valves are inspected in the course of two operating cycles. The valves are normally in a standby condition and are not operated except to provide a flowpath for borated water into the reactor vessel or for testing on a refueling outage basis. Due to the limited use of the valves, they are not likely to wear out due to fatigue. Therefore, the operating cycle length does not have a significant impact on maintenance requirements. An evaluation of surveillance test data from 1990 to 1995 indicates that the test results have always been within the acceptance criteria.

Conclusion SR 4.4.A.3

Based on past surveillance history and the limited use of these valves, extending this test to a 24 month interval will not significantly increase the probability of test failure.

<u>Surveillance Requirement 4.4.C.3 (Current Specification 4.4.C.3.a)</u>

This surveillance requires that the temperature and level elements associated with the sodium pentaborate storage tank and pump suction piping be calibrated once per operating cycle. The solution is maintained at least 10°F above the solution saturation temperature by a tank heater and a piping heat tracing system. This prevents the precipitation of sodium pentaborate in the storage tank and pump suction lines. Temperature indication and alarms for the system annunciate in the control room. Temperature is checked daily and provides assurance that the system is maintained as required by Technical Specifications. Level instrumentation is provided for the sodium pentaborate storage tank. Monitoring of tank level, along with level alarms, are used to detect whether the solution volume has changed, which may be indicative of a solution concentration change. Tank level is checked daily, as required by Technical

Specifications, using two independent means. These daily checks will detect instrument drift or level changes due to water addition, water evaporation, or system leaks.

An evaluation of past calibration data for the temperature instrumentation does not support extension of the calibration frequency to support a 24 month operating cycle. Based on operating history, temperature instrumentation drift will most likely result in alarms. Further investigation of these alarms will reveal the need for instrument calibrations. Temperature instrumentation is capable of being calibrated while the unit is at power. As such, the calibration frequency of 18 months is not cycle length or refueling outage dependant. Therefore, keeping this calibration on an 18 month frequency will not be a burden on plant operation or plant personnel.
An evaluation of past calibration data for the sodium pentaborate tank level instrumentation does not support extension of the calibration frequency to support a 24 month operating cycle. Based on past operating history, level instrument drift problems will most likely result in alarms which will alert plant personnel to verify the actual tank level. The level instruments are capable of being calibrated while the unit is at power. As such, the calibration frequency of 18 months is not cycle length or refueling outage dependent. Therefore, keeping the level calibration on an 18 month frequency will not be a burden on plant operation or plant personnel.

Conclusion SR 4.4.C.3
Based on the discussion above, the temperature and level calibration required by Specification 4.4.C.3 shall remain on an 18 month frequency.

Technical Specification Surveillance 4.4.C.4 (Current Specification 4.4.C.3.b)
This surveillance requires that the enrichment of the B-10 (in atom percent) in the sodium pentaborate solution be checked once per operating cycle. The minimum enrichment is 34.7 atom percent of B-10. The SLC boron concentration is checked by chemical analysis monthly, any time water or enriched sodium pentaborate is added, or if the solution temperature drops below Technical Specification limits. Once the solution is prepared in the tank, the concentration of boron will not lower unless more boron or water is added. Level indications and alarms are used to detect whether the solution volume has changed, which might be indicative of a solution concentration change. Boron enrichment in atom % will not vary with the addition of enriched sodium pentaborate material or water to the SLC tank provided that 34.7% enriched (B-10 Atom%) is added. Therefore, the check of boron enrichment in atom % is not affected by the longer operating cycle.

Conclusion SR 4.4.C.4
Based on the above information, the once per operating cycle check of boron enrichment in atom % can safely be extended to support a 24 month operating cycle.

ATWS Rule (10 CFR 50.62(c)(4)) Commitments
The commitments regarding conformance of the SLC system to the ATWS rule were reviewed to ensure the increased surveillance interval of 24 months would not invalidate those commitments. The ATWS rule requires that the SLC system have a minimum equivalent control capacity of 86 gallons per minute (gpm) of 13 weight percent sodium pentaborate solution. This equivalent control capacity is met by increasing boron-10 enrichment to 34.7 atom percent and taking credit for a 50 gpm pumping capacity of the SLC pumps. The final in-vessel boron concentration following injection of SLC solution was increased from 600 ppm of natural boron to 660 ppm of equivalent natural boron. This additional margin was used to permit increases in core reload enrichment and energy content in future reload core designs.

The proposed changes to Technical Specifications do not change the commitments related to the minimum equivalent control capacity of the SLC system because boron-10 enrichment will continue to be maintained at the minimum required enrichment. The capacity of the SLC pumps is verified once per month to be $\geq$ 50 gpm, therefore this commitment is not affected by the longer operating cycle. The affect of the longer operating cycle on the 660 ppm acceptance criteria has been evaluated by General Electric. The evaluation shows that 660 ppm is adequate to shutdown the reactor for an equilibrium, uprated core loaded for a 24 month cycle (Reference 2). Therefore, the proposed increase in surveillance frequency will not adversely affect the final in-vessel boron concentration following injection of the SLC solution.

IV. EVALUATION OF NO SIGNIFICANT HAZARDS CONSIDERATION

Operation of the FitzPatrick plant in accordance with the proposed Amendment would not involve a significant hazards consideration as defined in 10 CFR 50.92 since it would not:

1. involve a significant increase in the probability or consequences of an accident previously evaluated.

The proposed changes do not involve any physical changes to the plant, do not alter any SLC system functions, and will not degrade the performance of the SLC system. The type of testing and the corrective actions required if the subject SLC surveillances fail remain the same. The proposed changes do not adversely affect the availability of the SLC system or the ability of the system to bring the reactor from full power to a cold shutdown condition in the unlikely event that control rods cannot be inserted. A historical review of SLC surveillance test results indicated that there was no evidence of any failures that would invalidate the above conclusions.

2. create the possibility of a new or different kind of accident from any accident previously evaluated.

The proposed changes do not introduce any failure mechanisms of a different type than those previously evaluated since there are no physical changes being made to the facility. No changes are proposed to the type and method of testing performed, only to the length of the surveillance interval. Past equipment performance and on-line testing indicate the longer test intervals will not degrade SLC equipment. A historical review of surveillance test results indicated that there was no evidence of any failures that would invalidate the above conclusions.

3. involve a significant reduction in a margin of safety.

Although the proposed changes will result in an increase in the interval between surveillance tests, the impact on system reliability is minimal. This is based on more frequent on-line testing of major system components and the redundant design of the SLC system. A review of past SLC surveillance history has shown no evidence of failures that would significantly impact the reliability of the SLC system. The longer testing intervals do not significantly impact the SLC safety margins for SLC normal operation, operation with inoperable components, or sodium pentaborate solution as described in the bases of the Technical Specifications. Operation of the plant remains unchanged by the proposed SLC surveillance interval extensions. The assumptions in the Plant Licensing Basis are not impacted. Therefore, the proposed changes do not result in a significant reduction in the margin of safety.

V. IMPLEMENTATION OF THE PROPOSED CHANGE

Implementation of the proposed changes will not adversely affect the ALARA or Fire Protection Programs at the FitzPatrick plant, nor will the changes affect the environment.

VI. CONCLUSION

Based on the discussions above, the SLC surveillance tests in Specifications 4.4.A.2, 4.4.A.3, and 4.4.C.4 can be safely extended to accommodate a 24 month operating cycle. However, the SLC system temperature and level instrument calibration requirements of Specification 4.4.C.3 will remain on an 18 month frequency.

The assumptions in the Fitzpatrick licensing basis are not invalidated by performing the SLC surveillances at the bounding interval limits (30 months) to accommodate the 24 month operating cycle. The extended operating cycle does not adversely affect the commitments regarding conformance with the ATWS rule.

The Plant Operating Review Committee (PORC) and the Safety Review Committee (SRC) have reviewed these proposed changes to the Technical Specifications and have concluded that they do not involve an unreviewed safety question, or a significant hazards consideration, and will not endanger the health and safety of the public.

VII. REFERENCES

1. Generic Letter 91-04, "Changes in Technical Specification Surveillance Intervals to Accommodate 24-Month Fuel Cycle," dated April 2, 1991.

2. NYPA Report No. JAF-RPT-SLC-00336 Revision 2, "Standby Liquid Control (SLC) Surveillance Extensions," dated November 16, 1995.

ATTACHMENT III to JPN-95-051

Markup of the current Technical Specification pages
Extension of Standby Liquid Control System Surveillance Test Intervals to Accommodate 24-Month Operating Cycles (JPTS-95-001H)

New York Power Authority

JAMES A. FITZPATRICK NUCLEAR POWER PLANT
Docket No. 50-333
DPR-59

3.4 LIMITING CONDITIONS FOR OPERATION

3.4 STANDBY LIQUID CONTROL SYSTEM

Applicability:

Applies to the operating status of the Standby Liquid Control System.

Objective:

To assure the availability of a system with the capability to shut down the reactor and maintain the shutdown condition without control rods.

Specifications

A. Normal Operation

During periods when fuel is in the reactor and prior to startup from a cold condition, the Standby Liquid Control System shall be operable except as specified in 3.4.B below. This system need not be operable when the reactor is in the cold condition, all rods are fully inserted and Specification 3.3.A is met.

4.4 SURVEILLANCE REQUIREMENTS

4.4 STANDBY LIQUID CONTROL SYSTEM

Applicability:

Applies to the periodic testing requirements for the Standby Liquid Control System.

Objective

To verify the operability of the Standby Liquid Control System.

Specification:

A. Normal Operation

The operability of the Standby Liquid Control System shall be verified by performance of the following tests:

1. At least once per month -

   Demineralized water shall be recycled to the test tank. Pump minimum flow rate of 50 gpm shall be verified against a system head of ≥ 1,275 psig.

2. At least once during each operating cycle per 24 months -

   Manually initiate the system, except the explosive valves, and Pump solution through the recirculation path.

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4.4 (cont'd)

pump solution in the recirculation path.

Explode one of three primer assemblies manufactured in same batch to verify proper function. Then install the two remaining primer assemblies of the same batch in the explosive valves.

Demineralized water shall be injected into the reactor vessel to test that valves (except explosive valves) not checked by the recirculation test are not clogged.

Test that the setting of the system pressure relief valves is between 1,400 and 1,490 psig.

Once per 24 months

3. Disassemble and inspect one explosive valve so that it can be established that the valve is not clogged. Both valves shall be inspected in the course of two operating cycles. within two test intervals.

B. Operation with Inoperable Components

From and after the date that a redundant component is made or found to be inoperable, Specification 3.4.A shall be considered fulfilled, and continued operation permitted, provided that:

1. The component is returned to an operable condition within 7 days.

B. Operation with Inoperable Components

When a component becomes inoperable its redundant component shall be verified to be operable immediately and daily thereafter.

3.4 (Cont'd)

C. Sodium Pentaborate Solution

The standby liquid control solution tank shall contain a boron bearing solution with a minimum enrichment of 34.7 atom percent of B-10 that satisfies the volume-concentration requirements of Fig. 3.4-1 at all times when the Standby Liquid Control System is required to be operable and the solution temperature including that in the pump suction piping shall not be less than the temperature presented in Fig. 3.4-2. Tank heater and the heat tracing system shall be operable whenever the SLCS is required in order to maintain solution temperature in accordance with Fig. 3.4-2. If these requirements are not met, restore the system to the above limits within eight hours or take action in accordance with Specification 3.4.D.

4.4 (Cont'd)

C. Sodium Pentaborate Solution

The availability of the proper boron bearing solution shall be verified by performance of the following tests:

1. At least once per month -

Boron concentration shall be determined. In addition, the boron concentration shall be determined any time water or enriched sodium pentaborate is added or if the solution temperature drops below the limits specified by Fig. 3.4-2.

2. At least once per day -

Solution volume and the solution temperature shall be checked.

3. At least once per operating cycle - 18 months

a. The temperature and level elements shall be calibrated.

4. Once per 24 months -

b. Enrichment of B-10 (in atom percent) shall be checked.

D. If specifications 3.4.A through C are not met, the reactor shall be in at least hot shutdown within the following 12 hours.

D. Not Used

Amendment No. 116, 192

ATWS requirements are satisfied at all concentrations above 10 weight percent for a minimum enrichment of 34.7 atom percent of B-10.

Figure 3.4-1 shows the permissible region of operation on a sodium pentaborate solution volume versus concentration graph. This curve was developed for 34.7% enriched B-10 and a pumping rate of 50 gpm. Each point on this curve provides a minimum of 660 ppm of equivalent natural boron in the reactor vessel upon injection of SLC solution. At a solution volume of 2200 gallons, a weight concentration of 13% sodium pentaborate, enriched to 34.7% boron-10 is needed to meet shutdown requirements. The maximum storage volume of the solution is 4780 gallons which is the net overflow volume in the SLC tank.

Boron concentration, isotopic enrichment of boron-10, solution temperature, and volume are checked on a frequency adequate to assure a high reliability of operation of the system should it every be required. Experience with pump operability indicates that monthly testing is adequate to detect if failures have occurred.

The only practical time to test the Standby Liquid Control System is during a refueling outage and by initiation from local stations. Components of the system are checked periodically as described above and make a functional test of the entire system on a frequency of more than once each refueling outage unnecessary. A test of explosive charges from one manufacturing batch is made to assure that the charges are satisfactory. A continuous check of the firing circuit continuity is provided by pilot lights in the control room.

every 24 months

The relief valves in the Standby Liquid Control System protect the system piping and positive displacement pumps, which are nominally designed for 1,500 psig, from overpressure. The pressure relief valves discharge back to the standby liquid control pump suction line.

B. Operation with Inoperable Components

Only one of two standby liquid control pumping circuits is needed for operation. If one circuit is inoperable, there is no immediate threat to shutdown capability, and reactor operation may continue during repairs. Assurance that the remaining system will perform its function is obtained by verifying pump operability in the operable circuit at least daily.

C. Sodium Pentaborate Solution

To guard against precipitation, the solution, including that in the pump suction piping, is kept at least 10°F above saturation temperature. Figure 3.4-2 shows the saturation temperature including 10°F margin as a function of sodium pentaborate solution concentration. Tank heater and heat tracing system are provided to assure compliance with this requirement. The set points for the automatic actuation of the tank heater and heat tracing system are established based on the solution concentration. Temperature and liquid level alarms for the system annunciate in the control room. Pump operability is checked on a frequency to assure a high reliability of operation of the system should it ever be required.

Once the solution is prepared, boron concentration does not vary, unless more enriched sodium pentaborate or more water is added. Level indications and alarms indicate whether the solution volume has changed which might indicate a possible solution concentration change. The test interval has been established considering these factors.

Boron enrichment (B-10 atom percent) does not vary with the addition of enriched sodium pentaborate material or water to the SLC tank provided 34.7% enriched (B-10 atom percent) is added. Therefore, a check once per operating cycle is adequate to ensure proper enrichment.

every 24 months