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Licensee: New York Power Authority
P.O. Box 215
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Facility Name: Indian Point Nuclear Power Station, Unit 3

Inspection At: Buchanan, New York

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Areas Inspected: This inspection was performed to review the current surveillance testing of the Safety Injection System, the Auxiliary Feedwater System, the Containment Air Recirculation and Filtering System, and the Safety Related Station Batteries. Surveillance test procedures were compared to design basis safety function requirements delineated in Design Basis Documents, the Updated Final Safety Analysis Report, and the Technical Specifications. The surveillance testing performed on these systems is one measure of their ability to perform satisfactorily, and to provide protection for public health and safety during abnormal plant conditions or events.

Inspection Results: The current surveillance testing performed on these systems adequately demonstrated that the system's design basis safety functions would be fulfilled under accident conditions. The testing was found to be in conformance with Technical Specification requirements. Inspectors identified some concerns related to the testing and control of calibrated instruments installed in the boron injection tank and in the consistency and accuracy of technical details contained in various program documents such as equipment lists and system flow diagrams. No instances were identified where inaccuracies caused required surveillance tests to be missed or performed incorrectly or which invalidated accepted test data. These concerns were presented to the station management for resolution. Overall, the licensee's surveillance test program was found to exceed minimum technical specification requirements in the testing of safety systems and components. The program specified a range of tests which demonstrated the required operability and the ability of these systems to function in a manner which affords protection to public health and safety. However, the adequacy of the full stroke test of the check valve to the safety injection pump suction header could not be fully determined and will remain unresolved pending additional inspection. The reconstituted design bases developed for these systems were a positive initiative that permitted all licensee organizations to achieve a common understanding of the design requirements applicable to plant systems. The resulting Design Basis Documents were found to be valuable reference sources for the design functions of these systems.

EXECUTIVE SUMMARY

This inspection was a pilot project within NRC Region I to perform an in-depth engineering review of the existing surveillance tests performed on selected safety systems. The ability of these safety systems to meet challenging plant conditions is revealed to a large extent by periodic surveillance tests. The inspectors assessed the extent to which design basis functional testing was reflected in the licensee's test program and to which the existing surveillance test procedures demonstrated the ability of safety systems to meet their critical safety functions under design basis conditions. Three inspectors performed this inspection at the New York Power Authority Engineering Offices in White Plains, New York, and at the Indian Point Unit 3 Nuclear Plant in Buchanan, New York, from November 12 - 22, 1991.

The systems reviewed were the Safety Injection System (SIS), the Containment Air Recirculation Cooling and Filtration System, the Auxiliary Feedwater (AFW) System, and the Safety Related Station Batteries. Both the Technical Specification (TS) required surveillances and the non-Technical Specification testing for these systems and components were examined to define the overall scope of periodic tests and to compare the acceptance criteria and test results with the specifications contained in design related documents such as "Design Basis Documents" (DBDs), the Updated Final Safety Analysis Report (UFSAR), and Equipment Specifications developed by manufacturers and the original plant design and construction contractors. An effort was made to examine all of these documents in an item-by-item comparison of the current requirements in each of the critical functional areas. The matrix charts contained in Attachments A, B, C, and D were developed for this purpose.

The inspection centered upon the major thermal-hydraulic, mechanical, and electrical parameters such as total fluid flow, pump head and differential pressure, net positive suction head, heat exchanger efficiency, MOV stroke times, and battery voltage, which characterize the overall performance of systems and their major components. No effort was made to review surveillance testing of system actuation circuits, to cover the systems' total (i.e., safety and normal) functional design bases, or to assess the adequacy of the surveillance requirements contained in the Technical Specifications. It was also not the intent here to conduct a surveillance test "program review." The inspectors reviewed test program areas which required confirmation of design basis functions. A detailed review of test procedures was performed which included procedures designed to test and calibrate the installed instrumentation used to obtain official test data. The recently reconstituted design basis for the SIS, AFW, the Station Batteries, and the Service Water System, were used as foundation documents for design safety functions. The UFSAR and other design-related documents were also used as a basis for design specifications and they were examined for consistency with other test program documents.

Overall, the inspectors found that the periodic surveillance tests currently performed on these systems exceeded the minimum required testing specified by the Technical Specifications. In addition, surveillance testing generally extended to cover testing of many functional parameters which were not explicitly defined or required to determine system operability as defined by the TS. Test procedures that were used for operability determinations contained acceptance criteria which closely reflected the operability requirements stated in the TS. Although system operability requirements in the TS were somewhat general, the test program prescribed sufficient system testing to ensure that critical parameters which support the overall safety functions were adequately demonstrated. In general, inspectors found that extrapolation of test results to the design basis conditions could be made with confidence and with adequate engineering justification where necessary. However, one area relating to the adequacy of full flow/full stroke testing of A SIS pump suction check valve was not fully determined and remains unresolved.

Some minor exceptions to these general findings were observed and are detailed in the report; however, in no case did they appear to compromise the ability of safety systems to meet design function requirements. Program problems were found, for example, in the control of calibration of the temperature indicator controller in the BIT heaters and in the consistency and accuracy of some technical information contained in program level documents such as major equipment lists and specification sheets and the licensee's electronic work control program database. The licensee did not maintain a detailed and formal set of "Piping & Instrumentation Drawings." Some of the system flow diagrams in use contained out-of-date or inaccurate information. Some procedure and equipment lists in use were also found to be out-of-date. However, in these areas, no specific cases were found which impacted negatively on control of system configuration, upon the proper determination of system operability, or upon the acceptability of TS required test data.

The licensee's ongoing reconstituted design basis for major plant systems was seen as a positive effort which assisted all technical and operational organizations to achieve a common understanding of the functional bases upon which the performance of safety systems are judged. The DBD effort was also accompanied by a significant parallel effort to revise the UFSAR with accurate details which incorporated all system modifications performed since original construction.

DETAILS

1.0 Introduction

1.1 Persons Contacted

See Attachment E

1.2 Background

Although required Technical Specification (TS)[1] surveillance tests are performed on safety systems in nuclear power plants, the systems are not routinely tested to an extent that demonstrates their capability to satisfy design basis safety function requirements. In these cases, the surveillance tests do not measure full system performance capabilities although they may achieve the specific TS acceptance criteria required for operability. Sometimes the tests are inadequate, although on the surface they appear to achieve the desired results. At other times, the TS may not require tests which fully demonstrate the system's overall functional ability to respond to severe transient or accident conditions. In addition, licensees often do not upgrade TS tests to meet challenging conditions. There have been some examples of inadequate systems and tests in recent years among Region I plants. Some were evident from reviews of safety system performance during significant plant transients (e.g., degradation of service water flow following a loss of offsite power). Other concerns have resulted from comparisons of surveillance tests with design basis requirements, e.g., during Safety System Functional Inspections.

Inherent limitations often exist because integrated system testing cannot be performed when the plant is at normal operating temperature and pressure. Therefore, test results must often be extrapolated to accident or transient conditions. Also, many tests are not performed as integrated system tests with the various system configurations or alignments they would automatically assume in response to an abnormal event. Systems which have degraded from their original design condition can mask certain functional parameters if testing is not broad or thorough enough to measure system performance adequately or to derive a justifiable conclusion on a system's capabilities to meet design conditions. This inspection examined four safety systems in depth in order to determine that safety functions were adequately demonstrated by testing.

1.3 Organization of this Report

This report is divided into two major sections. First, the text portion provides an overview of the licensee's engineering and test programs related to the

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[1]Attachment G provides a table of acronyms and abbreviations used in this report.

systems reviewed and briefly describes the system design safety functions. The report contains the inspectors' evaluations of the extent to which the safety functions were reflected in the test program documents and the adequacy of specific surveillance test procedures.

The second part, the matrix charts presented in Attachments A, B, C, and D, provide more detailed system descriptions with engineering design specifications and technical information related to their safety functions and their principle active components. The charts can be used for a one-by-one comparison of the specific content of design level documents with the specific Technical Specification and test procedure requirements relating to each safety function. Each matrix permits a detailed review of how the defined safety functions are translated into operational requirements and surveillance test acceptance criteria. The charts vary somewhat in the way they represent safety functions; however, each system is represented in a manner suitable to the description of its design basis and the test procedures applicable to it. Brief results of recent system testing are also provided in the matrix charts.

1.4 Inspection Scope

This inspection was designed to review the critical functional parameters of active mechanical and electrical system components (motors, pumps, valves, fans, heat exchangers, etc.) for four safety systems at the Indian Point 3 Nuclear Plant. The Safety Injection System, the Containment Air Recirculation Cooling and Filtration System, the Auxiliary Feedwater System, and the Station Safety Related Batteries were reviewed to compare their design basis safety requirements to acceptance criteria and actual test data in both TS and non-TS surveillance tests. Testing of electrical power supplies and system actuation and control circuits were not reviewed in this inspection. The reviews conducted focused upon system tests involving major active components such as pumps, valves, and instrumentation, which perform specific safety functions. Parameters such as pump flow, differential pressure, net positive suction head, and heat exchanger efficiency, normally associated directly with safety functions defined in the design basis for the system, were reviewed. Other parameters such as pump run times, valve stroke times, motor horse power, and containment isolation were also examined because they directly affect a system's or component's ability to meet thermal-hydraulic, mechanical, or electrical design requirements. MOVATS testing of motorized valve actuators was outside the scope of this inspection. Valve stroke times normally checked during ASME Code Section XI periodic tests were included.

Many design functions are not amenable to periodic surveillance testing during normal plant operations. Many functional parameters cannot be obtained under simulated accident conditions. Therefore, the test data for active components taken under specified test conditions often have to be extrapolated to conclude that the systems and their components would perform as designed under accident conditions. Many surveillance test acceptance criteria were specified to closely match the normal function of the system. For example, some safety system pumps, which fall under the ASME Code Section XI requirements, are tested at "normal" system conditions. The test data are then related to a pump performance curve which requires an extrapolation to accident conditions. This method of data analysis is a generally accepted industry practice. Likewise, leak testing can be performed below normal operating pressure, but the data must be properly corrected to obtain accurate leakage information for higher pressures.

The inspectors did not attempt to define the entire functional design bases for these systems. The licensee's reconstituted Design Basis Documentation (DBD) was used as the foundation for critical safety functions and is represented here as it existed during the inspection. The existing design basis documents, i.e., DBDs, Updated Final Safety Analysis Report (UFSAR), manufacturers equipment specifications, etc., were assumed to be the valid engineering bases for the safety functions of these systems.

1.5 IP-3 Surveillance Test Program

The existing test program requirements were specified in Administrative Procedure AP-19, "Surveillance Test Program," which defined the management controls and the administrative responsibilities for the conduct of testing. The Performance and Reliability (P&R) group in the Technical Services Department held primary responsibility for the overall test program and performed surveillance tests. These responsibilities included writing test procedures, writing calibration procedures for instruments used for TS operability determinations, participating in the performance of tests, and conducting engineering reviews of test data. The P&R group was also involved in the resolution of test discrepancies to ensure that TS operability criteria were met. The P&R group was also responsible for ensuring that surveillance tests satisfied the safety function requirements defined in the design bases of plant systems. The Technical Services Department recently initiated a system engineer program which will eventually assume some responsibilities currently undertaken by the P&R group. Two system engineers have been assigned in this area, and this program was just in its early development.

The P&R group performed calibrations of special test equipment used in the place of installed plant equipment when a high level of accuracy was desired. Although all installed system process instruments (i.e., flow, pressure, temperature, etc.) were required by design to have an accuracy of $\pm 2\%$, many system surveillance tests necessitated the use of test instruments of greater accuracy for recording test data. These instruments were not maintained as part of the licensee's controlled Measuring and Test Equipment (M&TE) program; however, appropriate controls were in place to ensure that proper calibrations were performed prior to each use and that the instrument serial numbers were recorded in the test procedure.

Some testing was performed as necessary on a nonperiodic basis. These special tests were developed and written by the Technical Services Department groups who had needs for specialized data on system or component performance under specified conditions. These tests were often performed, in part, to obtain detailed data related to the performance of components under simulated abnormal or accident conditions. In some cases, these tests clearly stated that their purpose was to demonstrate the operability of a component under accident conditions (e.g., valve strokes under actual d/p conditions present during a Loss of Coolant Accident (LOCA). Some examples were found where the acceptance criteria contained within procedures of this type did not closely match the stated purpose of the test. These inconsistencies were highlighted as a concern to the Technical Services Department managers and supervisors because of the potential for misapplication of test procedures which may not fulfill their stated purpose or where unnecessary plant conditions may need to be established in order to obtain test data. The licensee acknowledged that inconsistency between a procedure's stated purpose and its specified acceptance criteria was inappropriate for such specialized test procedures.

1.6 <u>Instrumentation and Control (I&C) Surveillance Program</u>

The licensee's I&C department also performed surveillance tests on instrumentation associated with plant safety systems. However, their main role in surveillance testing was the actual performance of all calibrations on instrumentation and control circuits in the plant. The I&C department also maintained and performed calibration procedures for installed plant instruments which were not used for TS operability determinations. The inspectors noted some incongruities between calibration procedures written by I&C versus those written by the P&R group. However, the I&C group had a procedure upgrade in progress which was standardizing procedure format and improving the level of detail for instructions and acceptance criteria in these procedures. The inspectors discussed the potential problems that may exist in separating the calibration program for plant instruments between two major plant departments.

The I&C department also was putting calibration scheduling and tracking activities into an electronic work control database. This effort had been underway for several months in the I&C department and was proceeding in parallel with the entry of recently completed calibration data. The older "manual" list for scheduling calibration tests was rapidly falling out of date because more recently accomplished calibrations were being entered into the newer database. One instance was noted where the performance of a calibration for a temperature indicator controller for the boron injection tank was not completed due to a maintenance condition; however, the calibration had been entered into the new database as having been successfully completed. The next due date was then incorrectly established by the computer. This example appeared to be isolated after a review of other system instrument calibrations. Additional detail is described in paragraph 2.4 below.

2.0 Safety Injection System (SIS)

2.1 Purpose

This inspection reviewed the subsystems of the SIS which provide the active high head safety injection (HHSI) and the passive low head safety injection (LHSI) functions, i.e., safety injection accomplished by the HHSI pumps and associated piping and by the LHSI accumulators. A system description and diagram are provided in Attachment A.

2.2 SIS Design Basis and Safety Functions

As an engineered safety feature (ESF), the SIS was designed to protect against and mitigate the consequences of design basis accidents (e.g., a loss of coolant accident) by providing emergency cooling water to the reactor vessel during blowdown following a large rupture before the RCS is fully depressurized and the core is uncovered; or following a small rupture to control the reduction in reactor coolant system (RCS) pressure and temperature. The SIS assures that the core will remain intact and in place with its essential heat transfer geometry preserved following a rupture in the RCS. It also limits the extent of the cladding metal-water reaction so that the amount of hydrogen generated inside containment is tolerable.

By design, the SIS is capable of supplying the required volume and flow rate, and the necessary reactivity shutdown margin in the event of a loss of coolant accident (LOCA), a steam generator tube rupture (SGTR), or a main steam line break (MSLB). For a LOCA, the SIS maintains the core flooded or rapidly re-floods the reactor vessel if the core is uncovered. To achieve a high flow rate, the accumulators and two HHSI pumps provide minimum initial injection flow to the RCS during a large break LOCA. For small break LOCAs, SI flow is delivered by two HHSI pumps and the LHSI accumulators if RCS pressure drops to 660 psig. Flooding the core limits the fuel-cladding temperature increase due to decay heat and maintains core integrity.

Following a SGTR, at least two HHSI pumps deliver water to refill the pressurizer. The pumps maintain RCS inventory and provide sufficient shutdown margin to the reactor. Following a MSLB, the SIS will arrest an excursion in reactor power and the rapid introduction of negative reactivity from the boron injection tank (BIT) prevents the reactor from returning to power.

The inspectors categorized the critical safety functions of the SIS in several functional areas which are detailed in the matrix charts in Attachment A. These functions were those which provide the accident mitigating capabilities of the SIS, and those which protect the integrity of the SIS and ensure that its accident functions will be fulfilled. For example, the SIS accumulators were designed to contain sufficient nitrogen pressure to achieve rapid injection of their contents to the core. However, the accumulators' safety relief valves also provide a critical safety function because they protect the accumulators from an overpressure condition which could disable them and prevent a rapid delivery of their contents. The major functions described in Attachment A are as follows:

1. Availability of SIS flow paths to the RCS
2. Adequate HHSI pump and accumulator flow rates
3. Adequate NPSH to the HHSI pumps
4. Operational readiness of system MOVs
5. Full flow capability of system check valves
6. Leak tightness of SIS/RCS high pressure boundary check valves
7. Adequate nitrogen pressure in the accumulators
8. Minimum water volume available in the accumulators, the RWST, and the BIT
9. Accumulator, RWST, and BIT minimum boron concentrations
10. Accuracy of essential SIS instrumentation
11. SIS overpressure protection
12. Isolation of the injection flow paths to RCS hot legs

2.3 DBD, UFSAR, and TS Contents

In August 1991, the licensee issued the initial Design Basis Document (DBD) for the Safety Injection System. This document was a joint effort of the licensee, the original NSSS vendor (Westinghouse), and the original plant construction contractor (United Engineers & Constructors). The DBD was comprehensive in scope and provided a detailed description of the current design specifications related to the safety injection system and the functional requirements that the system was designed to meet. The DBD provided design basis information for all safety functions of the SIS and reflected the effects of modifications performed on the system since the original design. The design reconstitution process created some design issues, such as the correct basis and analysis for flow balancing in the injection header branch lines, which have developed from on-going reviews of original startup tests. These issues were formally identified and their resolution was being tracked by the licensee.

The DBD was not intended to specify how critical safety functions could be satisfactorily tested. It made reference to past testing which was performed to verify system original design characteristics (e.g., startup test verifications) and it did describe specific design features provided to permit testing of active components during plant operations. Aside from stating the mandatory requirements for testing in accordance with ASME Section XI, the DBDs did not identify what periodic testing or methodology would be acceptable to satisfy specific design criteria related to system performance under accident conditions. Therefore, the inspector used the DBD as a foundation document for defining the current design bases for SIS system safety functions. The inspectors considered that these bases were adequately validated in the formal engineering processes involved in the design basis reconstitution for which the DBDs were written. The licensee will benefit from the DBD in that it provided detailed functional parameters which could be easily translated into surveillance test acceptance criteria.

The Updated Facility Safety Analysis Report (UFSAR) sections describing the SIS contained references to the original 10 CFR 50 General Design Criteria (GDC) applicable to the system. Explicit statements were presented in the UFSAR which described capabilities designed into the SIS to demonstrate GDC requirements that design basis functions be testable. The UFSAR made specific references to the "testing of design capabilities," and also to other testing done to confirm design safety functions which were accomplished after the original FSAR was written.

The Technical Specifications (TS) for IP-3 were "customized" in format and tended to emphasize general system operability requirements. The sections which addressed Engineered Safeguard Features defined certain primary plant conditions which must not be exceeded unless the major SIS components are "operable" (e.g., RWST water level, BIT boron concentration, MOV power deenergized, etc., whenever RCS T-ave was above some value). The current TS definition of operability was "Properly installed in the system and capable of performing the intended functions in the intended manner as verified by testing..." Although not stated in the TS definition, the inspectors inferred that "intended" referred to the functions and manners prescribed in the current design basis. The TS surveillance requirements also specified plant conditions which shall not be exceeded until system testing has been performed to demonstrate "operability." Some specific tests with acceptance criteria were described in the TS, such as specific check valves which must be leak tested, various pumps start intervals, and appropriate breakers which must be tested for proper actuation. However, many of the specified acceptance tests have general requirements stated such as "the appropriate pump breakers shall have opened and closed and appropriate valves shall have completed their travel." In most cases, detailed acceptance criteria, or the specific components required to be tested for system operability were not detailed in the TS. The determinations of which components were applicable and precisely what were the test acceptance criteria for operability were generally specified in the surveillance procedure. No sections in the TS were otherwise found to make explicit reference to the design basis functional requirements of the SIS. However, certain tests which were specified (e.g., RCS boundary check valve leak tests) were clearly prescribed to confirm the adequacy of design basis safety functions. The TS basis section for surveillance testing requirements indicated that the purpose of the surveillance testing was to identify conditions in the plant that would lead to a degradation of reactor safety, but there was no other detailed reference to satisfying design basis functional requirements in the TS.

2.4 Surveillance Testing

The existing surveillance testing of the injection function of the safety injection system was provided by a series of test procedures designed primarily to satisfy the general system operability requirements prescribed by the TS for normal plant operations. Further, most of the SIS active components (pumps, MOVs, check valves, etc.) are subjected to the periodic testing requirement prescribed by ASME Section XI (IWP-3000 and IWV-3000, 1983 version). The safety functions defined in paragraph 2.2 above are not necessarily identical to the system functions described in the DBD, the UFSAR, or the TS; however, they provide a convenient way to group the functions of the major active components and for describing the surveillance tests which verify that these functions can be achieved.

This inspection was designed to review the larger system parameters, which, when tested, confirm the SIS capability to meet its design safety functions. To assure continued reliability, the SIS was designed to be tested during plant operations; and, consequently, features were provided in the design to make this possible. For example, leakoff drain lines are permanently installed upstream of SIS/RCS high pressure boundary valves to permit leak testing, and a test flow line is installed near the SIS injection header to permit pump testing without injecting water to the RCS. Certain tests, however, cannot be performed during plant operations since plant conditions are not appropriate or because too much of the SIS would have to be made inoperable when it is required to be available. For example, the test performed to demonstrate that the SIS responds properly to an SI actuation signal requires too much of the system to be disabled to permit this test to be conducted at power. Overall, the inspector considered that the proper distinctions had been made by the licensee in determining which SIS surveillance tests should be performed while shut down or while at power.

The SIS is normally configured so that a minimum number of component actions are required to accomplish injection flow to the RCS. For the non-BIT flow path, only the start of the HHSI pumps and the opening of system check valves is necessary. For the BIT flow path, 6 MOVs must reposition in addition to pump starts and check valves opening. In the accumulator flow path, check valve operation is the only action required. However, since the system can be temporarily out of its normal configuration for automatic injection, all other active components in the SIS (primarily MOVs) must also be tested to verify that the proper flow paths can be made available to meet the minimum injection flow delivery times assumed in the plant's safety analysis. Consequently, all MOVs in the SIS injection flow paths are stroke tested periodically to verify that they meet their maximum cycle times defined by the IST program. In addition, MOVs in the injection header branch lines are normally set to a predetermined throttled position required for correct flow balancing in the header. During cold shutdown conditions, the licensee conducts testing to confirm that these valves are in their correct positions and that they return to their correct positions when cycled. Confirmation of the availability of the injection flow paths also requires testing of system check valves to demonstrate their full stroke or full flow capability. The licensee performs surveillance tests for full stroke testing of all SIS (ASME Section XI, Category A) check valves required to open and pass flow during safety injection. Overall, this testing was determined to adequately demonstrate that these valves could meet their design flow requirements. However, inspectors expressed concerns about the test performed to demonstrate flows through the HHSI pump suction header check valve 847. This valve was tested as part of the "High Head Safety Injection Check Valves," which is performed each refueling to demonstrate the full flow capability of all injection branch line check valves (857s) in the non-BIT header and the #31 and #32 pump discharge (849A & 852A) and suction (847) valves. The test also determined that branch line flows were adequately balanced under pump runout conditions and verified adequate pump performance. Each pump was run individually at runout flow, and the individual flows through the branch lines were measured to ensure that the flow balance provided adequate flow in each line (≥100 gpm). This also demonstrated the full flow capability of all branch line check valves. The total pump flow demonstrated the full flow capability of the pump discharge check valves and the acceptance criteria for this test indicated that ≥650 gpm was adequate for the full flow capability of the HHSI pump suction header check valve (847) when the #31 pump was operating at runout. However, the DBD for the SIS indicated that two 50% capacity pumps must be capable of providing 918 gpm at O psig RCS pressure. Since all of the water provided to the HHSI pump suction header passes through valve 847, the inspectors considered that the full flow capability of this valve was not actually demonstrated by this test. In order to meet the ASME, Section XI, requirements for "full flow" in check valves, IP-3 has, in some cases, performed x-ray testing to confirm that valves are stroking full open when no other means of confirming position are available. Many check valves in the SIS have been shown to be full open at less than "full flow" conditions using x-ray testing. However, the licensee was not able to demonstrate that this method had ever been applied to the 847 valve. The P&R group indicated that tentative plans have been made to initiate multiple HHSI pump testing during future refueling outages which would provide direct verification of full flow capability in valve 847. Without current evidence of the full stroke or full flow required by ASME, Section XI, or confirmation of design basis minimum flow, the adequacy of this test for the 847 valve was not fully determined. This item is unresolved (URI 50-286/91-21-01).

The adequacy of HHSI pumps' delivery of the required injection flows was also tested on a monthly basis in accordance with the IST program. These requirements were primarily described in the UFSAR; however, additional performance parameters stipulated by ASME, Section XI, such as suction pressure, discharge head, and pump d/p were appropriately contained in these procedures. The test data obtained were used to compare minimum pump performance characteristics provided by pump vendors curves (degraded by 5%). The inspector verified that pump test data was consistent with the performance requirements contained in the DBD. Pump flow tests also included testing the adequacy of recirculation minimum flow required to ensure that the pumps could operate for a specified minimum time without overheating.

Accumulator discharge flow rates were tested by a surveillance procedure each refueling outage to measure and plot the flow rate over time. The resulting flow profile was used to determine that the total volume of water delivered would meet the minimum volume and delivery time assumed in the plant's safety analysis. This test also accomplished the full stroke/flow of the accumulator discharge check valves and operated the isolation MOVs to test their stroke times. In addition, the test provided assurance that the accumulator discharge line functioned properly under the specified N_2 blanket pressure maintained as a motive force to accelerate discharge flow.

Various SIS/RCS high pressure boundary valves provide protection to the SIS by preventing backleakage from the RCS which operates at several hundred pounds above SIS design pressure. These boundary valves were tested by detailed surveillance procedures which recorded leakage rates to the 1/100th gpm to verify that the valves met their design leakage maximums and to verify that total RCS leakage did not exceed the maximum permitted by the TS. Backup overpressure protection in the SIS was provided by three relief valves installed at various locations which ensure that all SIS piping is protected. These valves were subjected to IST program requirements for periodic setpoint testing and readjustment to system design pressures. All SIS relief valves were maintained on a testing schedule which ensured that their setpoints were tested and readjusted at least once every 5 years.

Since the SIS DBD was only recently completed and the system engineer program not yet fully developed, sufficient time had not passed for the P&R group to complete a full and detailed review of DBD functional requirements so that, where appropriate, they could be explicitly incorporated into surveillance procedure acceptance criteria. In most cases, the inspector considered the existing procedure requirements and acceptance criteria together were adequate to demonstrate that DBD functional requirements were being met. However, test acceptance criteria were sometimes noted to lack specificity or did not always provide an acceptable range of tolerances for test data. For example, some pump test procedures required test personnel to ensure that lube oil level or pump recirc flow was "proper" without any specification for what was acceptable. Some check valve leak tests were considered adequate if the total valve leakage was "negligible" without any clear specification for what was or was not acceptable. Lack of specificity in some test acceptance criteria appeared related somewhat to the customized and general operability requirements contained in the TS. However, no cases were observed where test procedures did not adequately test the design basis functions specified for the SIS. P&R supervisory personnel agreed to examine test instructions and acceptance criteria in existing procedures and to make appropriate enhancements. The inspector considered that, as the system engineer program develops and the DBDs are more widely used by plant organizations, test procedures will improve in consistency and specificity to reflect explicit design basis specifications.

2.5 Calibration of SIS Instrumentation

Although the temperatures and volumes of water contained in the large SIS vessels (RWST, BIT, and accumulators) are specified by TS operability requirements, they are not verified by the typical periodic surveillance testing. During normal plant operations, water temperature and volumes are verified on a frequent basis (each shift) by the observation of installed instrumentation. In addition, minimum water levels are also assured through the use of built-in alarms which alert operators to these conditions. The instrumentation used to monitor and test these system parameters is required to be accurate and within the required time limit for valid calibration. The inspector reviewed the calibration procedures for level and temperature instruments on these large vessels to verify that the calibrations were appropriate to the parameter if monitored (for example, $\pm 2\%$ accuracy for the RWST level instrument). The current status of these calibrations was also reviewed and found to be within the specified valid time period with the exception of the primary temperature controller for the BIT.

Calibration of the BIT primary temperature controller (TIC-918) is performed on a 2-year cycle in accordance with I&C procedure IC-PM-T-918. The last test results obtained when this calibration was performed (3/7/91) indicated that the calibration was not performed because the thermocouple portion of TIC-918 could not be removed from its instrument well in the BIT. A maintenance work request was written to correct this condition; however, the work was scheduled for the next refueling outage to allow the work to be done when the BIT was cold. TIC-918 was not a plant instrument listed in the TSs; and, therefore, a near term TS operability question was not involved. However, the status control system used by the I&C Department for tracking calibrations on safety-related instruments showed the TIC-918 calibration complete as of the 3/7/91 date and that the next calibration would not be due for at least another 2 years. I&C personnel indicated that the status tracking system was relatively new and that this error occurred when the calibration procedure was returned for administrative closeout. The inspector reviewed the status of calibrations on all of the SIS instruments in the calibration program; no other incorrect entries were found. The BIT temperature control was being maintained via the backup controller and heater bank at the time of this inspection. The incorrect status of the TIC-918 controller was considered to be an isolated instance. The I&C Department corrected the situation immediately.

2.6 Conclusions

With the exception of testing for the full flow capability of the HHSI pump suction check valve (SI-847), surveillance testing of the SIS at IP-3 was adequate to demonstrate its ability to fulfill design basis safety functions. Although design basis requirements did not always appear explicitly in test procedure acceptance criteria, the overall content of test procedures and test results verified that design safety functions were adequately tested. Within the foreseeable future, as the system engineer program is developed and as outstanding issues in the design basis reconstitution program are resolved, SIS surveillance procedures are expected to improve so that acceptance criteria will explicitly represent functional parameters specified in the DBDs.

The recently developed system for status tracking of system instrument calibrations appeared to be susceptible to errors which could improperly indicate the validity of calibration tests. This concern was highlighted to I&C and station management so that this system might be improved to the level of accuracy necessary to assure that the status of calibrations is correct.

3.0 Containment Air Recirculation Cooling and Filtration System

3.1 Purpose

This inspection reviewed the containment heat removal and air filtration functions provided by the Containment Air Recirculation Cooling and Filtration System. This system was designed to recirculate and cool the containment atmosphere in the event of a loss-of-coolant accident to limit containment pressure and temperature within the design values. A brief system description and diagram are provided in Attachment B.

3.2 Design Safety Functions

The Containment Air Recirculation Cooling and Filtration System was designed to recirculate and cool the containment atmosphere in the event of a Loss-of-Coolant Accident and thereby ensure that the containment pressure will not exceed its design value of 47 psig at 271°F (100% relative humidity). Assuming that the core residual heat is released to the containment as steam, any of the following combinations of equipment provide sufficient heat removal capability to maintain the post-accident containment pressure below the design value and reduce containment pressure at a rate consistent with limiting offsite doses to acceptable values within the guidelines of 10 CFR 100: (1) all five containment cooling fans; (2) both containment spray pumps (and one of the two spray valves in the recirculation path), or (3) any three out of the five containment cooling fans and one of the containment spray pumps. As stated in the TS Bases, any one of the three configurations constitutes the minimum safeguards for iodine removal. The closeness to which the combined equipment approaches minimum safeguards varies with the active failure assumed. Only the Containment Air Recirculation Cooling and Filtration System is discussed in this report.

Containment Heat Removal Systems at Indian Point 3 were subject to General Design Criterion No. 38 of 7/11/67 which required in part that the system safety function shall be to rapidly reduce, consistent with the functioning of other associated systems, the containment pressure and temperature following any loss-of-coolant accident and to maintain them at acceptably low levels. By design, suitable redundancy, leak detection, and isolation exist such that, even with consideration for a loss of offsite power, the system safety function can be accomplished, assuming a single failure.

General Design Criterion No. 52 of 7/11/67 was also applicable and required that where an active heat removal system is needed under accident conditions to prevent exceeding containment design pressure, the system shall perform its required function, assuming failure of any single active component. Heat removal capability for the Indian Point 3 containment is provided by two separate, full capacity, ESF systems: the containment air recirculation cooling and filtration system and the containment spray system. Both of these systems were designed to fulfill the design safety function following the failure of a single active component.

3.3 Design Basis Documentation

The Updated Final Safety Analysis Report, Technical Specifications, IP-3 Master Equipment List Data Verification Reports, the Design Basis Document (DBD) for Service Water, and the Vendor Technical Manual for the filtration system were used in compiling the design basis for various components in the containment air cooling and filtration system.

The Master Equipment List Data Verification Reports were used as the primary source of specifications on individual components in the containment cooling and filtration system. This data base was relatively new and was assumed to reflect the as-built component details. In addition, the service water DBD provided an excellent source of detailed information on the design of the service water system and a chronology of the modifications performed on the system. Numerous components in the service water side of containment air cooling and filtration system have been upgraded since the original construction with components constructed of materials better suited to the chemistry of the Hudson River. Following the replacement of the service water pumps in 1989, the service water system was aligned and balanced such that its performance objectives were met for all modes of operation. The FCU Discharge valves were throttled to a fixed position providing equal flow through the FCUs, and the flow was verified adequate to satisfy accident heat removal requirements. The throttled position of the discharge valves is maintained by administratively controlling the valves in a locked throttled position. A local posting on each valve inlet reinforce the position requirements indicated in procedures and checkoff lists.

The Updated Final Safety Analysis Report (UFSAR) provided basic system information and component functional descriptions and was used extensively for the air side information in the absence of a DBD for "Ventilation." Information from the extensive service water and accident analyses were reflected in the UFSAR. The IP-3 Containment Margin Improvement Analysis (WCAP 12269) completed in May 1989 reassessed many of the accident assumptions with the results being reflected in the UFSAR and recent Technical Specifications amendments. All analysis resulted in calculated containment pressures below the design value of 47 psig.

The Technical Specifications for this system also contained some specific design basis information in some areas, such as containment temperature operating ranges, heat detectors operability, and filtration unit efficiencies, but fan cooler unit performance was included only in the TS Section on Design Features.

The safety functions and attributes for the major active and passive components of the system is provided in Attachment B. The categories in which the critical functions were grouped were as follows:

1. Containment heat removal capacity
2. Containment air moisture removal
3. Containment air filtration; removal of fission products
4. Containment air temperature monitoring
5. Service water flow and temperature control
6. FCU system overpressure protection
7. FCU instrumentation accuracy
8. FCU system fire protection
9. Service water radiation detection

3.4 Surveillance Testing

To comply with Technical Specification Requirements (TS 3.3.B.1.b & TS 3.3.F.1) before the reactor is brought above cold shutdown, five fan cooler-charcoal filter units and the two spray pumps, with their associated valves and piping, and three service water pumps on the essential service water header, with associated piping and valves, must be operable. A subsystem/functional description of major surveillances performed is as follows:

Containment Air Temperature

The average of the five environmentally qualified resistance temperature detectors is logged in the control room every 4 hours. Technical Specifications require a temperature check every 24 hours with a minimum of four temperature inputs to the averaging circuit. Operators use the containment temperature indication as input to the manual positioning of the service water discharge valve (TCV-1103) in order to maintain the desired containment temperature.

Containment Air Filtration Units

During each refueling outage, the integrity and operability of the Containment Fan Cooler Unit Filtration Systems are verified through completion of procedure PT-R32B which includes the Technical Specification requirements for filter operability. The test results documented in December 1990 demonstrated that the actual system performance met or exceeded the Technical Specification requirements. For example, the removal efficiency for Methyl Iodine was actually 99% versus 85% per Technical Specifications. The surveillance results were documented, appropriate conversions were made from charcoal testing laboratory results, and the acceptance criteria was confirmed. Therefore, the Technical Specification and test procedure acceptance criteria were successfully satisfied.

During full power operations, four FCU fans are typically in service. Plant technical personnel make periodic containment entries to obtain vibration performance data on the FCUs. Maintenance personnel lubricate and visually inspect each FCU after approximately 2000 hours of fan operation. The surveillance data on vibration is distributed to the operating department. The fan in standby at the time of the inspection was the fan with the highest historical vibration readings.

The fans were verified to be operable from local panels in the switchgear area in May 1991. The fans were automatically loaded successfully onto the diesel generator during the Safety Injection Test performed in December 1990.

Service Water Supply

Since the service water system flow balancing in 1989, the position of the FCU discharge isolation valves (SWN-44s) have been maintained in a predetermined throttled position. As stated in the Service Water DBD, "the position of these throttling valves cannot be altered without evaluating the change in service water system flow distribution." The surveillance on the portion of the service water involving the FCU header is to ensure that the flowrate is not significantly degraded. SW flow was verified to be adequate during the 1989 performance tests when the actual flow lineup was modeled, i.e., the discharge valves were failed open to maximize flow. During the 1990 discharge outage, one FCU heat exchanger was inspected and eddy current tested with no degradation or significant fouling observed. In addition, a flush of the FCUs was performed during the 1990 outage with all FCU discharge flow directed through one FCU for a one hour period.

The licensee recently initiated a pilot heat exchanger performance monitoring program that included the FCU heat exchangers. Data from the pilot program should assist in identifying and localizing system degradation. On a daily basis, an auxiliary operator records the discharge flows through the FCU motor coolers and compares the value to the acceptable normal/accident range. Current plans indicate that 3 motor coolers and 2 FCUs will be inspected during the 8/9 Refueling Outage.

Valves identified as Containment Isolation Valves were exercised, timed and leak tested in accordance with their design bases as detailed in Attachment B.

Radiation Monitoring

Surveillance of the radiation monitoring system was performed by means of a daily channel check of the radiation monitor in accordance with standard Radiological Technical Specification requirements. The water flow through the radiation monitor sample line was logged daily by a floor operator with the acceptable flow range above that necessary for worst case assumed accident temperatures.

3.5 Calibration of System and Test Instruments

Containment Air Temperature

The five environmentally qualified resistance temperature detectors were calibrated during the last refueling outage. Calibration data for the test equipment used was documented in 3PC-R37.

Containment Air Filtration Units

The "calibration" of the HEPA filters and charcoal units depends upon the techniques used by individuals injecting particles of a known size and sample gas into the suction path of the equipment and gathering data at the air discharge to calculate removal efficiencies. IP-3 has on site a full scale generic filter train that has HEPA filters and full scale charcoal beds installed, with the capability to simulate equipment failures. This training mockup is used by plant technical personnel to maintain proficiency and standardize techniques prior to performing these tests since they are infrequently performed. The charcoal sample is sent off-site for the radioiodine penetration and retention test. The laboratory used provided a certificate of conformance that all test procedures and methods are in accordance with applicable standards and guidelines (RDT-M16-1T, ASTM-D-3803, Reg. Guide 1.52, Reg. Guide 1.140, and ANSI N509/510). The charcoal supplier provided a test certificate for the material that included the ignition temperature and the amount of impregnant on the carbon.

Service Water Supply

Procedures detailed in Attachment B were used for the calibration of temperature and flow instrumentation. Inspectors verified that documentation of the serial numbers for test equipment used and their current calibration dates were included in the calibration procedures reviewed.

Radiation Monitoring

Procedures detailed in Attachment B were used for the calibration and calibration checks. Documentation of the test equipment and sources used and current calibration dates were included in the calibration procedures reviewed.

3.6 Conclusions

Since the containment air recirculation cooling portion of this system is normally in service, continuous monitoring of system performance was part of routine operations. This monitoring includes periodic vibration trending, inspection, and lubrication. During the safety injection test (3PT-R3D), the system realigns to the actual accident configuration including loading onto the diesel generators. Efficiency testing of the filtration portion of the system during each refueling outage demonstrated the operability of the filtration flow paths at accident flow rates. One condition not tested was the operation of the system in a high temperature, high humidity condition. Since this is not a practical test, the original equipment qualification testing programs are referenced in Attachment B. System operation from outside the control room was adequately confirmed by surveillance testing. In summary, the surveillance and testing performed simulated the containment air recirculation cooling and filtration system response to accident conditions. Overall, the inspectors concluded that the required scope of testing met or exceeded the Technical Specification requirements and the FSAR testing commitments for this system.

Documentation of the design basis of the service water side of this system was considered to be comprehensive, with the Service Water DBD being the focal point. Documentation of the design basis on the air side was dispersed in various forms; its consolidation is anticipated when the planned Ventilation DBD is completed. The scope of the planned Ventilation DBD included the containment ventilation systems and the necessary heat removal function for containment pressurization events.

The replacement of a significant number of major components in this system since original construction indicated that the licensee had maintained a high performance level in this system and that its critical functions would be fulfilled for overall accident mitigation. Developing and maintaining proficiency in specialized skills used by personnel testing this system was evidenced by the full scale charcoal filtration system training mockup available on site.

4.0 Auxiliary Feedwater (AFW) System

4.1 Purpose

This inspection reviewed the auxiliary feedwater (AFW) system from the condensate storage tank (CST) suction to the discharge of AFW into the main feedwater (MFW) headers just outside the containment penetrations leading to the steam generators (SGs). A system description and diagram are contained in Attachment C.

4.2 Design Safety Functions

The AFW system had a Design Basis Document (DBD) completed in December 1989. This DBD was used by inspectors to determine the AFW system design basis. The DBD presented the general AFW system design basis requirements from the AEC/NRC, Westinghouse, and United Engineers and Constructors. It also provided considerable specific design bases information for AFW system components. The general design safety requirements are:

"In the event of a accident, motor driven AFWPs are automatically initiated to provide auxiliary feedwater to the SGs within 1 minute following an actuation signal. The design basis accidents for which the AFW system provides mitigation and recovery functions are:

Loss of Normal Feedwater (LNF);
Loss of Off-site Power (LOOP) to the Station Auxiliaries;
Loss of Coolant Accidents (LOCAs);
Steam Generator Tube Rupture (SGTR), and
Main Steam Line Breaks (MSLBs).

The AFW system is addressed in the UFSAR as the Steam and Power Conversion System. The design basis statement was that, "One turbine and two motor driven auxiliary feed pumps are provided to ensure that adequate feedwater is supplied to the steam generators for reactor decay heat removal under all circumstances, including loss of power and normal heat sink.

Auxiliary feedwater flow can be accomplished with emergency power sources. Auxiliary feedwater pumps and piping are designed as Class I seismic components." The specific AFW system functional requirements specified in the UFSAR are found in the Attachment C matrix.

Technical Specifications (TS) Section 3.4, Steam and Power Conversion System, contained the majority of AFW system functional requirements. It required that the reactor be below 350°F unless all three of the AFW pumps are operable and that the CST contain over 360,000 gallons of water. In addition, the system piping and valves necessary to deliver CST water and backup water from the city water system must be "operable." One AFW pump can supply sufficient FW to remove decay heat, and on loss of off-site power (LOOP), decay heat will be removed by the turbine driven (TD) or one of two motor driven (MD) AFW pumps.

Another TS section that applies to the AFW system is Section 3.5, Instrumentation Systems. Auto start of MD AFW pumps is specified for two of three level instruments in any SG at low-low level (5%). Automatic start of the TD AFW pump occurs if any two of the four SGs have the two of three low-low level indications. In addition, the tripping of a MFW pump or a safety initiation (SI) signal starts both MD pumps, and a station blackout signal starts the TD pump.

The inspector compared the IP-3 custom TS with NUREG-0452, "Standard Technical Specifications (STS) for Westinghouse PWRs." The STS surveillances require operability demonstrations of AFWPs and valves on 31-day and 18 months frequencies, only. The inspectors identified some differences between IP-3 TS and STS for instrumentation surveillance requirements. The major one was testing to ensure that reactor coolant pump (RCP) undervoltage starts the TD AFWP. Surveillance tests were generally less frequently required by the STS. The inspectors concluded that TS surveillance differences were generally small between IP-3 and STS.

4.3 <u>Surveillance Testing</u>

The matrix in Attachment C provides the design bases - surveillance testing comparisons in detail. Only the identified problems are discussed below.

AFWP operability testing is performed monthly under PT-M20A and M20B, Surveillance and Inservice Test Auxiliary Feed Pump Functional Test. The inspectors identified the following concerns with PT-M20A performed on September 26, 1991.

Inspectors noted that there appeared to be a lack of acceptance criteria for a number of important parameters including pump start times, suction and/or discharge pressures, lube oil conditions, and bearing temperatures. For example, AFWP-32 was considered to be operable if discharge pressure was $\geq$1130 psig for 15 minutes. Pump start time, suction and discharge pressures, and vibration were recorded, but were not requirements for pump operability.

The licensee indicated that some of these parameters were confirmed by other surveillance tests and by other programs. For example, the monitoring of bearing temperature, as a means of predicting bearing failure, is greatly overshadowed by vibration monitoring and analysis which has proven to be sensitive to bearing problems. Nevertheless, the licensee committed to review and incorporate additional acceptance criteria identified by the DBD or other means.

Two cases of component identification conflict were identified in AFW test procedures. First, the check valve identified as CT-29 in the table on Page 19 should be CT-29-2 per Flow Diagram 9321-F-20183. The same mistake appeared on Page 12, Step 3.5.9.2. Second, on Page 6, two recirculation block valve numbers were different from Flow Diagram 9321-F-20193; these were BFD-53 and BFD-62-4. The licensee took note of these errors and initiated corrective actions to eliminate the conflicts.

Test PT-Q20, "Surveillance and Inservice Test Auxiliary Boiler Feed Valves Testing," required Inservice Test (IST) program quarterly operability verification of the SG flow control valves. Inspectors noted some errors in the valve lineup of this procedure as follows: FCV-406A/B controls AFWP-31 flow to SGs 31/32 (SGs 34/32 per DBD Figure 1.1-1) and FCV-406B controls flow to SGs 33/34 (SGs 33/33 per FD-20193). The licensee took note of these errors and initiated corrective actions to eliminate the conflicts.

Test PT-CS01, "Main Steam Valves PCV-1310A and PCV-1310B," is performed during cold shutdown to demonstrate the operability of these valves. On May 5, 1991, the opening times for PCV-1310A and B were 8.9 and 8.8 seconds versus acceptance criteria of $\leq$8 & $\leq$14 seconds, respectively. Closing times were 2.4 and 1.0 seconds versus acceptance criteria of $\leq$5 and $\leq$3 seconds, respectively. A Temporary Procedure Change (TPC) was prepared to change PCV-1310A's acceptance criteria to 10 seconds. There was no stated basis for the acceptance criteria times contained in the test procedure. The licensee stated that the acceptance criteria were maintained near operating history times to provide sensitivity to pending operational problems. The inspector considered that this was performance monitoring, whereas acceptance criteria should have valid technical bases. The licensee agreed to review this practice to ensure technical bases are reflected in acceptance criteria.

Test PT-CS19, "Steam Driven Auxiliary Boiler Feed Pump Operability Test," was performed during cold shutdown to demonstrate the operability of the turbine-driven AFWP prior to the RCS exceeding 350°F. The test performed on December 14, 1990, found that at a speed of 615 rpm, the pump discharge pressure was only 76 psig. The acceptance criteria of greater than 100 psig was not met, but the operability criteria satisfied block was checked, "YES," and no comments were made. The licensee reviewed previously completed PT-CS19 tests and found cases where the 100 psig pump discharge test criterion was not met. In each of these other cases, a memo to file existed explaining that the low pump discharge pressure was caused by low main steam pressure, not by problems with the AFW pumps. The licensee committed to revise this procedure to require the surveillance not be performed until the RCS is above 300°F. The inspector concluded that the December 14, 1990, test acceptance was a one-time oversight and the commitment to revise PT-CS19 was acceptable.

As required by TS, the majority of surveillance testing for the AFW system is performed during each refueling outage. The inspector reviewed PT-R3D and R7 and PC-R07A, R07D, and R07E. The safety injection test, PT-R3D, performed on 12/9/90 did not meet its overall acceptance criteria due to breaker problems. Additionally, TPCs were required to correct procedure errors. TPC TS-90-841-SV made this strike-out change to Step 5.1.1:

> "The safety injection system shall be considered operable if all safety related components function as required~~ and each emergency diesel has been fully loaded within 30 second after the initial starting signal~~. For components that do not function as required the Operations Superintendent shall be notified to determine the safety significance."

The inspector questioned how the design basis was met with the TPC in effect. The licensee stated that to fully load the EDG is impossible in the test condition (shutdown), that this problem had previously been identified and that the procedure was being revised to remove the "fully loaded" aspect while keeping the 30-second requirement.

The AFWP full flow test (PT-R7) was performed at cold shutdown conditions for pumps 31 and 33 and at hot shutdown conditions for pump 32. Precaution 2.4 of this procedure stated that "To prevent water hammer S/G feed rings flow <u>must</u> be limited to a value of less than 150 gpm until a positive increase in S/G level is observed." The inspectors questioned this precaution since a reference to water hammer susceptibility could not be located in design basis documents. The licensee indicated that because of the J-tube SG feedwater ring modifications a number of years ago, and the more recent SG replacements, this limitation was no longer needed. They also indicated that such a limitation did no harm and was nonetheless considered to be very appropriate. The inspectors considered that while it may appear to be appropriate, it may also be misleading to state that this limit "prevents water hammer."

Recirculation flow control switches, FC-1135S and 1135AS and FC-1136S and 1136AS were modified and evaluated during special tests ENG-433 and ENG-433A (performed in December 1990). Three TPCs were required to correct procedure errors. The inspectors expressed a concern that no acceptance criteria for FCV-1121 & 1123 valve operating times were provided. Future calibration of the FC-1135/1136S controllers will be performed under IC-PM-F-1135S and 1136S I&C procedures. The I&C administrative directive, IC-AD-3, did not list any calibration procedure for FC-1135AS/1136AS, and those procedures listed were not available for inspector review. The licensee stated that IC-AD-3 will be corrected and that the subject procedures will be based on the post-modification tests.

Although the AFW DBD was a positive initiative, it appeared that its availability had not resulted in significant improvements in the AFW surveillance practices at IP-3. One example of this was the DBD Criterion 3.1.2 which stated that the motor-driven AFWPs are automatically initiated to provide auxiliary feedwater to the SGs within one minute following an actuation signal. Although the surveillance tests for auxiliary boiler feedwater pumps full flow test (PT-RT) and the safety injection system - breaker timing/bus stripping test (PT-R3B), appeared to perform adequate testing to confirm DBD functional criteria, it was not clearly identified in either of these procedures.

The DBD also stated that "In the event of an accident, the Motor-driven AFWPs are automatically initiated to provide auxiliary feedwater to the SGs within one minute following an actuation signal." Although AFW motor-driven pump start times are measured and recorded during performance of PT-R7, water flow to the SGs was not reported. The licensee provided a computer printout recorded during the performance of PT-R3B, Safety Injection System - Breaker Timing/Bus Stripping, which indicated that SG flow occurs in about 2 seconds following pump start. The inspector considered that such an important DBD parameter could be more formally addressed by surveillance procedures.

4.4 Testing and Calibration of AFW System Instrumentation

The licensee performed calibrations of AFW system instrumentation by two methods. For instrument directly specified by the TS, the Performance and Reliability Group is responsible for all calibrations. For others, the I&C department is responsible to prepare the preventive maintenance procedures, to schedule, and to perform these surveillance tests. The inspector reviewed calibration procedures most recently performed for the AFW system including the pressure, level, and temperature instruments for the CST, the AFW pumps, and the SGs. The instruments were verified to be within current calibration. In addition, the instruments that were used in the surveillance tests to obtain test data were also verified to be within their valid calibration period. The inspectors found I&C procedures to be of good quality.

4.5 Conclusions

The inspectors concluded that licensee's surveillance tests and instrument calibrations provided basic confirmation that design basis functional requirements could be satisfied during accident conditions. However, numerous individual cases existed where lack of explicit acceptance criteria in the surveillance program suggested some component operability concerns. Although the AFW DBD was a positive initiative, it appeared that having it available since 1989 had not yet resulted in any significant enhancements to the AFW surveillance procedures at IP-3.

5.0 Station Batteries

5.1 Purpose

The inspectors reviewed the 125 volt direct current (VDC) system from the 480 volt alternating current (VAC) supply through the battery chargers to the 125 VDC distribution system. The original IP-3 125 VDC battery design has been supplemented over the years by the addition of two additional batteries. During this inspection, there were four batteries of various size (numbered 31 to 34), five battery chargers (numbered 31 to 35), four DC main power panels (identified as PP-31 to PP-34), and six distribution panels (identified as DP-31 to DP-34 plus DP-31A and DP-32A). A system description and diagram are provided in Attachment D.

5.2 Design Safety Functions

The battery sub-system of the station electrical distribution system did not have a completed DBD. However, a draft copy entitled I.D. 27.1, "Safety-Related Electrical Power Distribution System," was available. Since this draft document was still being finalized by the contractor, confirmation of all data was required. The inspectors obtained useful design bases from this document as shown in the Attachment D matrix.

FSAR Section 8.1, Electrical Systems, provided the limited design information shown in the matrix. The major problem with the updated version is that it was not organized in a sub-section format, but the 125-VDC battery information is spread throughout the total electrical system text. This made the battery information difficult to locate and use effectively. The inspectors considered the FSAR information of only marginal usefulness in determining the battery system design bases.

TS Section 3.7, Auxiliary Electrical Systems, required that three batteries plus three chargers and the DC distribution systems be operable to bring the reactor above cold shutdown. One battery may be inoperable for 2 hours, provided the other batteries and the three battery chargers remain operable with one battery charger carrying the DC load of the failed battery supply system. Monthly, quarterly, and refueling outage general surveillance requirements are specified. The Attachment D matrix chart contains further details.

The inspectors compared the IP-3 custom TS with NUREG-0452, Standard Technical Specifications (STS) for Westinghouse PWRs. STS were more specific in that they required all DC electrical sources to be operable for plant operation. STS require weekly, quarterly, 18-month plant operation and plant shutdown, annual, and 60-month surveillance tests. The inspectors noted that some IP-3 testing requirements that are hard on batteries, such as the total discharge test, were required only every 60 months instead of the refueling outage schedule required by the IP-3 TS. The licensee considered that the more frequent discharge test was necessary to accurately predict battery end-of-life.

IEEE 450-1980, IEEE Recommended Practice for Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Generating Stations and Substations, is the standard NYPA is committed to for IP-3. As presented in the Attachment D matrix, considerable guidance is provided by this standard for battery testing. The most significant inconsistency in IP-3 battery surveillance testing was that no true battery load profile test as such was performed. This is discussed at length under the quarterly surveillance review below. The 1987 version of this standard will be used by NYPA for replacement batteries.

IEEE 485-1983, "IEEE Recommended Practice for Sizing Large Lead Storage Batteries for Generating Stations and Substations" is used primarily for battery sizing. Section 4.2.3 recommends that although momentary loads may exist for only a fraction of a second (following a LOOP) each is considered to last for a full minute, and the total load shall be assumed to be the simple sum of all momentary loads occurring within that minute. This is conservative and considered to be acceptable for IP-3 batteries.

The inspector reviewed the results of calculations for Batteries 31, 33, and 34 which showed emergency loading for the design basis event (LOCA with station blackout) of the four power panels. The amperage requirement for 0 - 1 minute (maximum demand) and the integrated total amperage were used to determine battery sizing.

5.3 Surveillance Testing

Test 3PT-W13, "Station Battery Visual Inspection," was a weekly inspection of all major batteries for cleanliness and degradation of cells. The check sheet used for the inspection includes the four station batteries plus batteries for the circulating water pumps, the technical support center diesel, the Appendix "R" diesel, the 4th floor computer battery, the command post generator, and the outage support building. A number of cells showed corrosion/crud buildup and the overall acceptance criteria (AC) were not met due to these conditions. A new MWR for corrosion on cell #40 of the TSCC battery was submitted. During the last inspection of station battery 32, cell #21 was identified to have a cracked jar. The defective cell was subsequently replaced.

Station battery deterioration was assessed monthly using 3PT-M21, "Station Battery Surveillance." Cell voltages, electrolyte levels, and any water added are recorded for each station battery. The inspectors noted a problem with step 3.7 which required a visual inspection of the battery room. This step should indicate that battery room condition, including cell and terminal conditions, ambient room temperatures, battery cell caps and vents in place, and ventilation systems operation for all battery rooms. No sign-off for the condition of each battery room was provided. The licensee stated that this check on room condition was in the weekly surveillance and that the lack of signoff had been previously identified and will be included in the next procedure change. The inspector did not find any significant problems with the observed condition of the battery rooms.

The inspectors reviewed surveillance test 3PT-Q1, "Station Battery Surveillance and Charging." Cell specific gravity, height of the cell electrolyte and temperature of every 5th cell were recorded. Specific gravity of each cell was corrected for average battery electrolyte temperature. The battery is placed on an equalizing charge for at least 24 hours and post-charge data was recorded. Operational Criteria and Overall Acceptance Criteria, were acceptable.

The latest TS-required battery capacity load test was performed during the October-November 1990 refueling outage using 3PT-R29A. During the outage, each battery was equalized and discharged at a temperature-compensated constant rate. The inspector expressed a concern with the 3PT-R29 discharge test in that it was a constant rate test unrelated to the actual battery discharge profile that is expected during a design-basis event. The guidance provided by IEEE 450-1980 and -1987 under Section 6.6, "Service Test" is that the discharge rate and test length should correspond as closely as is practical to the design requirements (battery duty cycle) of the system. The licensee stated that an engineering study to evaluate modifications needed for load profile testing had been performed. The study concluded that the physical plant layout, in particular the small size of the battery rooms, made it extremely costly (required new battery rooms) to make this testing possible. In addition, their analysis indicated that since the battery ampere-hours available determines the total battery capacity, their constant discharge load testing, along with the battery sizing calculations, adequately demonstrated that the batteries will be able to supply the required 2-hour loads.

The manufacturer's results of load profile tests for replacement Batteries 31 and 32 to be installed during the next refueling outage (March 1992) will correspond exactly to the licensee's calculated accident load profiles. Since these two batteries supply the majority of the emergency loads, and because the replacement batteries have been acceptable load profile tested, the inspectors concluded that this concern would be resolved upon installation of the replacements.

The licensee continuously monitored overall battery performance. During the last refueling outage discharge tests (October/November 1990), the percent battery capacities were as follows:

Battery	Capacity, %
31	98.65
32	96.51
33	93.50
34	117.50

The capacity evaluation shown above was not the only criterion used for battery replacement. Considerable information was gained by observing their physical condition and battery/cell recharging following the discharge test. Since the recharge rate of Batteries 31 and 32 in 1990 was reduced (required increased time to recharge) from previous tests, new batteries have been ordered and will be installed during the next refueling outage.

NYPA has recently purchased a Battery Impedance Test Equipment (BITE) portable instrument for battery cell testing. This state-of-the-art instrument will be used to test for conditions of sulfating, post-seal corrosion, poor intracell connections, and poor intercell connections. The inspectors found the procurement of the BITE, the development of PFM-72, Station Battery Impedance Test, and plans to use BITE to supplement other surveillance testing to be a good initiative.

5.4 Licensee Response to Previous Unresolved Issues (URI 50-286/91-80-04 and 05; and NOV 50-286/91-80-09)

During the Electrical Distribution Safety Functional Inspection (EDSFI) performed at IP-3 early in 1991 (Inspection Report 50-286/91-80), two unresolved issues related to no calculation or study performed by the licensee to determine the voltage drop for the most limiting components and to set the battery discharge limits to ensure that adequate voltage levels exist at the end devices (URI 50-286/91-80-04 and -05). During this inspection, discussions with corporate engineering personnel determined that these calculations have been performed.

The inspector reviewed IP3-CALC-EL-00108, 125 VDC Power Panel 32 and Associated Loads - Voltage Drop. The most limiting DC load supplied by PP-32 is the 25 KVA Static Inverter for instrument AC power. The calculation concluded that in order to obtain 105 VDC at the invertor, a voltage of 105.166 VDC is required at the power panels. IP3-CALC-EL-00185, "Component Sizing - 125 VDC - 32 Battery, Charger, Panels and Cables," was performed to show that the components related to Battery 32 has the capacity to serve the connected loads for 2 hours. Since these calculations used derated capacities (80% of manufacturers rating) and considered other conservative factors, the 105.166 VDC needed at the power panels to assure 105 VDC at the invertor criteria was met. Therefore, these issues are resolved and both URI 50-286/91-80-04 and 05 are closed.

The inspectors also reviewed another EDSFI issue related to DC short circuit tests of Type FB Westinghouse molded case circuit breakers. The licensee provided a June 20, 1991, letter from Westinghouse that certifies the Type FB circuit breakers that were questioned by the team. Review of this data resolved this concern; and, therefore, NOV 50-286/91-80-09 is closed.

5.5 Conclusions

With the minor problems identified above being corrected, the inspectors concluded that NYPA's combined surveillance testing was adequate to ensure station batteries 31, 32, 33, and 34 meet the design bases specified in the TS, FSAR, and the appropriate IEEE standards.

6.0 Overall Conclusions

Overall, the inspectors concluded that the current surveillance testing reviewed for the Safety Injection System, the Containment Cooling and Air and Filtration System, the Auxiliary Feedwater System, and the Station Batteries was found to be in conformance with Technical Specification requirements and adequately demonstrated that the systems' design basis safety functions would be fulfilled under accident conditions. Inspectors identified some concerns related to the testing and control of calibrated instruments installed in the boron injection tank, and in the consistency and accuracy of technical details contained in various program documents such as procedure and equipment lists, and some system flow diagrams. No instances were identified where inaccuracies caused required surveillance tests to be missed or performed incorrectly, or which invalidated accepted test data. These concerns were presented to the station management for resolution. Some concerns were expressed related to the adequacy of acceptance criteria in test procedures not explicitly defining the appropriate tolerances of certain parameters required for defining equipment functionality; the acceptance criteria in most test procedures were found to exceed minimum TS requirements. However, the adequacy of the full stroke testing of the HHSI pump suction check valve could not be fully determined and will remain unresolved pending additional inspection. The inspectors concluded that surveillance testing demonstrated the required operability and the ability of these systems to function in a manner which affords protection to public health and safety.

The reconstituted design bases developed for these systems and documented in the DBDs were a positive initiative permitting all organizations to achieve a common understanding of the current design requirements applicable to plant systems. The Design Basis Documents were found to be valuable reference sources for the design functions of these systems and represented useful foundation documents for the on-going development of the system engineer program.

The licensee's responses to previous NRC findings were found to be adequate to resolved the issues identified.

7.0 Exit Interview

The inspectors discussed the results of this inspection with Technical Services and I&C Department personnel at a pre-exit conference held on November 21, 1991. The final inspection results were presented to NYPA corporate and station management at the exit meeting held on November 22, 1991. Attendees are identified in Attachement E.

No written material was provided to the licensee during this inspection and no proprietary information is included in this report.

Attachment A

Safety Injection System (SIS) Description:

(Figure A provides a system diagram) The high head safety injection (HHSI) and low head safety injection (LHSI) subsystems are the portions of the Safety Injection System (SIS) which provide immediate emergency cooling to the post-accident reactor vessel before primary pressure and water level drop low enough to uncover the core. The HHSI injects coolant to the reactor vessel in the range of ≈1500 psi down to ≈660 psi where the accumulators begin to deliver their contents. If a rapid RCS pressure blowdown occurs following a large RCS rupture, the accumulators discharge their contents well before the HHSI pumps inject flow to the core. When the system is properly aligned, the injection function only requires active operation of the HHSI pumps and MOVs associated with the boron injection tank.

The SIS consists partly of active and passive subsystems. The active high pressure portion requires an outside signal for its activation. This portion consists of three HHSI pumps, the boron injection tank (BIT), and the RWST. The passive subsystem consists of four LHSI accumulators which contain borated water pressurized under a nitrogen blanket. A reduction of RCS pressure is the only action required to obtain flow from the accumulators. Automatic actuation of the SIS occurs upon high containment pressure, low pressurizer pressure, high steam line differential pressure, or high steam line flow coincident with a low T-ave, or a low steam generator pressure. The SIS system can also be manually initiated from the control room. HHSI to the RCS is accomplished through two independent injection flow paths and is delivered into the RCS cold loops through individual branch lines off each injection header. In the event of a loss-of-coolant accident (LOCA), a steam generator tube rupture (STGR), or a main steam line break (MSLB), the SIS provides emergency core cooling and an adequate reactivity shutdown margin.

Upon actuation of the SIS, the HHSI pumps receive a start signal and the necessary system valves receive an open signal. Most of the main system valves in the flow path are normally open, but still receive an open signal to ensure the flowpath is available. When the RCS pressure drops to the shutoff head pressure of the pumps (≈1500 psig), they inject water from the BIT and from the RWST into the RCS cold legs. When RCS pressure decreases to ≈660 psig, the accumulators inject borated water into the RCS. These actions are automatic, but indications of system actuation are monitored on the safeguards and SI supervisory panels in the control room to ensure the actions are being completed. When the RWST level reaches its low level alarm setpoint and the recirculation sump level is sufficiently high, the SIS system is shifted to the recirculation phase. Recirculation is manually placed into service remotely from the control room.

HHSI Pumps:

The HHSI pumps are all horizontal centrifugal pumps with a nominal rating of 400 gpm at 1100 psig. They each to provide 50% of the capacity required to meet the system's design criteria for flow delivery to the core. Each pump has a recirculation line to assure minimum recirculation flow if the main flow paths become blocked, or if the pumps must operate against a discharge pressure greater than their shutoff head (≈1500 psig). The pumps are arranged in parallel taking a suction on the RWST and discharging into the RCS through two high pressure injection flow paths. The pumps are arranged so that any two can supply borated water to both injection headers. With all three pumps running, RCS cold legs will be supplied through both injection headers. Pump 32 has its flow divided equally between the two injection paths via two motor operated valves. Check valves are arranged in the pump discharge header to ensure that no more than two pumps can feed a break in any one header. This ensures that the third pump will supply the RCS through the other header. The pumps normally draw a suction from the RWST through a single MOV (valve 1810) which is normally open during with its control power deenergized. The HHSI pumps are tested periodically using the test flow line and the pump recirc line which are instrumented to detect pump discharge flow and pressure.

Refueling Water Storage Tank (RWST):

The RWST is a large capacity water tank located at a relatively high elevation outside the primary auxiliary building to provide a positive suction head to the SIS pumps. During plant operations, the RWST is lined up to supply the HHSI pumps without repositioning any system valves. The minimum volume necessary to supply HHSI cooling water to the reactor vessel is 246,000 gallons during the injection phase. Approximately 13,400 additional gallons are provided as a safety margin. The minimum volume required by the Technical Specifications when RCS temperature is >200°F is 346,870 gallons, which ensures that the minimum safety injection volume is available. The tank is equipped with redundant level and temperature transmitters which feed both local and control room instruments. A low level alarm is incorporated into these instruments to signal operators to begin the sequence to switchover to the recirculation phase.

Boron Injection Tank (BIT):

The BIT contains 900 gallons of ≈21,000 ppm borated water at a minimum temperature of 145°F. This volume is required to provide the minimum negative reactivity insertion in the core to limit core power after a main steam line rupture. The temperature of the tank is automatically maintained by two 3KW electric heater banks.

LHSI Accumulators:

The four LHSI accumulators each contain ≈6100 gallons of 2000 ppm borated water under a nitrogen gas blanket of ≈660 psig. Each accumulator tank is connected to its associated RCS cold leg through the non-BIT injection header. The piping which connects each accumulator to a cold leg contains two isolation check valves and an isolation MOV. The check valves provide primary RCS boundary protection during normal operations. During normal operation, the power supplies to the MOVs are deenergized and the valves remain open. Test lines are installed in the system piping between the isolation check valves and the MOVs for the purpose of leak testing the check valves during plant operations.

MATRIX CHARTS

The following matrix charts provide a graphic representation of the principle safety functions of the Safety Injection System. The entries contained in each column are not exact quotes from the referenced documents, but are abbreviated for the sake of brevity. The essential technical content of each referenced document is accurately represented as it existed at the time of this inspection.

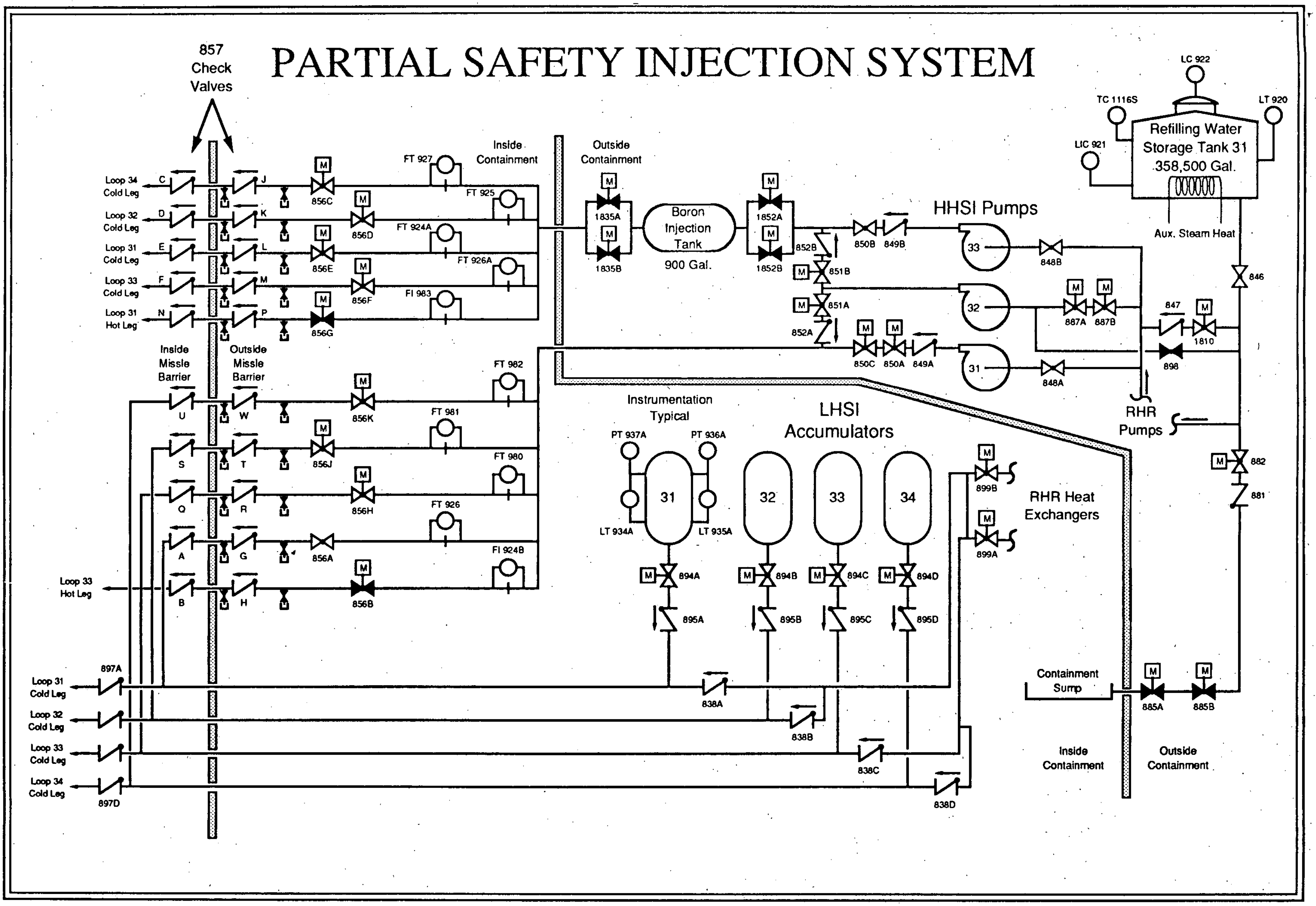
The numbering scheme used for surveillance test procedures provide a code for identifying the type of test and its frequency of performance in accordance with the following:

PT = Periodic Test (Unit 3)
PC = Periodic Calibration
ENG = Special Engineering Test
COL = Checkoff List

M = Monthly
Q = Quarterly
SA = Semi-annual
CS = Cold Shutdown
Y = Yearly
R = Refueling
V = Variable

Attachment G contains a complete list of abbreviations and acronyms.

Figure A


PARTIAL SAFETY INJECTION SYSTEM
857 Check Valves
Inside Containment
Outside Containment
Loop 34 Cold Leg
Loop 32 Cold Leg
Loop 31 Cold Leg
Loop 33 Cold Leg
Loop 31 Hot Leg
Loop 33 Hot Leg
Inside Missle Barrier
Outside Missle Barrier
FT 927
FT 925
FT 924A
FT 926A
FI 983
FT 982
FT 981
FT 980
FT 926
FI 924B
856C
856D
856E
856F
856G
856K
856J
856H
856A
856B
1835A
1835B
Boron Injection Tank
900 Gal.
1852A
1852B
852B
851B
851A
852A
850B
849B
850C
850A
849A
HHSI Pumps
848B
887A
887B
848A
847
1810
898
846
RHR Pumps
882
881
Refilling Water Storage Tank 31
358,500 Gal.
LC 922
TC 1116S
LT 920
LIC 921
Aux. Steam Heat
Instrumentation Typical
PT 937A
PT 936A
LT 934A
LT 935A
LHSI Accumulators
894A
894B
894C
894D
895A
895B
895C
895D
899B
899A
RHR Heat Exchangers
Containment Sump
885A
885B
897A
897D
838A
838B
838C
838D

ATTACHMENT A

SAFETY INJECTION SYSTEM SURVEILLANCE TESTS, BASES, AND REQUIREMENTS

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
A. HHSI Flow Paths to the RCS					
HHSI BIT header flow paths available to RCS cold legs. Operational readiness of branch line isolation valves MOVs 856A,C,E,H,& J Full flow capability of BIT cold leg branch line check valves 857C,D,E,F,J,K,L,& M	DBD Sec 2.2.1.2: SIS active equipment shall be capable of being tested during normal plant operations to verify component operability iaw 1983 ASME Section XI, IWV-3000 requirements for valves	Sec 6.1: Demonstration checking of the system as directed by the Tech Specs provides assurance that the system alignment is correct for the safety injection function of the components Fig.6.2-1A: Valves 856A, C,D,E,F,H,J,& K are normally open. Valves 856A,F,&K are locked open with their motor valves disconnected during plant operations	Sec 3.3.A.3.e: 3 HHSI pumps and associated piping and valves shall be operable when T-ave >350°F Sec 4.5.A.1.d: Verify that the mechanical stops on valves 856A,C,D,E,F,H,J,K are set at the position measured & recorded during the most recent ECCS operational test. Sec 4.5 Basis: Mechanical stop adjustments are verified periodically to assure HHSI flow distribution is iaw flow values assumed in the core cooling analysis.	PT-CS23: Stem open positions are measured and verified correct iaw the last ECCS operational flow test (original startup) COL-SI-1: MOV 856A,D,F,& K breakers are verified locked open and MOV 856C,E,J,& H breakers are verified shut during each plant startup. PT-CS24: Obtains and assesses IST data for MOVs 856C,E,J,H - full stroke seconds, open and closed PT-V29: Full stroke test of check valves 852B, 849B, and 857C,D, E,F,J,K,L,& M. All 857s must flow ≥100 gpm. 849B & 852B must flow ≥400 gpm.	PT-CS24 test of 11/27/90: All valves met acceptance criteria
Flow path available from HHSI pumps through the BIT to the injection header Operational readiness of MOVs 851B; 1852A,B; 1835A,B; and AOVs 1851A,B. Full flow capability of HHSI pump discharge check valves 852B & 849B	DBD Sec 2.2.2.1: The SIS shall be capable of supplying the required emergency core cooling in the event of a LOCA, a SGTR, or a MSLB. Injection flow bases range from 0 gpm at 1200 psig to 918 gpm at 0 psig RCS pressure.	Sec 6.2.4: The TSs establish limiting conditions regarding the operability of the SIS system when the reactor is critical.	Sec 3.3.A.3.e: 3 HHSI pumps and associated piping and valves shall be operable when T-ave >350°F Sec 4.2.3.1.a: Inservice inspection shall be conducted in accordance with Section XI of the ASME B&PV Code.	PT-M16: Measures open & close stroke times for 850A&,C; 851A,&B; and performs partial stroke test of 849A&B, 852A&B, 884A,B,&C, and 847. Acceptance criteria require MOV stroke times ≤28 seconds and check valves to indicate flow only.	

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Availability of full flow path from the RWST to the suction of HHSI pumps 31, 32, & 33: Operational readiness of HHSI pump suction isolation MOVs 887A,B; pump recirc valves 842 & 843; and pump suction header MOV 1810. Full flow capability of HHSI pumps suction check valve 847.*	<u>DBD Sec 2.2.1.2</u>: SIS active equipment shall be capable of being tested during normal operations to verify component operability. It is mandatory to make periodic tests on the safeguards pumps and to exercise essential valves iaw ASME Section XI	<u>Sec 6.1</u>: During the injection phase, the SI pumps do not depend upon any portion of other systems. [SI is accomplished only by the correct alignment and actuation of SIS components]	<u>Sec 3.3.A.3.e</u>: 3 HHSI pumps and their associated piping & valves shall be operable when T-ave >350°F <u>Sec 3.3.A.3.i</u>: Valve 1810 shall be open and its power supply deenergized when T-ave >350°F <u>Sec 3.3 Basis</u>: MOVs 842 and 843 shall be open with power supplies deenergized to prevent spurious closure and overheating of the HHSI pumps. MOV 1810 is maintained open and its power supply is deenergized to assure flow from the RWST during the post-LOCA injection phase.	<u>PT-CS8</u>: Obtains and assesses IST data for MOV 1810 - full stroke seconds within acceptance criteria of ≤12 seconds. <u>PT-R121</u>: Test of #32 HHSI pump suction MOVs 887A & 887B. Measures the opening and closing times for both valves. Also verifies the valve positioning in each test. <u>ENG-431</u>: Differential pressure test of HHSI pump supply MOV-1810 to demonstrate operability under actual d/p conditions.	Positions of all valves in this flow path are verified weekly. All manual valves are locked open. *Full flow capability of check valve 847 could not be verified; (URI 91-21-01)

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Adequate NPSH available to the HHSI pumps (NPSHr=NPSH required) (NPSHa=NPSH available)	DBD Sec 3.1.3.3: NPSHr shall be ≤ NPSHa for the limiting system configuration. NPSHr* = 30 ft. at 650 gpm. The limiting system configuration is during the injection phase with three HHSI pumps operating at runout (650 gpm) and both RHR pumps operating at design flow. NPSHa is calculated to be 42 ft. under these conditions, ie., >NPSHr DBD Sec 3.1.3.4: **The maximum specified pump flow is 675 gpm. A pump discharge orifice is included in the design to ensure adequate NPSH.	Sec 6.2.3: The end of the injection phase operation gives the limiting NPSH requirement. At the end of the injection phase, 20% NPSH margin is available assuming all three pumps are running together at design flow. Table 6.2-13, NPSH Requirements for Class I Seismic Pumps: Safety Injection Pumps NPSHr = 30.0 ft. NPSHa = 42.1 ft.	Sec 3.3.A.1: The RWST shall contain >346,870 gallons when T-ave >200°F. Sec 3.3.A.3.i: Valve 1810 in the suction line to the ligh level SI pumps shall be open when T-ave >350°F.	PT-M16: Measures pump suction pressure after 15 minute run (33.5 psig at 30.5 gpm and 1520 psig discharge pressure)	*The pump vendor subsequently identified NPSHr as 30 ft. at 675 gpm **The HHSI system performance was verified during preop testing. Testing allowed for injection flows up to 660 gpm. Including minflow, total pump flows ≥680 gpm could have been experienced. DBD contractor is analyzing potential flow measurement errors in small lines ≤2" diam. that could result in flows above indicated. Analysis of flows >pump runout during RWST suction not complete to date.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Availability of HHSI non-BIT flow path to the RCS: Operational readiness of HHSI pumps 31 & 32 discharge MOVs 850A,C and 851A; Full flow capability of HHSI pump 31 & 32 discharge check valves 849A & 852A, and non-BIT injection header check valves 857A,G,Q,R,S,T,U,& W.	DBD Sec 2.2.1.2: SIS active equipment shall be capable of being tested during normal operations. It is mandatory to exercise essential valves iaw ASME Section XI	Sec 6.2.4: The TS establish limiting conditions regarding the operability of the system when the reactor is critical.	Sec 3.3.A.3.e: 3 HHSI pumps and associated piping and valves shall be operable when T-ave >350°F. Sec 4.5.B.1.a & b: The HHSI pumps shall be started at intervals not greater than one month. Acceptable levels of performance shall be that the pumps start, develop the required head on recirc flow, and operate for at least 15 minutes.	PT-M16: SI pump functional test; verifies that discharge check valve 852A opens (not a full stroke or full flow test). Measures open and close stroke times for MOV 850A & C, and close time for MOV 851A. PT-R64: Performs a stroke test of HHSI non-BIT check valves 857A,G,Q,R,S,T,U,& W; pump suction header check valve 847; and #31 & #32 pump discharge check valves 849A and 852A. 857s must flow ≥100 gpm each; 849A & 852A ≥400 gpm each; and 847 ≥650 gpm.*	Test data from performance on 11/28/90 was acceptable. However, adequate verification of full flow through check valve 847 not complete. (URI 91-21-01)
Isolation of the recirculation suction lines from the containment sump during the injection phase Leak tightness of suction line isolation MOVs 888A & 888B	DBD Sec 3.14.3.1: These valves shall be maintained in their ECCS position during power operation. The ready status position of these valves is closed. They are interlocked with the RHR system to prevent accidental diversion of RCS inventory to the RWST.	Sec 6.2.2: MOVs 888A & B are maintained in the normally closed position at all times. The valves are exercised iaw TS requirements. The valves are opened one at a time and each valve is returned to its normal position before exercising the next one. No automatic opening features are provided; hence the probability of a spurious signal to open the valves is nil. The two valves are provided in series to protect against the inadvertent opening of one valve.	(Not specifically defined beyond the general requirement for operability of the SI and recirculation pumps, valves, and piping when T-ave >350°F)	PT-R67: Leak test of valves MOV 888A & 888B. Acceptance criteria are met if the visible leakage is negligible.	11/15/90 test results indicated leakage from both valves was zero.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Isolation of HHSI flow paths to the RCS hot legs during plant operations and during the post-LOCA injection phase. Operational readiness of hot legs branch line isolation valves MOVs 856B & G	DBD Sec 3.10.3.3: These valves shall be maintained in their ECCS position with AC power removed during power operation. The "ready status" position of these valves is closed to eliminate the need to evaluate the effects of steam/water counterflow and steam condensation associated with hot leg injection early in the accident mitigation phase.	Fig 6.2-1A: MOVs 856B & G are normally shut	Sec 3.3.A.3.h: Hot leg injection MOVs 856B & G must be closed and power supplies deenergized when T-ave >350°F Sec 3.3 Basis: Keeping these MOVs closed prevents SIS flow to the hot legs during the post-LOCA injection phase. Open breakers prevent spurious valve openings during the injection phase.	COL-SI-1: MOV breakers are verified open during each plant startup PT-CS24: The stem open (recirc) positions are measured and verified correct iaw the last ECCS operational flow test (initial startup) PT-CS9: Obtains and assesses IST data for MOVs 856B & G. Full stroke time open and closed required to be ≤30 seconds.	PT-CS9 test data for 11/21/90 acceptable.
B. LHSI Flow Paths to the RCS					
Availability of full flow path from the accumulators to the RCS cold legs: Accumulator discharge flow rate Full flow capability of accumulator discharge check valves 895A,B,C,& D and 897A,B,C,& D Operational readiness of accumulator isolation MOVs 894A, B, C,& D	DBD Sec 3.4.1: The gas volume requirement is sized to be sufficient to force the liquid contents of the accumulator against zero backpressure into the RCS within the time required to start the EDGs and the HHSI pumps Pre OL commitment: Remove AC power (during power operation) from MOVs 894A, B, C,& D.	Sec 6.2.2: In the event an MOV is closed for accumulator or valve testing at the time injection is required, a SI signal is applied to open the *valve, overriding the test closure.	Sec 3.3.A.3.c: Accumulator isolation valves 894A, B, C,& D shall be open and deenergized when T-ave >350°F and when RCS pressure >1000 psig. Sec 3.3.A.4.a: For the purpose of accumulator check valve leak testing, one accumulator may be isolated at a time for up to 8 hours, provided the reactor is in the hot shutdown condition. Sec 4.5.B.2.b: The accumulator check valves shall be checked for operability during each refueling shutdown.	PT-CS4: Stroke test of accumulator discharge check valves 897A,B,C,& D; and 895A,B,C,& D. Acceptance criteria is met if flow through the valves is verified.	*If power is available

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
C. SIS/RCS Boundary Protection					
Leak Tightness of RCS/SIS high head injection headers cold leg check valves SI-857A,C,D,E,F,G,J,K, L,M,O,R,S,T,U,& W	<u>DBD Sec 3.23.3.4</u>: The valves are designed for exceptional tightness against seat backleakage to ensure integrity of the RCS pressure boundary during normal and accident conditions. The 2-inch valves (857A-H & 857J-N) were tested by the manufacturer to be ≤10 cc/hr/inch disk diam. at hydrostatic pressure. (Valves 857P-U and 857W were not specifically mentioned in this section but are applicable under DBD general leakage criteria for 2-inch valves).	<u>Sec 6.2.2</u>: SIS valving is specified for exceptional tightness. Check valves are specified to be ≤3 cc/hr/inch nominal pipe size at hydrotest pressure. 300 and 150 lb. USA Standard valves are specified to be ≤10 cc/hr/inch nominal pipe size.	<u>Sec 3.1.F</u>: Reactor coolant identified leakage shall not exceed 10 gpm. <u>Sec 3.3.A.3.e</u>: SIS valves shall be operable when T-ave >350°F. <u>Sec 4.5.B.2.c</u>: SI-857 check valves shall be checked for gross leakage every refueling <u>Table 4.1-3</u>: Check and evaluate primary system leakage 5 days per week.	<u>PT-R15</u>: Leak test of all 857 check valves. Acceptance criteria is ≤10 gpm total leakage for all of the 857 check valves combined.	12/14/90: Total leakage from all 857 valves was ≈0.4 gpm
Leak Tightness of RCS/SIS Accumulator discharge check valves SI-895A,B,C,& D Leak Tightness of RCS/SIS low head injection header check valves SI-897A,B,C,D, and 838A,B,C,& D	<u>DBD Sec 3.23.3.4</u>: The valves are designed for exceptional tightness against seat backleakage to ensure integrity of the RCS pressure boundary during normal and accident conditions. The 10-inch valves (895A-D) were tested by the manufacturer to be ≤10 cc/hr/inch disk diam. at hydrostatic pressure. The 10-inch valves (897A-D) were tested by the manufacturer to be ≤10 cc/hr/inch disk diam. at hydrostatic pressure. Preoperational testing demonstrated these valves were ≤100 cc/hr.	<u>Sec 6.2.2</u>: SIS valving is specified for exceptional tightness	<u>Sec 4.5.B.2.b</u>: Accumulator check valves shall be checked for operability during each refueling. <u>Sec 4.5.B.2.c</u>: The 895 check valves shall be checked for gross leakage each refueling. <u>Sec 4.5.B.2.d</u>: The 895 check valves shall be checked for gross leakage midway between refuelings <u>Sec 4.5.B.2.c</u>: 897 and 838 check valves shall be checked for gross leakage each refueling. <u>Sec 4.5.B.2.d</u>: 897 and 838 check valves shall be checked for gross leakage midway between refuelings.	<u>PT-CS4</u>: Leak test of check valves 897A-D, 895A-D, and 838A-D. Acceptance criteria for leakage is met if total leakage is ≤10 gpm.	5/22/91 test results indicated total corrected leakage from all 895, 897, and 838 check valves was = 3.05 gpm

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
D. HHSI Pump Performance					
Availability of HHSI pumps 31, 32, & 33. HHSI pumps 31, 32, & 33 discharge head and flow rates.	DBD Sec 2.2.1.2: SIS active equipment shall be capable of being tested during normal plant operations to verify component operability iaw 1983 ASME Section XI Pre OL commitment: "Provide 600 gpm minimum delivery to RCS cold leg injection lines with 2 SI pumps operating." ConEd Memo: 4/22/77; Established the HHSI pump minimum operability criteria at ≥3292 ft. head with 25-35 gpm minflow as a conservative means to achieve SI flow greater than that assumed in the safety analysis, and to match the SI head flow curve provided in the FSAR (Fig 6.2-2). DBD Sec 3.1.3.5: Plant safety analyses have been based on calculated system performance which utilized a vendor certified head/flow curve degraded by 5% (125 ft) of the design head, uniformly applied over the entire curve. The maximum amount of pump head degradation shall be the lesser of ASME Section XI and/or Safety Analysis flow assumptions	Table 6.2-5: SI pump design flow = 400 gpm at design head = 2325*ft. *Changed to 2375 ft. (See comments) Fig 6.2-2: Manufacturer's certified pump curve degraded by 5% (125 ft.) 25 gpm = 3300 ft. 35 gpm = 3290 ft. 400 gpm = 2530 ft. 600 gpm = 1675 ft. Sec 3.1: (GDC#35) With minimum onsite power available, the emergency core cooling equipment available is two out of three safety injection pumps. Sec 6.2: The SI pumps can be tested periodically during plant operation using the minimum flow recirculation lines available. Pressure indication is provided for the main flow paths of the SI pumps Sec 6.2.2: ≈525 gpm to the core is required to match boil-off at 1800 sec*** (earliest time to initiate SIS recirc). 600 gpm minimum is specified to account for uncertainties in flow measurement and to provide margin.	Sec 3.3.A.3.e: 3 SI pumps together with their associated piping and valves shall be operable whenever T-ave >350°F Sec 3.3.A.j: Valves 842 and 843 in the HHSI pump minflow return line shall be deenergized in the open position when T-ave >350°F Sec 4.5.B.1.a: SI pumps shall be started at intervals of not greater than 1 month. Sec 4.5.B.1.b: Acceptable levels of performance shall be that the pumps start, reach required head on recirc flow, and operate at least 15 min.	PT-M16: SI pump functional test. Operates each HHSI pump separately for > 15 min. Measures test flow up to the injection headers, verifies opening and full closure of suction and discharge check valves. Measures pump recirc flow, pump d/p, and discharge head. Verifies d/p >3292 ft., & recirc flow >27 gpm & <31 gpm. Obtains and assesses IST data for HHSI pumps** 31 & 32 discharge isolation MOVs 850A,C & 851A,C. Verifies full stroke times open and close ≤28 seconds.	*FSAR was in error during this inspection. The recalculated pump design head was based upon the pump's E-Spec design head of 2500# - 5% = 2375 ft. **HHSI pump 33 has no discharge isolation MOV Test Data from 10/17/91: All pump flows ≈30 gpm; MOV stroke times all ≤28 seconds. ***These values have been revised in the DBD by more recent analysis to 520 gpm and 1600 secs to accommodate the specific fuel type in the next core load

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Availability of the HHSI pump minflow recirc return line flow path Adequacy of pump recirc flow	DBD Sec 3.1.3.4: Each pump shall be capable of operating continuously anywhere between the vendor specified minimum and maximum flows. To facilitate surveillance testing and to accommodate against RCS pressure >pump shutoff head, a minflow line is provided for each pump. The orifice is sized to pass ≈25 gpm with the pump on recirc flow. 25 gpm was confirmed to be adequate in response to NRC Bulletin 88-04. SECL-89-508: The thermal minimum flow for the HHSI pumps is substantially below the actual pump flow for each mode of operation. The nominal minimum flow is adequate to prevent over heating, cavitation, and potential short term failure. The calculated nominal mechanical minimum flow is < the actual flow for each mode. See comments ConEd Memo: 4/22/77; Established the HHSI pump minimum operability criteria at ≥3292 ft. head with 25-35 gpm minflow as a conservative means to achieve SI flow greater than that assumed in the safety analysis, and to match the SI head flow curve provided in the FSAR (Fig 6.2-2).	Sec 6.2.2: A minflow bypass line is provided on each pump discharge line to recirculate flow to the RWST in the event the pumps are started with the main discharge path blocked.	Sec 3.3.A.3.c.: Three SI pumps together with their associated piping and valves must be operable when T-ave >350°F. Sec 3.3.A.3.j: Valves 842 & 843 in the min-flow return line from the discharge of the SI pumps to the RWST must be deenergized in the open position when T-ave >350°F.	PI-M16: SI pump functional test. Measures pump recirc flow after pump runs for >15 minutes. Recirc flow should be ≥25 gpm per pump. Acceptance criteria require 25-35 gpm with delta P = 3292 ft. for pump operability.	Required pump flow in gpm for LBLOCA - 650 SMLOCA - 400 NonLOCA - 650 Surv Test - 25 Corresponding Thermal/Mech. gpm minflow for each LBLOCA - 12/23 SBLOCA - 12/23 NonLOCA - 12/23 Surv Test - 12/23

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
SIS high head injection cold leg branch line flow rates Throttle position correct for cold leg branch line isolation MOVs 856A,C,D,E,F,H,J, & K	DBD Sec 2.3.1.2.1: The cold leg injection lines on each HHSI header shall be capable of being throttled and shall be flow balanced to ensure ECCS flow capability is consistent with safety analysis and pump performance capability.	Sec 6.2: Flow in each High Head Injection branch line and in the main flow line is monitored by a flow indicator during testing of the emergency core cooling system.	Sec 4.5 Basis: The mechanical stop adjustments are verified periodically to assure HHSI flow distribution is iaw flow values assumed in the core cooling analysis.	PT-CS23: The MOV stem open positions are measured and verified correct iaw the last ECCS operational flow test (original startup)	The branch line MOVs were set during the original preop testing to satisfy system flow and pump runout requirements. The original hydraulic analysis considered that the cold leg and branch line resistances were only based on system operating conditions. Review of the previous analysis and test results indicates a potential discrepancy in branch line flow balance. NYPA is currently working with the DBD contractor to resolve this question.
Accumulator nitrogen blanket pressure Accumulator pressure indication	DBD 3.4.3.1: The design pressure of the accumulators is specified to be 700 psig. To provide for pressure control and to preclude relief valve weepage and chattering, N2 pressure is controlled to ≈650 psig.	Sec 6.2.2: The accumulators are pressurized with N_2 gas. Table 6.2-2: Accumulator normal operating pressure = 650 psig.	Sec 3.3 A.3.c: All accumulators are pressurized to 600-700 psig when T-ave >350°F. Sec 3.3.A.3.d: One pressure transmitter shall be operating per accumulator when T-ave ≥350°F.	PC-R17: Check and caliabration procedure for accumulator pressure instruments	

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
E. SIS Injection Volumes					
Total volume available in the RWST	DBD Sec 4.1.1.1: A minimum delivered volume of 250,000 gallons of 2000 ppm boron shall be available for injection following a SI actuation.	Sec 6.2.2: Total RWST capacity is based on the quantity required to flood the refueling canal. The TS required volume of ≈340,000 gallons provides 21,000 gal. to reflood the Rx Vessel; 50,000 gal. borated water to increase initially spilled RC to a point which prevents a return to criticality; and 175,000 gal. on the CB floor to initiate the recirculation cooling phase.* The current minimum injection volume is 246,000 gals.	Sec 3.3.A.1.a: RWST must contain ≥346,870 gal. when T-ave >200°F.	(No a surveillance test. RWST level checks are contained in each shift operator log. The level is checked prior to pump and valve flow tests)	*These volumes will be revised by design basis analysis to delete the 21,000 gal; to provide 120,000 gal. to prevent a return to criticality, 80,000 gal. to adjust the pH in all CB sumps after a LOCA, and 250,000 gal. to initiate recirc.
RWST level instrument indication. LT-920 and LIC-921	DBD Sec 3.41.3.1: LT-920 was specified to have a range of 0 - 480 inches and is ±2% accurate. The LT-921 range is 0 - 580 inches and is ±0.5 ft. accurate.	Sec 6.2.2: One level indicator is provided in the control room.	Table 4.1-1: RWST Level instrument checked weekly; calibrated each refueling	PT-SA33: Check and calibration of the RWST Lo Lo Level Instrument. ENG-229: RWST level calibration	
Total volume available in each Accumulator	DBD Sec 3.4.3.1: A minimum volume of 775 ft^3 and a maximum volume of 815 ft^3 was used for fuel cycle no.7.	Sec 6.2: The accumulators and the SI piping are maintained full of borated water at refueling water concentrations while the plant is in operation. Sec 6.2.2: The design capacity of the accumulators is based on the assumption that flow from one accumulator is spilled on the CB floor thru the ruptured loop. The flow from the three remaining accumulators provides water to reflood the core.	Sec 3.3.A.3.c: The accumulators shall contain 775 - 800 ft^2 of water when T-ave >350°F. Sec 3.3.A.3.d: One level transmitter shell be operating per accumulator when T-ave ≥350°F. Sec 4.5 Basis: "Accumulator water volume is checked periodically." Table 4.1-1: Level instrument is checked each shift; calibrated each refueling.	PC-R16: Accumulator Level System Check and Calibration. Acceptance Criteria: As-found low level indicators <9.4%, high level indicators >33.2%	PC-R16A performed satisfactory on 11/19/90

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Accumulator level instrument indication LI-934A, B, C, & D; LI-935A, B, C, & D.	DBD Sec 3.42.3.1: The level instrument shall have an indicated range of 0 - 100% corresponding to a 14 inch accumulator operability band. The accuracy of the indicator is specified to be ±2% of full scale. The channel accuracy is estimated to be ±3.5% of full scale.	Sec 6.2.2: Redundant level instruments are provided with readouts on the main control board.	Table 4.1-1: Level instrument is checked each shift; calibrated each refueling. Sec 3.3.A.3.d: One level instrument shall be operating per accumulator when T-ave >350°F. Sec 4.1.A: Check the accumulator level instrument each shift; calibrate the instrument each refueling; test the instrument quarterly	PC-R16: Accumulator Level System Check and Calibration. Acceptance criteria: As-found low level indicators <9.4%, high level indicators >33.2%.	
BIT minimum volume available	DBD Sec 3.3.3.1: The BIT is specified to have a total internal volume of 900 gallons.	Sec 6.2.2: The BIT is maintained in the 100% full condition.	Sec 3.3.A.3.b: The BIT shall contain 900 gals. of 11½-13 weight % boric acid (20,112-22,735 ppm boron) solution at a temp ≥145°F.	(No Surveillance test for the BIT volume is performed. The BIT surge tank volume/level is recorded each shift to ensure the BIT is 100% full)	*Subsequent safety analysis has shown that the negative reactivity insertion requirements can be met without the BIT tank.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
F. SIS Tank Temperatures and Boron Concentration					
RWST boron concentration	<u>DBD 3.5.3.4</u>: The RWST minimum boron concentration is specified and monitored as stated in the TS. <u>DBD Sec 3.5.3.5</u>: The concentration of boric acid is normally 1.4 wt.%. At this concentration, the solubility temperature is <32°F. <u>DBD Sec 2.2.2.1</u>: The SIS shall be capable of supplying the required reactivity shutdown margin in the event of a LOCA, a SGTR, or a MSLB to prevent an uncontrolled return to criticality.	<u>Table 6.2-4</u>: RWST boron concentration = 2000 ppm	<u>Sec 3.3.A.1.a</u>: RWST boron concentration must be ≥2000 ppm when RCS temp is >200°F. <u>Table 4.1-2</u>: RWST boron concentration is tested monthly.	<u>RE-CS-012.1</u>: Radiological procedure; requires monthly sampling of the RWST for boron concentration <u>RE-CS-033</u>: Radiological procedure with operator aids for sample point locations	*NYPA currently has a project to increase the RWST boron conc. which will change the time required before the recirc cooling phase can be initiated.
RWST temperature control	<u>DBD Sec 2.3.4</u>: SIS piping and valves located outdoors and above ground are provided with freeze protection to maintain static water within a range of 35 - 45°F when continuously subjected to a minimum ambient air temperature of -5°F and a maximum wind velocity of 40 mph.	<u>Table 6.2-4</u>: Design temperature = 120°F Operating temperature = above freezing	(Not explicitly addressed by TS)	<u>IC-PM-T-1116S</u>: Calibration of RWST temperature controller TC-1116S. Acceptable limits are: Trip setting = 30-40°F and Reset = 35 - 45°F.	

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
BIT temperature indication and control	DBD Sec 2.3.3.1: Temperature control is required in the BIT and connecting piping to maintain the high concentration (21,000ppm) of boric acid in solution. DBD Sec 3.3.3.1: The temperature of the BIT contents shall be maintained above the boric acid solubility temperature. The BIT normal temperature is automatically controlled to ≈165°F (well above the solubility of 12 wt.% of boric acid). DBD Sec 3.37.3.2: The temperature instruments shall provide a control signal to turn the BIT heaters on and off. TIC-918 turns the primary heaters on at 160°F and off at 170°F. TIC-917 turns the backup heaters on at 156°F and off at 170°F. The specified setpoints have a ±2°F tolerance.	Table 6.2-3: Design temperature = 300°F Operating temperature = 150 - 180°F	Sec 3.3.A.3.b: The BIT temperature shall be ≥145°F when T-ave >350°F.	IC-PM-T-918: Calibration of TIC-918 BIT heater controller.* Trip setting = 156 - 164°F. Reset = 166 - 174°F.	*Unable to calibrate TIC-918 on 3/7/91 due to broken TC well. Scheduled for repair next refueling. Status of calibration incorrectly entered into tracking system. Not listed in TS and not an operabilty issue.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
BIT boron concentration	DBD Sec 2.2.2.1: The SIS shall be capable of supplying the required reactivity shutdown margin in the event of a LOCA, a SGTR, or a MSLB to prevent an uncontrolled return to criticality. For an MSLB, the SIS will terminate a reactor power transient by rapid introduction of negative reactivity (21,000 ppm boric acid solution). DBD Sec 3.3.2: The BIT provides a source of concentrated boric acid (nominal 12 wt.% - 21,000 ppm)	Sec 6.2.2: The BIT contains 21,000 ppm boron (12% solution)	Sec 3.3.A.3.b: The BIT shall contain 20,612 to 22,735 ppm boron when T-ave >350°F. Table 4.1-2: BIT boron concentration is tested weekly.	RE-CS-012.1: Radiological procedure; requires weekly sample of the BIT boron concentration RE-CS-033: Radiological procedure with operator aids for sample points	Subsequent safety analyses have shown that the contents of the BIT are no longer required.
Accumulator boron concentration	DBD Sec 2.2.2.1: The SIS shall be capable of supplying the required reactivity shutdown margin in the event of a LOCA, a SGTR, or a MSLB to prevent an uncontrolled return to criticality. DBD Sec 3.4.3.1: Accumulator boron conc. shall be maintained as defined in the TS.	Table 6.2-2: Accumulator boron concentration = 2000 ppm	Sec 3.3.A.3.c: The four accumulators shall contain water at a boron conc. ≥2000 ppm. Table 4.1-2: Accumulator boron concentration is tested monthly.	RE-CS-012.1: Radiological procedure; requires weekly sampling of accumulator boron concentrations RE-CS-033: Radiological procedure with operator aids for sample points	

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
G. SIS Availability					
SIS testability System actuates properly in response to an SI actuation signal.	DBD Sec 2.2.1.2: SIS active components shall be capable of being tested during normal operations to verify component operability.	Sec 1.3: (GDC#37) the design provides for periodic testing of active components for operability and performance. Sec 6.2.1: The design provides for the ability to test, to the extent practical, the full operational sequence up to the design conditions for the SI system. Sec 6.1.1: In the event that one of the components should require maintenance as a result of failure to perform during the test according to prescribed limits, the redundant component is immediately tested to confirm functional availability. Sec 6.1.2: An *integrated system test is performed when the plant is cooled down and the RHR pumps are in operation. This test would not introduce flow into the RCS but would demonstrate the operation of the valves. GDC#41: Each ESF provides sufficient performance capability to accommodate any single failure of an active component and still function in a manner to avoid undue risk to the health and safety of the public.	Sec 3.3.A.3.3.e: Three HHSI pumps will be operable when T-ave ≥350°F. Sec 4.5.A.1.a: Each refueling with RCS pressure ≤350psig and temp ≤350°F, apply a test SI signal to initiate system operation. Sec 4.5.A.1.b: The system test is satisfactory if MCB indication and visual observation indicate all components received the SI signal in the proper sequence and timing, i.e., breakers operated and valves completed travel. Sec 4.5 Basis: With the pumps blocked from starting, a test signal is applied to initiate automatic action and verification is made that components receive the SI signal in the proper sequence. The test demonstrates the operation of the valves, pump circuit breakers, and automatic circuitry.	PT-M14A: SIS logic functional test; demonstrates the operability of the SIS train A logic and the proper actuation of pump and valve power breakers	Single train testing per PTs. Each train's redundant components are tested independently

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
H. SIS Overpressure Protection					
Overpressure protection of HHSI pump discharge headers injection piping (BIT and non-BIT). Setpoint pressure and relief capacity of relief valve 855	<u>DBD Sec 3.25.3.2</u>: The HHSI pump discharge headers are protected from over pressure by SI-855. The relief set point is set at the maximum allowable working pressure (at 200°F) of 1575 psig with 15% accumulation. <u>DBD Sec 3.25.3.3</u>: The relief capacity for the HHSI pump discharge piping relief valve is set at 15 gpm of borated water at 120°F.* <u>DBD</u>: The SIS piping and components shall be protected from overpressurization during all modes of plant operation. Relief valve SI-855 is installed in the common SI pump discharge headers and is set at SIS design pressure to protect lines designed for < RCS design pressure.	<u>Sec 6.2.2</u>: The SI test line relief valves are provided to relieve any pressure above design that might build up in the HHSI piping. The valves can pass a nominal 15 gpm (2.25X10^{5} cc/hr)	<u>Sec 4.2.1.3.a</u>: Inservice inspection of ASME Code Class 1, 2, and 3 components shall be performed in accordance with Section XI of the ASME B&PV Code.	<u>PT-R126</u>: Safety injection header relief valve 855 setpoint test.	

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Accumulator over pressure protection Setpoint and relief capacity of valves 892A,B,C,& D	<u>DBD</u>: Each accumulator has a relief valve sized to pass nitrogen gas at a rate in excess of the accumulator gas-fill rate. They will also pass water in excess of the maximum anticipated liquid fill rate. <u>DBD Sec 3.4.3.4</u>: Each accumulator shall be provided with over pressure protection to maintain accumulator pressure within 110% of the system design pressure. <u>DBD Sec 3.25.3.1</u>: The accumulator tanks are designed to Section III, Class C Vessels of the ASME B&PV Code. They are provided a relief valve set at the tank design pressure of 700 psig. The maximum accumulation for these valves is 15%. <u>DBD Sec 3.25.3.3</u>: The relief capacity for the accumulator relief valves is set at 1150 lbs/hr of N_2 at 20°F based upon the maximum expected liquid inlet flow with the tank isolated.	<u>Sec 6.2.2</u>: A relief valve on the accumulators protect them against pressures in excess of the design value. Relief valves are sized to pass N_2 gas in excess of the accumulator gas fill rate. <u>Table 6.2-2</u>: Relief valve setpoint = 700 psig.	<u>Sec 4.2.1.3.a</u>: Inservice inspection of ASME Code Class 1, 2, and 3 components shall be performed in accordance with Section XI of the ASME B&PV Code.	<u>PT-R108</u>: Verifies operational readiness of relief valves 892A, B, C, & D at a lift pressure of 700 ±21 psig (shop bench test). Acceptance criteria are satisfactory if the as-found and the as-left lift pressures = 679 - 721 psig. Valve leakage must be ≤10 cc/hr at 630 psig.	Testing for valve accumulation is not performed or required.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
BIT over pressure protection Setpoint and relief capacity of valve 1823.	DBD: Relief valve 1823 is installed on the discharge side of the BIT to protect from piping from a BIT heater control failure. DBD Sec 3.25.3.1: The BIT tank is designed to ASME Section III, Class C Vessels of the ASME B&PV Code and is provided with a relief valve set at the tank's design pressure of 1750 psig. The maximum accumulation allowed for this valve is 15%. DBD Sec 3.25.3.4: The relief capacity for the BIT and connected piping is specified at 3 to 5 gpm of borated water at 120°F*.	Sec 6.2.2: The SI test line relief valves are provided to relieve any pressure above design that might build up in the HHSI piping.	Sec 4.2.1.3.a: Inservice inspection of ASME Code Class 1, 2, and 3 components shall be performed in accordance with Section XI of the ASME B&PV Code.	PT-R089: Boric acid injection safety relief valve functional test. Adjusts vakve 1823 to the BIT design pressure of 1750 psig.	*The maximum relief temperature is not specified but is currently under design analysis)

Attachment B

Containment Air Recirculation Cooling and Filtration System

System Description

The Reactor Containment Air Recirculation Cooling and Filtration System (Fig. 3.0) is an Engineered Safety Feature (ESF) which provides a means to maintain containment building temperatures within the Technical Specification range of 50-130°F during normal plant operation, and to reduce containment building temperatures and remove iodine from the steam-air mixture during conditions. Four fan cooler units (FCUs) are in service at normal full power operations, with the fifth in standby with service water flow but no fan in service. Upon receipt of a safety injection signal all five fan motors start, the service water header discharge valves open to maximize heat removal from containment, and the FCU containment air filtration train aligns for service.

Containment air temperature is monitored by five resistance temperature detectors, RTDs TE-1416, located near the air inlet to each FCU. The five RTD temperature signals are averaged and the result displayed in the control room near the controls for the service water header temperature control valve.

The five FCUs are spaced symmetrically on the middle floor in the containment structure, outside of the primary reactor coolant system missile shield. During normal plant operation, hot air is drawn from the containment atmosphere through the normal inlet dampers (A,B,& C), past the Service Water cooling coils, and is discharged by the fan into the common air distribution header. The common air header is ducted to various areas throughout containment, including inside the missile shield and the upper portions of the containment structure. Following the receipt of a safety injection signal, the air flow pathway changes to a split suction to the cooling unit and fan; the charcoal filtration stream damper D and blow-in door open to provide filtration of a portion of the air stream and the normal inlet dampers (A&B) close and one normal/incident damper C goes to a preset position for incident flow. The air flow through the filtration train is through a bank of moisture separators, HEPA filters and carbon filters. The cooled and filtered air flow is directed to the common discharge air distribution header.

Cooling water is supplied to the FCUs during normal and incident conditions by the essential service water header. The FCU outlet valves (SWN-44s) are throttled and locked in a predetermined position to provide adequate cooling flow to the FCUs during all modes of operation while ensuring that other important equipment on the essential service water header maintain adequate flow during all plant conditions. For normal containment temperature control, a temperature control valve (TCV-1103) in the common discharge header of the FCUs is positioned by control room operators to regulate service water discharge flow and maintain the desired containment air temperature. In the incident mode, the service water cooling to the FCUs is maximized by fully opening two valves (TCV-1104 & TCV-1105) on the common FCU service water discharge header to ensure adequate heat removal capability. A minimum flow of 1400 gallons per minute through each FCU is assumed in accident analysis.

Service water is provided to the fan motor cooler heat exchangers with the discharge directed to a common fan motor cooler header. A minimum flow of 50 gpm through each heat exchanger is required for normal operations and accident analysis.

Two redundant radiation monitors, RE-16 & RE-23, are installed on a sampling line from the FCUs and the fan motor coolers to detect radioactive material in-leakage into service water from the containment atmosphere in the event that containment pressure exceeds service water pressure and a leak path exists. FCU inlet and discharge manual isolation valves are provided to isolate an individual FCU or motor cooler if necessary. A slip stream of service water from the supply header to the FCUs provides the driving flow to the radiation monitor mixing valve and limits the water temperature to the radiation monitor.

Heat detectors are provided for the charcoal filters in the incident air filtration path. If the temperature exceeds 400°F, an alarm annunciates in the control room and the dousing system can be manually initiated by the operator. A supply of water is available from the containment spray header during the injection phase of the accident or the RHR heat exchanger during the recirculation phase of the accident to douse the charcoal beds on indication of a hot spot or fire. Redundant motor operated valves (880s) are operated from the control room to supply the water to drench the charcoal beds.

A computer screen associated with the Critical Functions Monitoring System indicates the service water header inlet and outlet temperatures, individual flow rates and temperatures from the FCUs, and the operating status of the fan motors. Containment air temperatures from the RTDs near the FCU inlet and the containment pressure are included in the computer screen display.

Active components in this ESF system are powered from highly reliable sources. The fan motors and service water pumps are on the 480 VAC system which can be supplied from off-site power or the emergency diesel generators. 118 VAC supplies power to the process instrumentation cabinets. The system solenoid valves are powered from the 125 VDC supply system. All solenoid valves fail in the safe position on loss of electric power.

Control air for valves and dampers is supplied by the instrument air system, and all components in the system fail in their safe positions upon loss of air.

MATRIX CHARTS

The following matrix charts provide a graphic representation of the identified safety functions of the Containment Air Recirculation Cooling and Filtration System. The entries contained in each column are not exact quotes from the referenced documents, but are somewhat abbreviated for the sake of brevity so that the essential technical content is accurately represented as it existed.

The numbering scheme used for surveillance test procedures provide a code for identifying the type of test and its frequency of performance in accordance with the following:

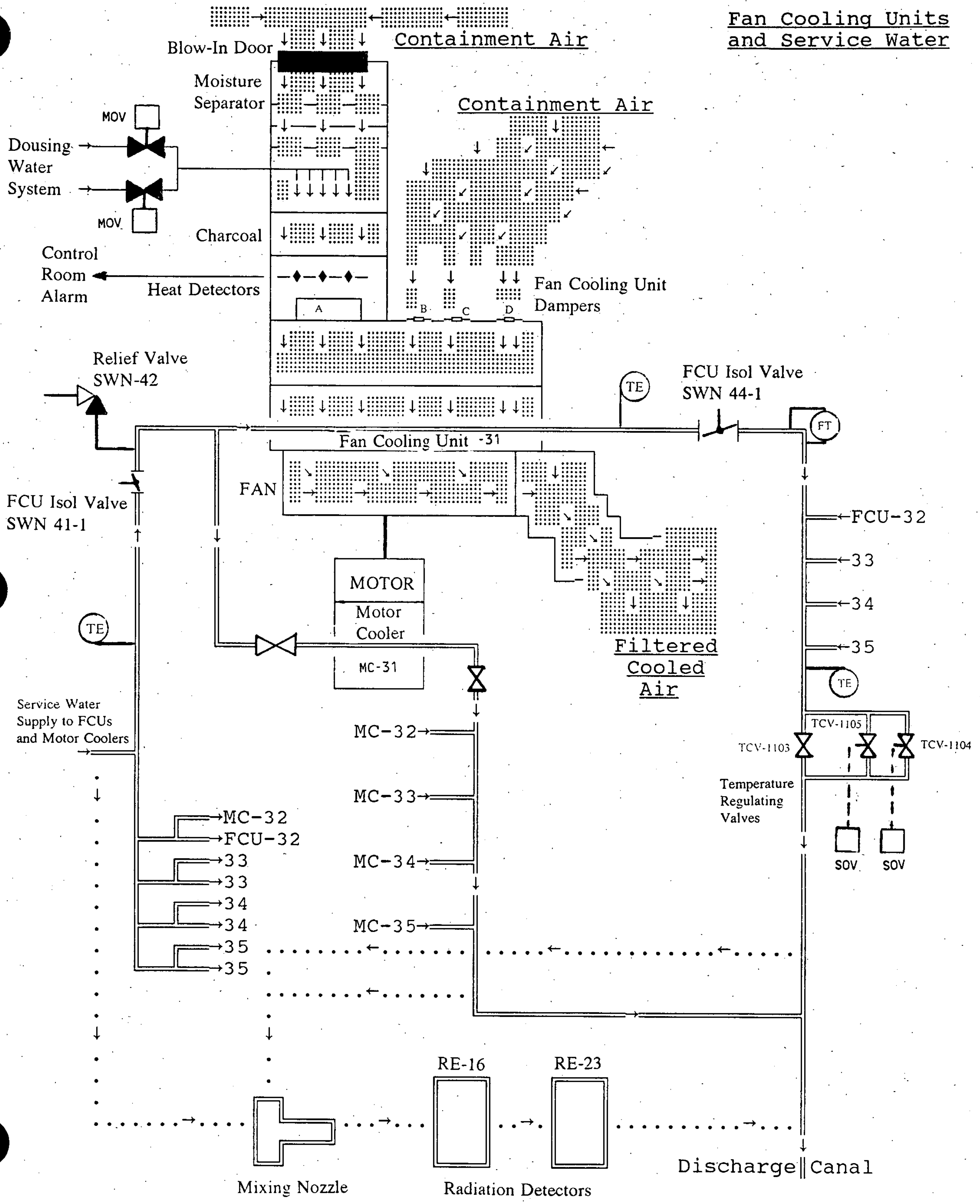
PT = Periodic Test (Unit 3)
ENG = Special Engineering Test
PC = Periodic Calibration
COL = Checkoff List

W = Weekly
M = Monthly
Q = Quarterly
SA = Semi-annual
CS = Cold Shutdown
Y = Yearly
R = Refueling
V = Variable

Attachment G contains a complete list of abbreviations and acronyms.

Figure B

Fan Cooling Units and Service Water



ATTACHMENT B

CONTAINMENT AIR RECIRCULATION COOLING AND FILTRATION SYSTEM SURVEILLANCE TEST BASES

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
FCU Air Side					
FCU Moisture Separator During post-accident operation, moisture seperators remove all entrained moisture from the containment air before the air reaches the HEPA filter to protect the HEPA filters from becoming water saturated.	MEL: Maximum Air Flow Rate 1600 CFM/unit; 8 units/Moisture Separator Maximum ΔP = 12" water gauge. Materials: Stainless Steel & Fiberglass	FSAR 6.4: Protect HEPA filters from adverse pressure due to water buildup; Influent 0.31 gpm, Effluent 0 moisture Constructed of fire resistant materials	TS 4.5.4a "Visual inspection of the filter installations shall be performed in accordance with ANSI N 510 (1975) every refueling, or at any time fire, chemical releases or work done on the filters could alter their integrity." Note: no specific reference to the moisture separator as a specific component	PFM-24: Perform visual inspection to ensure that the filters, their holding devices, gaskets, the housing and all associated components have no apparent deficiencies. Reference ANSI N510-1980 "Testing of Nuclear Air Cleaning Systems" The visual inspection is a prerequisite for testing the entire filtration system in procedure PT-R32B which has acceptance criteria to verify flow at 8000 CFM +/- 10%	The system vendor manual indicates the moisture separator is designed to withstand a continuous delta P of 12" water and the separator was designed and tested to handle a water load of 0.31 gal/1000 SCF. The design efficiency of the media permits removal of 99.9% by weight of all water droplets over 10 microns. There is no flow through this separator during normal fan cooler unit operations.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
FCU HEPA Filter During post-accident operation, removes particles 0.3 microns or larger from the containment air stream prior to the air reaching the charcoal filters.	<u>MEL</u>: Nominal air flow rate through the filter = 8000 scfm	<u>FSAR 6.4</u>: HEPA filters are capable of 99.97% removal efficiency for 0.3 micron particles post accident at incident T, 100% relative humidity. Filters are subject to manufacturer's efficiency and production tests prior to shipment in accordance with numerous standards.	<u>TS 4.5.4a</u>: "Visual inspection of the filter installations shall be performed in accordance with ANSI N 510 (1975) every refueling, or at any time fire, chemical releases or work done on the filters could alter their integrity." <u>TS 4.5.4.b(1)</u>: At each refueling demonstate the pressure drop across the combined HEPA filters and charcoal adsorber banks is <6" water at ambient conditions and accident design flow rates. <u>TS 4.5.4.c(3)</u>: Each refueling "A locally generated DOP test of the HEPA filters at ± 20% of the accident design flow rate and ambient conditions shall show ≥ 99% DOP removal." DOP=Dioctylphthalate Particles	<u>PFM-25</u>: In-Place Leak Test of HEPA Filter Bank; verifies the HEPA filters are installed properly, checks for damage, verifies no leaks or flow bypass. PFM-25 is performed when directed in PT-R32B which tests the entire filtration system. PT-R32B acceptance criteria specifies; a pressure drop across the HEPA as <6" water gage, air flow 8000 cfm ±10%, and removal efficiency for DOP >99%.	There is no flow through the HEPA filters during normal operation. 12/90 PT-R32B data results indicate the pressure drop across the combined HEPA filters and charcoal adsorber banks were < 2.2" water gage for each of the five FCUs. The acceptance criteria as stated in PT-R32B would permit acceptance of a total pressure drop < 9" (the HEPA at < 6" plus the charcoal at <3"). The licensee was notified of this procedure discrepancy and will review and modify the procedure.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
FCU Carbon Filter During post accident operation, removes fission product iodine from containment air.	MEL: Nominal air flow rate = 8000 SCFM through the carbon filter. Maximum pressure drop across filter = 6 psid iaw ASME B&PV Code Section III-1968	FSAR 6.4: Activated Carbon coimpregnated with TEDA and KI. Must remove at least 5% of the incident radioactive iodine in the form of methyl iodide at 8000 cfm design flow rate. The face velocity of the filtration path is ≈50 Feet per Minute Appendix 6C: Discussion on the removal of methyl iodide.	TS 4.5.4a: "Visual inspection of the filter installations shall be performed in accordance with ANSI N 510 (1975) every refueling, or at any time fire, chemical releases or work done on the filters could alter their integrity." TS 4.5.4.b(1): At each refueling, demonstate the pressure drop across the combined HEPA filters and charcoal adsorber banks is <6" water at ambient conditions and accident design flow rates. TS 4.5.4 c(1): At each refueling demonstrate "Impregnated activated charcoal from each of the five units shall have a methyl iodine removal efficiency ≥ 85% at ±20% of the accident design flow rate, 5-15mg/m³ inlet methyl iodine concentration, at ≥95% relative humidity and ≥250°F. In addition, ignition shall not occur below 300°F." TS 4.5.4.c(2): At each refueling, demonstrate ≥99% Freon Removal at ±20% of the accident design flow rate at ambient conditions	PFM-24: Visual Inspection of the carbon filters reviews the cells for damage, and evaluates the condition of clamping devices and gaskets. PFM-28: Representative Charcoal Sample; ensures that the sample analyzed is typical of the entire bed. PT-R032B: acceptance criteria specify the pressure drop across the carbon filter shall be <3" water gage. Acceptance criteria specify that the activated charcoal shall remove ≥85% of the Methyl Iodide (5-15 mg/m³ concentration) injected into the inlet. The air flow shall have a relative humidity ≥95% and a temperature of 250°F with an air velocity of 55FPM ±20% at 47 psig. Ignition temperature shall be >300°F. PFM-26: In-Place Leak Test; verifies proper installation, no damage or leaks, no bypassing (Freon test) which is input to the overall acceptance test PT-R032B. PT-R032B Acceptance criteria for air flow through the filtration unit is 800 cfm±10%, with removal efficiency of the carbon filter >99%.	The test results from latest test including the offsite laboratory analysis results indicated that the data met all TS limits. Two samples are typically taken from each fan cooler unit, with one sent to the offsite lab, the other retained as a precaution until the laboratory results have been confirmed. The ignition temperature on the Test Certificate supplied by the charcoal supplier indicated the Ignition Temperature iaw ASTM D-3466-76 was 344C for the coconut shell carbon installed in the beds. A typo in TS, duplicated in the procedure should be >300°C not °F for the ignition limit. Heat Detectors are set at 400°F. Refer to the dousing system in this matrix for additional information. During normal operations, there is no flow through the carbon filters.

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FCU Dampers Normal Inlet Dampers A & B w/Solenoid Operator Normally these dampers are open, but close during post accident operation when the air filtration path goes into service. The dampers provide the normal air supply to the fan cooler unit.	MEL: Dampers are open for normal operation; open w/Fan in Service and closed in the accident mode. SOV to open in accident mode; (fails closed) Damper A: 24"Wx72"H, max flow = 26,600 CFM Damper B: 48"Wx60"H, max flow = 27,600 cfm Solenoid Operator is powered from 125V DC supply.	These dampers are not discussed in any specific detail in the FSAR	TS 3.3.5.b.1.b.: The 5 Fan Cooler-charcoal filter units and the two spray pumps, with their associated valves and piping, must be operable above cold shutdown. Note: no direct reference to dampers or their operability.	PFM-24: Visual inspection of dampers for damage or distortion of frame or blades, bent pivot pins, operator, and check of seats and blade edging. PT-R032B: verifies the dampers position correctly when the fan is manually started in the "Incident" mode; actual position and control room position indication are verified. see note 1	Control Room position indication of damper position available during all operating conditions. Note 1: The dampers are not called out with specific acceptance criteria in PT-R032B, but in the procedure Cautions and Limitations there is a statement that the dampers must operate properly before commencing the filter testing portion of this procedure, therefore the procedure could not be completed satisfactorily without proper damper operation.

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FCU Dampers Normal & Incident Damper C During post accident operation, the C damper opens to a fixed position to channel containment air directly to the fan cooler unit.	MEL: During normal operation, damper is in the open Position w/Fan in service. Nominal Flow = 15,000 cfm Accident Operation - Damper remains open to a preset position to meet accident flow requirements. This flow intentionally bypasses the charcoal filter path. Nominal Flow = 26,000 CFM Solenoid Operated, Vertical Damper, 24"W x60"H	FSAR 6.4: Damper "C" has a preset position.	TS 3.3.5.b.1.b: "The 5 Fan Cooler-charcoal filter units and the two spray pumps, with their associated valves and piping, are operable" above cold shutdown. Note: no direct reference to damper	PFM-24: Visual inspection of dampers including; damage or distortion of frame or blades, bent pivot pins, operator, check of seats and blade edging. PT-R032B: verifies the dampers position correctly when the fan is manually started in the "Incident" mode; actual position and control room position indication are verified. Note 1 (previous page) applies.	No containment entry is made when the unit is at full power. The damper is physically limited to full open or the preset accident position. Flow was established by the preset damper positioning.
FCU Dampers Incident Damper D During post-accident operation, the "D" damper opens; provids a flow path from the carbon filters exhaust to the fan cooler unit	MEL: Damper "D" is closed during normal operation, damper fails open upon loss of electrical signal to the solenoid. Vertical Damper 30"W x 84"H. The Maximum Flow of air through the filtration path is nominally = 8000 cfm.	FSAR 1.3: Closed Dampers periodically tested in non-operating unit. Deflection is verified by instruments in the control room. FSAR 6.4: A "Leak tight" damper prevents air inleakage into charcoal to prevent deterioration. Safety injection signal trips a 3 way control air SOV so the accident damper & filtration inlet open.	TS 4.5.4 b(3): At each refueling outage "The charcoal filter isolation valves shall be tested to verify operability"	PT-R032B: verifies the dampers position correctly when the fan is manually started in the "Incident" mode; actual position and control room position indication are verified. Note 1 (previous page) applies.	Control room indication of damper position is available during all operating conditions. The "D" Damper is normally closed to protect the carbon filter train.
FCU Blow-In Door During post accident operation the door opens, providing air flow into the moisture separator	MEL: Door closed in normal operation. Door mounted on the inlet side of filter unit, opened during an accident by an external overpressure of 0.5psi and/or a pneumatic air cylinder.	FSAR 6.4: Damper and Blow in Door Fail Open Safety Injection signal trips a 3 way control air SOV so accident damper and filtration inlet open.	TS 4.5.4 b(3): At each refueling outage "The charcoal filter isolation valves shall be tested to verify operability"	PT-R032B: verifies the blow-in doors position correctly when the fan is manually started in the "Incident" mode; actual position and control room position indication are verified. Note 1 applies	Control room indication of damper position available during all operating conditions.

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Containment Recirculation Fans; fan motor During post-accident conditions, the fan has a suction path from the air filtration pathway through damper "D" and an unfiltered air supply through damper "C" discharging into a common discharge header.	MEL: Capacity ≈70,000 SCFM; 225 Horsepower motor at 720 rpm; 1 Stage, centrifugal Load: +160.0 KW +j136.83 KVAR (Electrical Load Study Calculation, pg 9)	FSAR 6.4; "Each fan can provide a minimum flow rate of 34,000 cfm when operating against system resistance of approximately 8.6" s.p. existing during the accident condition" Expected motor bearings temperatures: 125-140C during incident conditions FSAR 5.3.2.2 & Table 5.3-1: Normal air flow/FCU approx. 70,000 cfm Post Accident air flow approx. 34,000 cfm with 8,000 CFM thru the filtration flow path. Table 8.2-1A: The load schedule for the diesel indicates that each FCU is rated for 160 KW maximum.	TS 4.5.4 b(2): Containment Air Filtration System: At each refueling outage "Using either direct or indirect measurements, the flow rate of the system fans shall be shown to be at least 90% of the accident design flow rate."	PFM-23: The air flow traverse generic procedure is used in combination with the overall system acceptance test PT-R032B. Acceptance criteria requires that the air flow through the filtration unit shall be 8000 cfm ±10% (7200-8800) PT-R032B: Fans are started and stopped manually in the Incident Mode PT-R90B: Emergency Local Operational Test of the FCUs - verifies that an alarm is received in the Control room when a fan is taken to local control, and verifies the fan will start from a local panel. Operability Criteria: Operable if all five units can be started and stopped at the local station. PT-R03D: Step 3.40 verifies the fans are loaded automatically on to the Diesel Generator after an auto diesel start. PT-R24: Containment FCU Coil Fouling Inspection checks for excessive fouling of the air side of the cooling coils Operability Criteria: Satisfied when the visual observation described in procedure shows no discrepancies present (e.g. no buildup of dirt, lint, grease, or foreign material)	Methods used to monitor fan performance: Containment Entry is made following approximately 2000 hours of fan operation for lubrication and inspection per LUB-001-GEN. The Performance and Reliability Group trend motor and fan vibration on a periodic basis, and distribute trend results to operations, et al. The fan with the highest vibration readings was the fan in standby. The acceptance criteria of PT-R032B were met in the 12/90 test. PT-R90B was performed sat in 5/91. PT-R3D was performed sat in 12/90 PT-R24 was performed 10/90. No major fouling was observed.

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FCU Common Discharge Air Header The distribution header routes cooled air from the 5 FCUs to various locations in containment.	A completed engineering design basis document was not available. MEL: Duct Relief Disks: 12" O.D. X 8" long; lift pressure = 3 psid	FSAR 6.4: Ducting designed to withstand reactor coolant system energy and energy from associated chemical reactions. Dampers along ducts open at slight overpressure ≈3.0 psid. Ducting designed & supported to withstand the maximum thermal expansion during a design basis accident. FSAR 5.3: The recirculating ductwork located in the annulus was provided with spring loaded relief dampers designed to open inward when external pressure on the ductwork reaches 3 psig.	No TS testing of the ventilation relief protection is specified or required.	No test procedures existed to test the relief dampers.	Relief dampers are passive components. Licensee does not inspect the relief dampers. No regulatory or industry standard type requirement for periodic testing of these valves could be identified.
Containment Air Temperatures 5 RTDs provide average containment air temperature indication during all operating conditions.	Maximum design Temperature of RTD = 500°F, Minimum = 0°F; Input;Output: 40-400°F; 101.7 - 177.5 ohms	FSAR 6.4: Ambient temperature controlled by manually modulating the service water flow through the fan coolers. Average temperature indication is available at the QSPDS display and at the CCR Supervisory Panel. Individual temperatures for each RTD are displayed at the Critical Function Monitoring Screen. An increase in ambient temperature indicates fan cooler failure or service water discharge control valve malfunction. Either cause can be easily checked.	TS 3.6.C: Containment Ambient Temp shall be >50°F but shall not to exceed 130°F when above the cold shutdown condition. "Containment ambient temperature shall be the arithmetic average of temperatures measured at no fewer than 4 locations, at least once per 24 hrs" TS Table 4.1-1: requires a daily check and calibration during refuelings.	PC-R37: Containment Temperature Calibration includes a check of the control room alarm, the temperature indicators in a control room back panel, and the computer output to the Critical Function Monitoring System screen Acceptance Criteria: operable if "as found" within procedure specified limits. The average containment temperature is manually logged every 4 hours in the contol room.	PC-R37 was performed during the refueling in 11/90. RTDs were calibrated for a range of 40-400°F. The temperature averaging circuit logic will annunciate in the control room if an RTD fails. In accordance with alarm response procedures, the operator would monitor individual temperatures at the control room back panel to verify four valid inputs remain in service.

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Service Water Side					
Service Water Temperature Indication Provides indication of the cooling water inlet header temperature flowing **TO** each FCU, FROM each FCU and the common cooling water header discharge temperature during all operating conditions The temperature information is provided to verify containment heat removal capability	The cooling water inlet header temperature instrument was upgraded as described in NSE 86-03-019, the engineering evaluation associated with the modification to comply w/ Reg. Guide 1.97 (Enhanced Post-LOCA Monitoring). The existing equipment was upgraded to a strap on platinum RTD, which was thermally insulated to minimize local environment effects on the readings. MEL; DBD-SW Sec. 3.23: Temperature from each FCU: Range 50-150°F; Maximum Design Temperature = 500°F. The common cooling water discharge Temperature: Range is 0-250°F Temperatures for ALL of the above are displayed on the Critical Function Monitoring System Screen	FSAR 6.4: EQ qualified RTD's are installed on the fan cooler service water outlet lines and a RTD is installed on the inlet line to provide ΔT indication on the critical function monitoring system (CFMS).	(Not addressed)	PC-R42: FCU Service Water ΔT Calibration includes calibration of the RTDs in the service water inlet and discharge piping. The RTDs are calibrated for the range of 50-150°F. The acceptance criteria stated "FCU Service water ΔT function shall be considered operable if the "As Found" R/I values are within ± 0.02 VDC and the CFMS temperature readings are within ± 1°F. IC-PC-I-T-1178/22: (formerly IC-PC-SW-Temp) Calibrates the FCU common discharge header temperature indicator. The instrument range was 0-250°F, with acceptance criteria; "As Left data are within ±5°F (±2%) of Acceptable values." The Acceptable values are specified in the procedure.	

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FCU Supply Isolation Valve SWN-41, & FCU Motor Cooler Outlet Isolation Valve SWN-71 These valves are normally full open in all operating conditions, may be manually closed post-accident if necessary to isolate an individual FCU or FCU motor cooler.	MEL: The FCU supply valve is a 10" valve with a manual & remote manual operator. It is full open in all modes except the isolation mode. Maximum Design Pressure = 150 psig, Maximum Design Temperature - 160°F MEL: The motor cooler outlet valve is a 2" manual valve, full open in all modes except isolation Maximum Design Pressure = 150 psig. Maximum Design Temperature = 160°F.	FSAR 5.2, Table 5.2.3: Containment Piping Penetrations and Valving CIV sheet includes the SWN-41 and SWN-71 valves. The table includes: Operating Type - manual; Position - open all modes; Minimum test pressure = 47 psig.	TS Table 3.6-1: Non Automatic CIVs Open Continuously or Intermittently for Plant Operation includes SWN-41 and SWN-71 valves. TS Table 4.4-1: CIV; Isolation valves in Table 4.4-1 shall be tested for operability at intervals no greater than 2 years with test fluid and pressure specified. SWN-41 and SWN-71 valves are to be tested with water @ 47 psig	These valves are included in the IP-3 ISI Program) PT-Q77: Containment FCU manual Isolation valves are exercised fully open & closed. The acceptance Criteria are satisfied if manual valves are exercised as the procedure requires. PT-R35: CIV Leakage Test Data Sheets 29-33 provide the test configuration to test the valves associated with each FCU. Water is used with 47 +1,-0 psig maintained. If the average leakage rate >1350 cc/min the ISI Supervisor is to be informed.	PT-Q77 was completed satisfactorily in 9/91.
FCU Supply Pressure Relief Valve SWN-42 Provides relief protection for each fan cooling coil during the isolation of an individual FCU	MEL: The valve is rated at 150 psig.	FSAR 6.4: The design internal pressure of FCU cooling coils is 150 psig at 300°F. The coils can withstand an external pressure of 47 psig at 271°F.	TS Table 4.4-1: CIV; Isolation valves in Table 4.4-1 shall be tested for operability at intervals no greater than 2 years with test fluid and pressure specified. SWN-42 valves are to be tested with water at 47 psig.	PT-R106: Verifies operational readiness of relief valves at 150+/-5 psig by water test, and includes a leakage determination. Acceptance criteria is satisfied if the "as Found" is within the range of 145-155 psig, and the "As Left" leakage is <3 cc/min. PT-R35: CIV Leakage Test Data Sheets 29-33 provide the test configuration to test the valves associated with each FCU. Water is used with 47 +1,-0 psig maintained. If the average leakage rate is >1350 cc/min the ISI Supervisor is to be informed.	The as-found data sheet for PT-R106 indicated the results were within the range of the acceptance criteria.

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Containment Fan Cooler Unit (FCU) 5 units located outside the missile shield on the middle elevation of containment Provide the heat transfer surface for hot containment air to transfer heat to service water.	MEL: Maximum design pressure = 150 psig; Maximum design Temp = 300°F; Heat Transfer Area = 30K ft^2; The FCU is capable of 76.32M BTU/hr at saturated conditions & 47 psig. The Safety Evaluation for an Ultimate Heat Sink Temperature Increase to 95°F (WCAP-12313); Table 4.3 and DBD-SW Table 4.1-1 concludes that the FCU must provide a minimum of 1400 gpm/FCU at accident conditions of 271°F and 47 psig, w/95°F river water WCAP-12313 assumed a fouling factor of 0.004; 4% of the SW Tubes to be Plugged; and fan capacity post-accident = 34,000 cfm. The safety evaluation (NSE 81-03-055 FCU), associated with the replacement of the original cooler units with AL-6X stainless steel tubes, and with 4-pass water flow and copper fins (3/4 refueling outage) documented the analysis on design heat removal capability. Containment integrity is maintained post-LOCA using a heat removal rate of 49X10^6 BTU/hr per FCU.	FSAR 5.3.2.2: Service Water removes: 2.3X10^6 Btu/hr during normal operation, 49 E6 Btu/hr-accident per FCU when 1400 gpm cooling water at 95°F inlet Temp (7/91 rev to the FSAR) FSAR 6.4: The objective is remove 74.5X10^6 Btu/hr from Containment at 47 psig and 271°F. FSAR 6.4: Heat removal capability of the cooling coils is 49X10^6 Btu/hr per FCU at saturation conditions (271°F and 47 psig) Note: the information on page 4, apparently was not updated to reflect the WCAP-12313 analysis. See Inspector Comments #2	TS 5.2.C.2: The design features each FCU capable of transferring heat at a rate of 21,200 Btu/sec-unit @ 47 psig, 271°F. All FCUs equipped with activated charcoal filters to remove volatile iodine following an accident.	Eng-281: Post Service Water Pump replacement: flow balance and flow verification completed May 25, 1989. The FCU outlet valves (SWN-44s) were positioned and locked in a throttled position to maintain flow balance and ensure a minimum flow of 1400 gpm/FCU in the accident configuration PT-V33: Recirc Fan Cooler Unit Flush maximized SW flow and pressure and flushed the ventilation cooling coils for 1 hour. Completed 9/18/90. The redundant fail open discharge valves (TCV-1104 & 1105) were open during the flush. With all SW flow directed through one FCU at a time, flows >2500 gpm/FCU Acceptance Criteria required a minimum 1 hour flush for each FCU. See Inspector Comments #3.	1. Functionally: Any of the following combinations will Maintain Containment below the design capacity limits: T = 271°F; pressure = 47 psig, 5 FCUs, or 3 FCUs + 1 Containment Spray, or 2 Containment Spray 2. Extensive analysis has been performed for numerous MW ratings and SW temperature assumptions since the original design. The conclusion per WCAP-12313, with 1400 gpm flow per FCU under accident conditions were that adequate heat removal capability was available to maintain containment below 271°F, 47 psig. Flow rate established by permanently positioning valves. 3. Activities have been conducted to assure that the minimum SW flow to the FCUs will be maintained: FCU #31 was inspected per HTX-001-Gen during last refuel outage (included Eddy Current Testing). Test results indicated no degradation. Licensee's test plans to inspect 2 additional FCUs during the 8/9 Refuel outage ('92). Also, a pilot heat exchanger performance monitoring program that is being implemented includes the FCUs. PT-V33 data indicated no significant change in pressures noted

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FCU Discharge Flow Transmitter Water flow rates from each FCU are provided to assist in verifying adequate containment heat removal capability during all modes of operation.	<u>MEL</u>: DBD-SW Sec. 3.2.6; Range 0-2500 gpm, Design Pressure Max 160 psig, Design Temp Max 120°F; Power Supply = 125 VDC. Provides indication to control room and displays on the Critical Function Monitoring System Screen During the modification described in safety evaluation NSE 86-03-018SWS to comply with Regulatory Guide 1.97 (Post LOCA Monitoring enhancements) the original transmitters were upgraded to IEEE-323-1974 & IEEE 344-1975, changed sensing lines to 3/4" from 3/8" to minimize crud trapping.	<u>FSAR 6.4</u>: flow measurement of each fan cooler service water effluent is provided by an indicating flow transmitter installed in each line	(Not addressed in TS)	<u>IC-PM-F1123</u>: This procedure is used for calibration and preventative maintenance of FCU service water flow transmitters and indicators. The procedure lists the materials required to maintain transmitter environmental qualification. Flow Range calibrated - 0-2500 gpm The acceptance criteria requires that the "As-Left data are within ±0.9in. Water Column (2.5%) of acceptable values." Acceptable values are specified in the procedure.	The transmitter is an elbow tap w/limitations by design. Program on heat exchanger performance monitoring will provide additional data for system monitoring. A pilot program is being implemented.

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FCU Manual Outlet Isolation Valve SWN-44 The permanently established throttled position of these valves ensures that the minimum accident service water flow of 1400 gpm is achievable to maintain heat removal capability	MEL; DBD-SW Sec. 3.15: Design Flow = 2900 gpm; Maximum Design Pressure = 150 psig; Maximum Design Temp = 160°F; 10" Manual Containment Isolation Valve (ASME XI), valve throttle position must satisfy both individual and system flow limits and cannot be altered w/o evaluation of the consequences. May be used to isolate FCU if radiation is detected in a SW line following an accident. DBD-SW Table 2.3-1: The throttled position limits the service water flow during the post-LOCA injection phase such that each FCU receives at least 1400 gpm and all other essential flow requirements are satisfied.	FSAR 5.2 Table 5.2.3: Containment Piping Penetrations and Valving Sheet includes the SWN-44 valves. The table also includes the following information: Operating Type - manual; Position = open all in modes; Minimum test pressure = 47 psig.	TS Table 3.6-1: Non-Automatic CIVs - Open Continuously or Intermittently for Plant Operation; The table includes SWN-44 valves. TS Table 4.4-1: Isolation valves in Table 4.4-1 shall be tested for operability at intervals not greater than 2 years with test fluid at pressure specified. SWN-44 valves are tested with water @ 47 psig.	PT-Q77: Containment FCU Manual Isolation Valves; each valve is fully opened & closed. Acceptance Criteria is satisfied if manual valves are exercised as the procedure requires. PT-R35: 4 Leakage Test Data Sheets provide the configuration to test the valves associated with each FCU. Water is used at 47 +1,-0 psig. If the average leakage rate is > 1350 cc/min, the ISI Supervisor is to be informed.	Procedure PT-Q77 specifies the throttled and locked position for these valves which is consistent with ENG-281 flow balancing and the locked valve check off list position. COLs for Fan Cooler Unit Service Water Verification. Service Water System and Locked Valve Check off List specified correct throttled positions.
Service Water Temperature Control Valve Normal Ops TCV-1103 This valve is manually throttled by the control room operators to regulate the cooling water flow to maintain the desired containment temperature during normal operating conditions	MEL; DBD-SW Sec 3.10: This 8" manual valve is designed for throttling to regulate SW flow in common discharge line from FCUs to maintain Containment 50-130°F during normal operation. Fails open on loss of air. Maximum Design Pressure 150 psig Maximum Design Temp 160°F	This valve is not discussed in specific detail in the FSAR	TS 3.6.c.1 &2: Containment Temperature >50°F if above cold shutdown, but shall not exceed 130°F TS 3.3.5.B.1.b: Rx shall not be >cold shutdown unless 5 FCUs and associated valves are operable.	Control Room Operators manually adjust valve to maintain desired temperature. Average Containment Temperature is logged every 4 hours	Valve continually in service; no requirement for full open/full closed stroking. No accident function assumed.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Service Water Discharge Isolation Valves TCV-1104,1105 These large valves located in the common discharge header open post-acccident to maximize cooling water flow through the FCUs and increase heat removal capability from containment.	MEL; DBD-SW, Sec 3.10: These 18" redundant, fail open, full flow valves open on Safety Injection or high containment pressure to maximize flow through the FCUs. Pneumatic, spring, diaphragm operators have high reliability. When the solenoid air operator is deenergized, the air vents and valve opens to ensure supply of SW to FCUs on loss of power. Maximum design pressure = 150 psig; maximum design Temp = 160°F (ASME Section XI).	FSAR 9.6: Both valves fail open upon loss of air pressure, either valve 100% service water flow capacity. FSAR 1.3: GDC-40; valves auto open on high pressure in containment or on a Safety Injection signal.	TS 3.3.5.B.1.b: The reactor shall not be above cold shutdown unless 5 FCUs and associated valves are operable.	PT-Q16: Quarterly test for operability and to obtain ISI data. Operability Requirements are met for the Inservice Inspection Program if the valves were cycled and the stoke time are ≤ time limits specified in procedure (ie, opens in ≤5 sec). PT-R3D: Step 3.44; confirms the automatic valve open feature during the automatic diesel start and loading following an SI signal The valves were failed open during the May 25, 1989 SW flow test, ENG-281, to simulate accident conditions prior to balancing the essential water flow paths.	PT-Q16 was performed in 10/91. The valves met the overall acceptance criteria and opened in <2 sec.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
FCUs Motor Coolers An individual motor cooler heat exchanger maintains adequate cooling for each fan motor.	The Safety Evaluation for the Ultimate Heat Sink Temperature Increase to 95°F at IP3 (WCAP 12313) Table 4-6, and FSAR Table 9.6-1 concluded that a minimum service water flow rate of 50 gpm per motor cooler must be provided (normal operation and accident condition) assuming a 95°F River Temp. in order to provide adequate heat removal capability. The evaluation assumed a fouling factor of 0.004, with 10% of the SW tubes plugged. Based upon the positive performance of the AL-6X stainless steel used in the replacement FCUs, the motor coolers were upgraded by installing the same materials used in the FCUs with a two pass flow. Safety evaluation (NSE 85-3-113 FCU) describes the modification.	FSAR 6.4: The heat removal capability of motor cooler = 110,868 Btu/hr at 271°F and 47 psig. The Safety Evaluation (NSE 85-3-113 FCU) for the replacement coolers indicated the original design heat removal capability was 97,933 BTU/hr with numerous assumptions. The guaranteed value for the replacement units that are currently installed is 98,661 BTU/hr with a 10% tube plugs allowed while maintaining minimum cooling capacity.	(Not addressed in TS)	ENG-281: Flow was verified during the balance test performed on May 25, 1989. Service water flow was verified >250 gpm at the common discharge of the motor coolers under accident flow conditions simulated during the test. Plant operators log the flow from the local indicator on a daily basis. The range is 250-280 gpm.	The vendor technical manual states 50 gpm per cooler is adequate for normal and accident conditions

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Dousing System					
Dousing System Water Supply A water source is provided to drench the carbon filters if a fire/hot spot is detected due to the heat produced from decay of isotopes filtered during post-accident recovery.	FSAR 6.4: Dousing Flow (≈12 gpm per FCU) was sized to wet carbon completely and to remove the decay heat of the adsorbed iodine. Prevents heating to the ignition temperature. Provisions are installed for testing thru an air hose connection.	FSAR 6.4: Drench the absorbers (charcoal) thoroughly in the event of a carbon fire during the post-accident recovery. The water supply is from the containment spray header during the injection phase. The water sypply is from discharge of the RHR HX during the recirc phase.	TS 3.14.B.1.c: The system must be operable whenever the filter units are operable. TS 4.12.b.1: Verify valve in correct position monthly if accessible location (these valves are considered inaccessible-in containment) Cycle the valves every 18 months.	PT-R41: Charcoal Filter Dousing Inspection: drains the system, strokes valves. Acceptance criteria includes: all 880 valves fully cycle open and close; verification of FCU spray header completed; no blockage of FCU spray nozzles exists. PT-3Y3: Fan Cooler Unit Dousing Air Flow Test; Drain lines and connect air supply to go thru dousing valves & verify air flow at nozzle near the charcoal. Acceptance criteria: FCU nozzles are considered operable if no abnormalities are found that would impair their operation.	The most recent PT-R41 (11/90), noted no blockage of spray nozzles. Original Acceptance of Test Results (5/12/75 ltr) for INT-TP-4.5.9 Containment Spray and Filter Dousing. The acceptance was based upon air flow through individual nozzles- similar to current test. PT-3Y3 performed 4/89 as part of 3 yr cycle. The licensee plans to evaluate the elimination of the filtration system. If the charcoal is removed, the function of the dousing system would be unnecessary.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Charcoal Filter High Temperature Detectors 6 installed per FCU which monitor the air temperature at the discharge of the carbon filters. Provides an early warning to the control room operator of a hot spot/fire in the carbon beds during the post-accident recovery period	<u>MEL</u>: Capability for Detecting and alarming the presence of fires and localilzed hot spots in the carbon filters	<u>FSAR Table 5.3.-1 and Sec 6.4</u>: Setpoint = 400°F (Per Corporate Engineering): The Basis of the Setpoint was to establish a temperature significantly below the carbon ignition temperature (≈680°F) so the system will provide an adequate warning of fire significantly above maximum containment design temmperature to minimize false alarm conditions.	<u>TS Table 3.14-1</u>: Must have a minimum of 4 operable Heat detectors/FCU when the system is required to be operable. <u>TS 4.12.D.1.b(iii)</u>: the operability of heat detectors including the actuation of appropriate alarms shall be verified every 18 months.	<u>PT-R43</u>: Fan Cooler Unit Heat Detectors test. Performed every refueling outage to verify operability iaw TS. The test uses a heat gun locally and verifies the alarm in control room. Operability criteria: FCU charcoal heat detector system shall be considered operable if at least 4 heat detectors per FCU alarm in the control room.	PT-R43 was performed on 12/90. Alarm Response Procedure SMF-SI: "Carbon Filter High Temperature" - setpoint = 400°F. Detectors are made of a bimetallic material which by design is highly reliable, vendors confirmation tests are used for setpoint confirmation since no degradation is anticipated. There is normally no flow through the carbon filter flow during normal operating conditions.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Radiation Monitoring					
Radiation Monitor Mixing Nozzle SWN-74 The mixing nozzle is normally in service with cool service water from the supply heaader being combined with warmer water from the discharge of the FCUs and fan motor coolers to limit the sample water temperature to the radiation elements for equipment protection reasons	MEL; DBD-SW 3.5.3.1: The 2" mixing nozzle maintains SW supply to rad monitors below 160°F to protect radiation detectors. 1 gpm supply service water for every 13 gpm of Service Water from return of FCU. Maximum Design Pressure = 150 psig; Maximum Design Temperature = 500°F.	FSAR Table 9.6-1: A minimum of 60 gpm service water flow is required (same for normal operating conditions and accident) assuming 95°F river temp	TS 3.1, Table 3.1-1: Service Water System Effluent Line specified testing/surveillance frequencies as Daily, monthly, quarterly, and during refueling.	Service water flow greater than minimum requirements (60 gpm) is verified during the flow balance test ENG-281 (performed May 25, 1989). Total flow is verified locally by operators and recorded on daily rounds; expected flow is 150-180 gpm.	Mixing nozzle is normally in service. Service water valves are maintained in the balanced flow configuration established during the 1989 ENG-281 test. During Refueling Outage 8/9, licensee plans to modify the flow path to the radiation monitor and to change the type of monitor. As a result, this mixing nozzle will be removed.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Radiation Elements RE-16 & RE-23 The radiation detectors are in service during all operational modes to provide monitoring of the cooling water discharge flow	Off-site Dose Calculation Manual ODCM & Standard Radiological Technical Specifications RETS: Provide Leak Detection from Containment FCUs and motor coolers during post LOCA conditions. During normal operation provided monitoring of liquid effluent.	FSAR 9.6: The Vent Cooler Discharge is monitored for Radioactivity	TS 3.1, Table 3.1-1: Service Water System Effluent Line specified testing/surveillance frequencies as Daily, monthly, quarterly, and during refueling.	PC-R13: Process Radiation Monitor Calibration is performed during refueling outage. Acceptance Criteria is met if the "as left" values and annunciator actions function as required by the procedure. PT-Q11: The Process Radiation Monitors Calibration Check is performed quarterly. Acceptance Criteria is met if process radiation monitors' "as left" source readings minus their respective background readings is within their respective Decay Corrected Accceptable Range as specified in the procedure. PT-M36: Process Radiation Monitor - Monthly Functional Test. Acceptance Criteria includes satisfactory setpoint specification, checksource required response, and annunciator response Daily Channel Check recorded on Control Room Operator Log sheet. Functionally, if radiation is detected then FCU and FCU motor cooler outlet Hi RAD would alarm in control room. Investigation and isolation of the leaking unit is possible.	Control Room Instrumentation indicated that the level during normal operation is well below the alarm setpoint. The rad monitor is currently located in a relatively high background area. During the 8/9 Refueling Outage in 1992, the RE-16 and RE-23 will be replaced with radiation detectors with more reliable electronics. The monitors will be relocated to a low background area and the sample dilution will be eliminated due to reduced temperature dependence of the detectors. MOD 90-03-290RMS & ENG-414E

Attachment C

Auxiliary Feedwater System

Auxiliary Feedwater System Description

(Figure C provides an AFW system diagram) The AFW system was provided to supply SG feedwater when the normal high-flow capacity MFW system is unavailable or its use is undesirable (hard to control at low-flows). Thus, the AFW system is used for normal reactor startups and cooldowns as well as for accident conditions such as loss of normal feedwater, loss of coolant accident (LOCA), or other event leading in reduced SG inventory.

AFW is supplied by diverse subsystems consisting of: 1) a single turbine-driven (TD) AFW pump supplying all four SGs; or, 2) two motor-driven (MD) AFW pumps each supplying two SGs. The turbine-driven AFW pump is powered by steam from the main steam (MS) system independent of all AC. Control power is 125 VDC supplied by the diverse station batteries. The motor-driven AFW pumps are powered from diverse engineered safety buses 31 and 32, backed up by the emergency diesel generators (EDG).

The AFW pump suction is from the 600,000 gallon CST which is automatically controlled to guaranty 360,000 gallons of water for just the AFW system. Backup pump suction is from the city water system (CWS) where up to 1.5 million gallons is available.

The AFW system performs its design function supported by other plant sub-systems including station electrical (both AC and DC), pressure, temperature, and flow instrumentation, pump initiation and control circuits, seal water, lubricating oil, etc.

MATRIX CHARTS

The following matrix charts provide a graphic representation of the identified safety functions of the Auxiliary Feedwater System. The entries contained in each column are not exact quotes from the referenced documents, but are somewhat abbreviated for the sake of brevity so that the essential technical content is accurately represented as it existed.

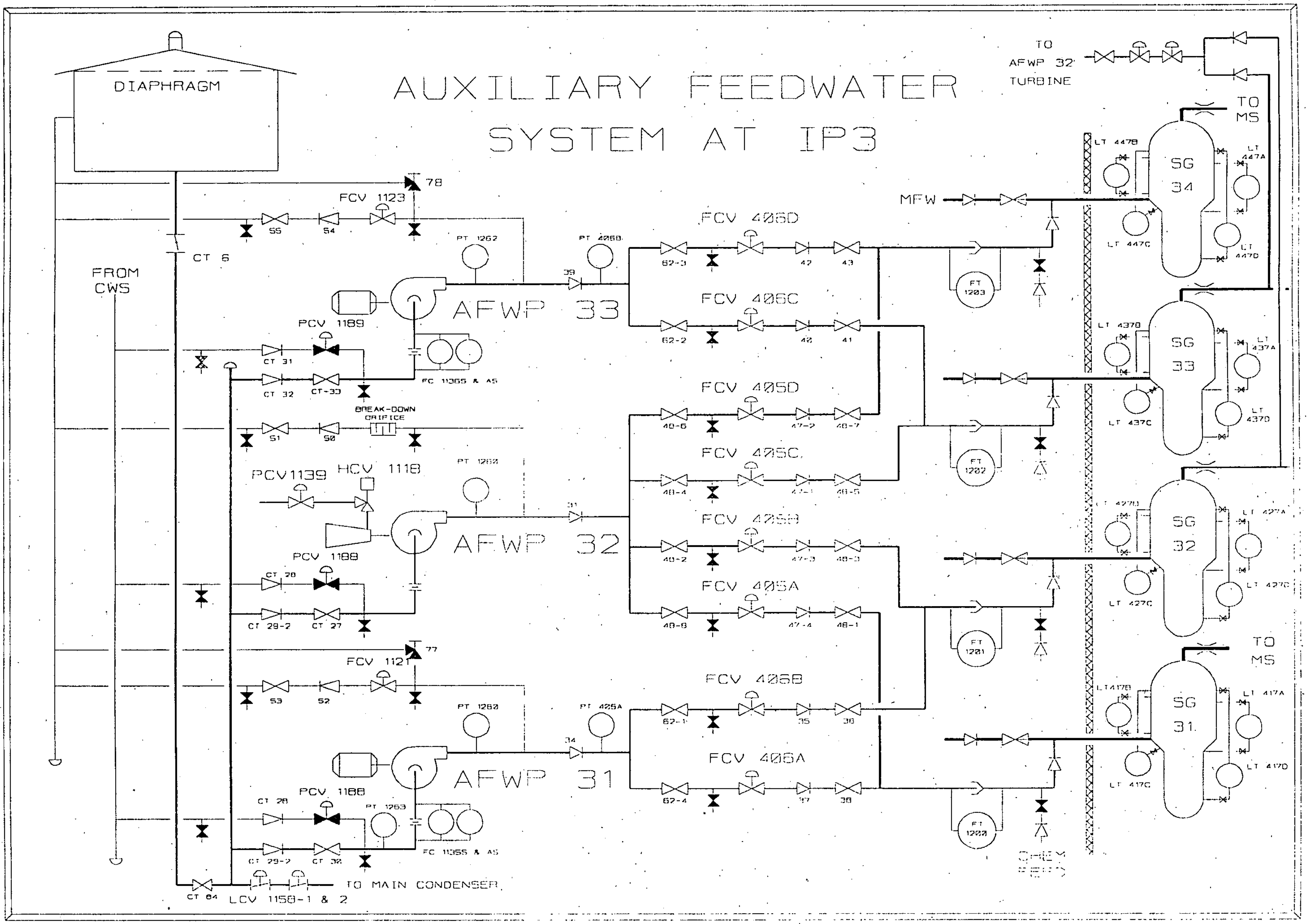
The numbering scheme used for surveillance test procedures provide a code for identifying the type of test and its frequency of performance in accordance with the following:

PT = Periodic Test (Unit 3)
ENG = Special Engineering Test
PC = Periodic Calibration

W = Weekly
M = Monthly
Q = Quarterly
SA = Semi-annual
CS = Cold Shutdown
Y = Yearly
R = Refueling
V = Variable

Attachment G contains a complete list of abbreviations and acronyms.

Figure C



AUXILIARY FEEDWATER SYSTEM AT IP3
DIAPHRAGM
FROM CWS
CT 6
FCV 1123
78
55
54
PT 1262
PT 405B
39
AFWP 33
PCV 1189
CT 31
CT 32
CT-33
FC 1136S & AS
BREAK-DOWN ORIFICE
51
50
PCV1139
HCV 1118
PT 1260
31
AFWP 32
PCV 1188
CT 28
CT 29-2
CT 27
FCV 1121
77
53
52
PT 1260
PT 405A
34
AFWP 31
CT 30
PT 1263
FC 1135S & AS
CT 64
LCV 1158-1 & 2
TO MAIN CONDENSER
FCV 406D
62-3
42
43
FCV 406C
62-2
40
41
FCV 405D
48-6
47-2
48-7
FCV 405C
48-4
47-1
48-5
FCV 405B
48-2
47-3
48-3
FCV 405A
48-8
47-4
48-1
FCV 406B
62-1
35
36
FCV 406A
62-4
37
38
FT 1203
FT 1202
FT 1201
FT 1200
MFW
TO AFWP 32 TURBINE
TO MS
SG 34
SG 33
SG 32
SG 31
LT 447B
LT 447A
LT 447C
LT 447D
LT 437B
LT 437A
LT 437C
LT 437D
LT 427A
LT 427C
LT 417B
LT 417A
LT 417C
LT 417D

Attachment C

AUXILIARY FEEDWATER SYSTEM SURVEILLANCE TEST BASES

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
GENERAL					
General Functional Requirements	DBD 3.1.1 - AFWPs provide auxiliary feedwater to the SGs for normal startup & cooldown. DBD 3.1.2 - In the event of a accident, MD AFWPS provide AFW to the SGs within 1 min. DBD 3.2.2 - The TD AFWP provides AFW to SGs during a SB or if both MD pumps are unavailable. AFWP flow to SGs is a Operator action.	Sec 10.1.1 - One TD and two MD AFWP are provided to ensure that adequate FW is supplied to the SGs for reactor decay heat removal under all circumstances, including loss of power and normal heat sink. AFW flow can be accomplished with emergency power sources.	TS Bases - One AFW pump can supply sufficient FW to remove decay heat. TS Bases - On LOOP, decay heat is removed by TD or 1 out of 2 MD AFW pumps. Sec 3.4.A.2 - Reactor kept <350°F unless 3 of 3 AFW pumps operable. Sec 4.8.1.a/b/c & 2 - Monthly testing of pump start (head reached, operate for 15 min), refueling check of SG feed; six-month discharge valve check and refueling check of CWS. Sec 4.8.3 - At refueling outages verify: a) Recirculation valves will actuate to correct position; and, b) Pumps will start upon receipt of each test signal.	FR-H.1 - Try to establish AFW flow to at least one SG by CCR check, use of city water, pump breaker check, and manual valve operation. PT-R3D - Test that the diesel generators will supply all normal and safety injection equipment, including AFWPs 31 and 33. PT-R7 - Simulated auto start on loss of MFW test for AFWPs 31/33.	FH-H.1 guidance on ways to get secondary heat sink back. PT-R3D test performed on 12/9/90; did not meet its overall acceptance criteria, due to breaker problems. Additionally, TPCs were required to correct procedure errors. TPC TS-90-841-SV changed Step 5.1 by deleting the 30 second fully loaded statement. Overall acceptance criteria meet although the 86P and 86BU relays yet to be tested when conditions permit. PT-R7 performed 12/15/90 showed start times of 33.5/28.1 seconds for AFWPs 31/33. This did not consider pressure & flow, only pump start. No confirmation of AFW flow to SGs <1 min.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
WATER SUPPLY					
Condensate Storage Tank	DBD 4.2.3 - 360,000 gal of the 600,000 gal condensate in the CST is reserved for AFW. This supplies AFW for 24-hours in the hot shutdown condition.	Sec 10.2-22 - AFW system provides water from CST to SGs when MFW pumps are unavailable. Table 10.1.1 - 360,000 gal in 600,000 gal tank; alternate supply from city water	Sec 3.4.A.3 - Reactor <350°F unless a minimum of 360,000 gal in CST.	PT-V8B - Maintain at least 360,000 gal in CST. PT-R7 - Level (LI-1128) & Temp (TI-1216) are recorded.	PT-V08 - no concerns. PT-R7 12/15/90 CST level was 30.5 ft at 55°F. Test did not provide explicit acceptance criteria for CST level and temperature limits.
Low CST Level Shutoff Valves LCV-1158/1158A	DBD 4.2.3 - These 12-inch LCVs isolate the condenser hotwell makeup at the 360,000 gal level.	(Not described in the FSAR)	Sec 3.4.A.4 - System piping and valves must be operable when the Rx is >350°F.	IC-PM-L-1128/1128A - Calibrates LT-1128, LS-1454, LI-1128, LT-1128A & LI-1128A. PT-CS11 - Test auto closure of LCV-1158-1/2 on simulated low CST level.	IC data for 3/15 & 3/18 tests acceptable. PT-CS11 data for 5/15/91: Closed/Open 1158-1 61 sec/37 sec 1158-2 1.5 sec/2.4 sec Both within acceptance criteria.
City Water Backup Valve PCV-1187, 1188 & 1189 & Block valves CT-28, 29-1 & 31	DBD 4.2.2 - The CWS provides a 1.5 million gal alternate source of water to the AFWP suction. DBD 3.9/3.10 These air 6-inch globe valves can open & close with 77 psid, fail closed upon loss of IA, have N_2 backup & a local handwheel.	Sec 10.2-27 - If the bladder would enter the tank discharge, either of the 2 remaining pumps can be aligned to the city water supply.	Sec 3.4.A.7 - Rx must be <350°F unless city water piping & valves are operable. Sec 4.8.1.C - Backup valves from the city water system will be tested each refueling outage.	PT-R27 - Demonstrates city water backup to AFWPs through isolation valve CT-49, check valves CT-26/29-1/32 and control valves PCV-1187/1188/1189. Test is a line flush only, no pump operation.	PT-R27 last performed on 9/19/90 for IST of valves. PCV-1187, 1188, & 1189 opening times were 6.0, 6.5, & 10.7 seconds and closing times were 13.5, 10.9, & 15.2 seconds, all less than acceptance criteria of 20 seconds. No pump operation on CWS is acceptable.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
AFW Pumps					
AFW PUMPS 31/32/33	DBD 3.1.3 - Each MD AFWP shall be capable of >340 gpm to mitigate the Loss of Normal FW Event. The MD AFWP have a rated flow of 400 gpm. MD AFWPs shall develop 3120 feet of head at 340 gpm, so they can deliver AFW to the SGs at a pressure equal to minimum pressure setting of the MSSVs. The MD AFWPs shall have a NPSH requirement <20 feet. MD AFWP maximum shutoff head <3750 feet. AFWP motors shall <400 HP with a 1.15 service factor, & shall be powered from the 480 VAC Emer power system. MD AFWPs shall not exceed 400 gpm to limit motors to 460 BHP.	Sec 10.1.1 - One TD and 2 MD AFW pumps are provided. AFW flow can be maintained until LOOP is restored or decay heat removal is by emergency power sources. Sec 10.2.6 - AFW head is sufficient to deliver FW to SGs at the highest SV setting. Redundancy is provided. Each pump's design capacity = 400 gpm (assumed to be 340 gpm) Table 10.1.1 - 3 (one steam TD, two MD). Design capacity: TD - 800 gpm MD - 400 gpm each	Sec 3.4.A.2 - Rx must be kept <350°F unless 3 of 3 AFW pumps are operable. Sec 3.4.A.4 - Rx must be <350°F unless system piping and valves are operable. Sec 4.8.1.a/b/c & 2 - Monthly testing of pump start (head reached, operate for 15 min), refueling check of SG feed; six-month discharge valve check and refueling check of CWS.	PT-R7 - AFW flow acceptable if MD pump >340 gpm & TD pump >400 gpm. Also checks recirculation flow and check valve operability. PT-M20A - AFWPs-31/32/33 operable if discharge pressure ≥1130 for 15 min. Pump start time, flow, suction pressure, differential pressure, vibration, bearing temp & valve operation are requirements for ISI operability.	PT-R7 run at cold shutdown conditions for AFWPs 31 and 33 and at hot shutdown for AFWP 32. Limiting AFW flow to 150 gpm until a positive increase in SG level to avoid water hammer is not validated in the design basis. Test supplemented by normal use of AFWPs for startup and cooldown. PT-M20A was performed on 9/26/91 with suction pressure about 34 psig and discharge pressures of 1570, 1160 & 1530 psig for pumps 31, 32 & 33. No suction pressure or flow through FIs 1131, 1132 & 1133 required for acceptance criteria. Pump d/p recorded for ISI data. Pumps ran for 22, 24 & 17 minutes with vibrations <1.5 mils acceptance criteria. Bearing temperatures were recorded, but without acceptance criteria. Test results acceptable except two valve numbers were different than the drawings; these were ~~BFD-63~~ BFD-53 and ~~BFD-64-4~~ BFD-62-4.
			Sec 4.8.3 - At refueling outages verify: a) Recirculation valves will actuate to correct position; and, b) Pumps will start upon receipt of each test signal.	PT-R7 - When flow testing 31/33, do not exceed 370 gpm. Also checks reverse flow, vibration, recirc flow & runout protection. No acceptance criteria for start time, suction/discharge pressure, or vibration given	PT-R7 12/15/90, AFWPs 31 and 33 started in about 33.5 and 28.0 seconds, respectively. Suction and discharge pressures were 1425/1335 psig at 370/360 gpm.
				PT-R90 - Local operation of AFWPs for Appendix R emergencies.	PT-R90D last performed on 9/19/90 to demonstrate local operation of AFWP 31 and FCVs-406A/B.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
AFWP Support Systems (Seal Water, Lube Oil, Bearings, etc	DBD 3.14 - TD AFWP bearing water is regulated by PCV-1213. It is an air OP, fail open valve that OPs against 1700 psid & supplies 10 gpm to turbine & 3 gpm to pump bearings. DBD 3.15 - AFW turbine and pump is protected from overpressure by CD-123, a relief valve set at 70 psig. Capacity needs to be determined.	Not addressed in FSAR.	No TS requirements.	PT-M20A - Lube oil level checked, bearing temp measured, no specific acceptance requirements.	PT-M20A performed 9/26/91 recorded lube oil condition and the bearing temperatures
Suction/Discharge Check Valves CST Suction - CT-26, 29-2 & 32 CWS Suction - CT-28, 29-1 & 31 Pump Discharge - BFD-31, 34, & 39.	(Not directly addressed in the DBD)	(Not directly addressed in the FSAR)	Sec 4.8.1.b - The AFW pump discharge valves will be tested at less than 6 Month intervals.	PT-M20A - Check valves CD-122, CT-26, 29 & 32 & BFD-52 & 54 operation required for test.	PT-M20A, performed on 9/26/91, confirmed check valve openings. However, check valve table incorrect as follows; ~~CT-29~~ CT-29-2. Same mistake in Step 3.5.9.2.
			Sec 4.8.3 - At refueling outages verify: a) Recirculation valves will actuate to correct position; and, b) Pumps will start upon receipt of each test signal.	PT-R7 - FCVs 1121/1123 auto opens on pump start, closes on 170 gpm & reopens at 40 gpm. Supply check valves tested.	PT-R7 tests of 12/15/90 found proper operation of FCVs-1121/1123 with open/close times <10 second acceptance criteria. Test acceptable.
(Continued next page)			Sec 3.4.A.4 - System piping & valves operable.	PT-CS15 - AFWP 31/33 check valves ISI tested to stroke open: Pump 31/33 suction valves CT-26/32 Pump 31/33 discharge valves BFD-34/39 Pump 31 cont. to SGs valves BFD-35/37 Pump 33 cont. to SGs valves BFD-40/42 AFW to MFW valves BFD-67/68/69/70	PT-CS15 3/26/91 ISI test of check valve operability was acceptable.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
(Continued from previous page)			Sec 4.8.1.a/b/c & 2 - Monthly testing of pump start (head reached, operate for 15 min), refueling check of SG feed; six-month discharge valve check and refueling check of CWS.	PT-CS15 - AFWP 31/33 check valves ISI tested to remain closed: MFW pumps to SGs BFD-6-1/2/3/4 Pump 32 SG cont BFD-47-1/2/3/4	
Pump protection recirc control valves FCV-1121 & 1123 (AFWP-31/33) & Breakdown Orifice (32)	DBD 3.1.1 - The MD AFWPs provide CST freeze protection. Acceptance criteria met if recirc valves open on pump start, close at about 170 gpm to SGs, and reopens at about 40 gpm. Valves to stroke in <10 sec. DBD 3.1.3.6 - MD AFWPs shall have a auto recirc system at minimum flow of 100 gpm (25% of the 400 gpm design flow). DBD 3.2.3.10 - The TD AFWP shall have a recirc system open at all times.	(Not addressed in FSAR)	Sec 4.8.1.a/b/c & 2 - Monthly testing of pump start (head reached, operate for 15 min), refueling check of SG feed; six-month discharge valve check and refueling check of CWS.	PT-M20A - Valve time for FCV-1121 & 1123 are tested; operation required for test. Results not in test acceptance criteria. Recirc block valves (BFD-53/55) throttled to get 100 ±10 gpm flow. Tests CV-52 &54. Results not in test acceptance criteria. Flow through FI-1131, 32 & 33 indicate opening of recirculation valve CV-122 for AFWP 32.	PT-M20A performed 9/26/91 found FCV-1121 & 1123 opening times of 1.6 & 6.1 and closing times of 5.8 & 2.4. Acceptance criteria was <10 seconds for all. Test confirmed recirculation flow, but did not record flows or provide explicit acceptance criteria.
	DBD 3.7.3.2 - These 2-inch globe valves shall open & close against 1500 psid, fail closed upon loss of IA, & have N_2 backup.		Sec 4.8.3 - At refueling outages verify: a. Recirculation valves will actuate to correct position; and, b. Pumps will start upon receipt of each test signal.	PT-R7 - Normal recirc flow about 100 gpm. Recirc flow of about 170 gpm through FC-1135/1136 closes FCV-1121 & 1123 and about 40 gpm opens FCVs. BFD-53/55 locked to get about 100 gpm each. Tests low flow alarm.	PT-R7 performed recirculation flow test on 12/15/90, with no SG flow, 102 & 104 gpm for AFWP 31 & 33. FCV-1121 shut at 170 gpm in 8.6 seconds & opened at 37 gpm in 1.05 seconds. FCV-1123 shut at 173 gpm in 3.24 seconds & opened at 37 gpm in 2.63 seconds. Acceptable operating times for the FCVs not provided in the procedure.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Recirculation block valves BFD-53/55 (AFWPs 31/33) Cold weather CST freeze protection valves BFD-77/78	DBD 3.8.3.2 - These manual 2-inch globe valves shall be able to throttle flow to 100 ± 10 gpm. DBD 3.13 - These handwheel operated 1½-inch angle valves shall pass 125 gpm of cold condensate at 1560 psid to prevent CST freezing at temps above +13°F.	(Not described in the FSAR)	No TS requirements.	PT-R7 & PT-M20A - confirm the recirc block settings.	Did not locate cold weather CST testing.
Pump Controls	DBD 3.1.3.8 - MD AFWPs shall auto start & manual start from CCR or local. DBD 3.1.3.9 - MD AFWPs shall auto stop on low flow thru pump, elec overload, or bus stripping. DBD 3.2.3.11 - TD AFWP shall start auto or manually from CCR and AFWP room. DBD 3.2.3.12 - TD AFWP shall stop on turbine overspeed.	Sec 7.2.1 - AMSAC provides a AFW pump start for: TD pump with power >40% & 3/4 MFW flow ≤21% after 300 to 25 sec at power levels of 40 to 100% time delay. MD pump with power >40% & 3/4 MFW flow ≤21% after 28 sec time delay.	Table 3.5.3 - Auto start of MD pumps on 2/3 in any SG at ≥5% low-low level; 2/3 in 2 SGs req to start TD pump: Check on "S" freq; Cal on "R" freq; Test on "Q" freq. Table 3.5.3 - SI signal starts MD pumps. Table 3.5.3 - Station Blackout starts TD pump: Cal & Test on "R" freq. Table 3.5.3 - Trip of MFW pumps starts MD pumps: Test on "R" freq. Table 3.5-5 - AFW flow rate: 1/pump: Cal on "R" frequency	PT-R7 - Auto start of AFWPs-31/33 on MFW pump trip; start time, flow & pressure recorded.	PT-R7 of 12/15/90 showed acceptable flows and pressures, no explicit acceptance criteria for start time, flow or pressure.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
AFWP-32 Turbine					
Turbine Pump	DBD 3.2.3.6 - The AFWP turbine shall be rated at 600 psig, with a maximum of 770 psig (set pressure of flow relief valve - 700 psig + 10%).	Sec 10.2.1 - Steam for AFW turbine from two of the 28" SG outlet mains	Sec 3.4.A.2 - T-ave shall be kept <350°F unless 3 of 3 AFW pumps are operable.	PT-TY-M49 - Inservice pressure testing of steam lines from CVs Ms-41/42 to turbine stop valve HCV-1118.	PT-TY-M49 acceptable performed on 7/30/87.
	DBD 3.2.3.3 - NPSH required to be <16 feet.	Sec 10.2.6 - TD AFW loop was designed to supply 800 gpm flow to the SGs.		PT-TY-M50 - Inservice pressure testing of AFWP 32 turbine and steam exhaust line.	PT-TY-M50 acceptable performed on 8/25/87.
	DBD 3.2.3.4 - Design shutoff head <3750 feet.				
	DBD 3.2.3.1 - TD AFWP is rated at 800 gpm to any/all SGs.			PT-V8 - With CST at normal level, Start AFWP 32 and open FCVs 405A/B/C/D to about 100 gpm to each SG. Test overspeed trip occurs at 4000 ± 50 rpm.	PT-V8 - On 12/16/90 test, AFWP-32 tripped acceptably at 3970 rpm.
	DBD 3.2.3.5 - TD AFWP can operate with MS supply pressure from 1200 down to 110 psig.			PT-CS19 - TD pump pre-operation lube oil check, run pump at 500 rpm for 15 to 30 minutes with discharge pressure >100 psig and with <5 mills Vibration. Verify rpm with stroboscope.	PT-CS19 performed on 12/14/90 showed: SG steam pressure 100/100 psig; pump 32 on for 30 minutes at 615 rpm; suction pressure 34 psig; and discharge pressure 76 psig. Vibration <5 mils and bearing temperatures <81
	DBD 3.2.3.2 - TD AFWP is rated at 3120 feet at 800 gpm; allows pump to deliver AFW to SGs at minimum MSSVs setpoint pressure.		Sec 4.8.3 - At refueling outages verify: a) Recirc valves will actuate to correct position; and, b) Pumps will start upon receipt of each test signal.	PT-R7 - TD pump tested at >400 and <800 gpm. Bearing vibration determined for turbine and pump.	PT-R7 records vibration readings. No specific acceptance criteria given.
	DBD 3.2.3.7 - TD AFWP shall be capable of full flow <1 min, starting without preheating & prelubrication.		Sec 4.8.1.a/b/c & 2 - Monthly testing of pump start (head reached, operate for 15 min), refueling check of SG feed; six-month discharge valve check and refueling check of CWS.	PT-M20A - AFWP-32 operable if discharge pressure ≥1130 psig for 15 min.	PT-M20A performed on 9/30/91 showed discharge pressures of 1570/1160/1530 psig for AFWPs 31/32/33. Pump start time, suction & discharge pressure, and vibration are recorded, but are not requirements for operability. No confirmation that flow from AFW pumps is provided in <1 min.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Isolation Valves PCV-1310A/B	(Not addressed in the DBD)	(Not described in FSAR)	Sec 3.4.A.4 - System piping and valves for AFWS operable.	PT-CS01 - Test open and close operability of MS isolation valves PCV-1310A&B.	PT-CS01 performed on 5/13/91. Opening times for PCV-1310A&B were 8.9 & 8.8 verses acceptance criteria of $\leq$8 & $\leq$14 seconds; closing times were 2.4 & 1.0 verses acceptance criteria of $\leq$5 & $\leq$3 seconds. TPC prepared to change PCV-1310A's acceptance criteria to 10 seconds. No technical basis for acceptance criteria provided.
Turbine Control Valve HVC-1118 and Pressure Control PCV-1139	DBD 3.2.3.9 - AFWP turbine shall have an overspeed trip lever and limit switch alarming in CCR. DBD 3.3.1 - PCV-1139 supplies pressure to AFWPT at 600 psig during all conditions, with pressure drop across valve <10 psig, DBD 3.3.3.3 - PCV-1139 shall be capable of opening or closing against differential pressure <1193 psig. Valve fail open on loss of IA, have N_2 backup. Valve operable from CCR or AFWP room. DBD 3.4 - SV downstream of PCV-1139 set, capable of 170,000 lb/hr, at 700 + 10% psig to protect AFWP turbine.	(Not described in FSAR)	3.4.A (2) - The Rx shall not exceed 350°F unless 3 of 3 AFW pumps are operable.	PT-M20A - Manually trip the overspeed mechanism and verify pump trip valve PCV-1139 closes. Record stop time.	PT-M20A performed 9/30/91, no valve operating times requested and no acceptance criteria times for PCV-1139 or HCV-1118.
AFWP Lube Oil & Gland Seal	DBD 3.2.3.8 - TD AFWP shall have 10 gpm of turbine & 3 gal of pump bearing cooling water from the AFWP discharge.		No TS requirements.	PT-M20A - Lube oil level checked; not required for Acceptance Creiteia.	PT-M20A - Lube oil level not required for acceptance criteria.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Distribution					
AFW Header	(Not described in DBD)	Sec 10.6.2 - Each AFW pump supplies two SGs	Sec 3.4.A.4 - System piping and valves for AFWS must be operable when Rx is >350°F.	PT-V08 - Precaution states to prevent water hammer by limiting SG flow to 150 gpm until positive increase in SG level.	PT-V08 - No valid design basis reference on suseptability to water hammer could be located.
SG Control Valves FCV-405 A/B/C/D	DBD 3.5 - Two inch globe valves, fail open on loss of IA with N_2 backup, capable of opening or closing against 1440 psig. Valves can be operated by handwheel. DBD 3.5.3.9 - FCV-405s have pressure sustaining devices to limit pump runout.	(Not described in the FSAR)	Sec 3.4.A.4 - System piping and valves for AFWS must be operable when Rx is >350°F. Sec 4.8.1.b - AFWP discharge valves tested at six-month intervals.	PT-V08 - Achieve 100 gpm to each SG. PT-Q20 - ISI test of FCV-405A, B, C & D. Valves left at pre-test settings.	PT-V08 - no concerns. PT-Q20 performed on 9/19/91 - acceptable.
SG Control Valves FCV-406 A/B - Pump 31 FCV-406 C/D - Pump 33	DBD 3.6 - Two inch globe valves, fail open on loss of IA with N_2 backup, capable of opening or closing against 1440 psig. Valves can be operated by handwheel.	(Not described in the FSAR)	Sec 3.4.A.4 - System piping and valves for AFWS must be operable when Rx is >350°F. Sec 4.8.1.b - AFWP discharge valves tested at six-month intervals.	PT-R07 - Tests FCV-406A,B,C&D operation to make sure controls limit flow to SG is set to >350 & <370 gpm. PT-Q20 - ISI test of FCV-406A, B, C & D. Valves left at pre-test settings. PT-R90 - Local operation of AFWPs for Appendix R emergencies.	PT-R7 flows for SG 32 & 34 was 370 gpm and SG 31 & 33 was 360 gpm. PT-Q20 performed on 9/19/91 - acceptable. PT-R90D/E last performed on 9/19/90 & 12/14/90 to demonstrate local operation of AFWP 31 & 33 and FCVs-406A/B & C/D.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Check Valves Open: BFD-35/37/40/42 (31/33 to SGs) BFD-47-1/2/3/4 (32 to SGs) BFD-67/68/69&70 (AFW to SGs)	(Check valve flow not explitily described in DBD)	(Check valve flow not described in FSAR)	Sec 3.4.A.4 - System piping and valves for AFWS must be operable when Rx is >350°F.	PT-R7 - Flow on FI-1200 series indicate BFD-35/37/40/42 have opened. PT-R7 - Flow on FI-1200 series indicate BFD-47-1/2/3/4 have opened. PT-R7 - Flow on FI-1200 series indicate BFD-67/68/69/70 have opened.	PT-R7 12/15/90 checks BFD-35/37/40/42 open. PT-R7 12/15/90 checks BFD-47-1/2/3/4 open. PT-R7 12/15/90 checks BFD-67/68/69/70 open.
Above CVs leakage	DBD 3.16 - These 4-inch swing check valves prevent reverse high pressure/temperature FW flow.	(Check valve leakage not described in FSAR)	Sec 3.4.A.4 - System piping and valves for AFWS shall be operable when Rx is >350°F.	PT-R7 - Checks for CV leakage of above valves by opening BFD-44 & BFD-49 individually.	PT-R7 indicated no check valve leakage.
Recirc for AFWP over-heating protection through FCV-1121 & 1123	DBD 3.1.1 - The MD AFWPs provide CST freeze protection. Acceptance criteria OK if recirc valves open on pump start, close at about 170 gpm to SGs, and reopens at about 40 gpm. Valves to stroke in <10 sec. DBD 3.1.3.6 - MD AFWPs shall have a auto recirc system at minimum flow of 100 gpm (25% of the 400 gpm design flow).	(Not described in FSAR)	No TS requirements.	PT-M20A - FCVs-1121/1123 operation timed as part of this test. ENG-433 & -433A: Operability demonstration of FC-1135S, -1136S and AS control of recirc flow FCV-1121 and FCV-1123 after modification 88-03-199AFW.	PT-M20A performed on 9/30/91, but no explicit acceptance criteria provided for times. ENG-433 & -433A performed on 12/4/90 confirmed operability of FC-1135S and FC-1136S. No acceptance criteria for operating times for FCV-1121 and FCV-1123

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Instrumentation					
CST Pressure, Level and Temperature	(Not described in the DBD)	(These instruments not described in the FSAR)	Sec 4.1-1.28 - Instrument channel check, calibration, or test.	PT-R7 - Level (LI-1128) & Temp (TI-1216) are recorded.	PT-R7 12/15/90 CST level was 30.5 ft at 55°F.
City Water Supply Pressure	DBD 3.22 - PI/PT-1205/R provide CWS supply pressure in CCR & SCF.	(Not described in FSAR)	Sec 4.1-1.28 - Instrument channel check, calibration, or test.	IC-PM-P-1205 - Calibration of PT-1205 and CCR instruments.	IC-PM-P-1205 review found 3/1/90 data acceptable.
Turbine Speed and Steam Pressure	DBD 3.25 - PC/PA-1176S & PT/PI-1126 provided steam pressure indication & alarm downstream of PCV-1139.	(Not described in FSAR)	Sec 4.1-1.28 - Instrument channel check, calibration, or test.	IC-PM-H-1103 - AFWP-32 turbine tachometer. IC-PM-Y-1118 - AFWP-32 turbine speed control. PT-M20A - Turbine speed within 100 rpm of stroboscope. Not required for acceptance criteria. IC-PM-P-1126 - Calibration of PT-1126 & its recorder. IC-PM-P-1176S - Low steam pressure switch calibrated.	IC-PM-H-1103 calibration of tachometer procedure not reviewed. IC-PM-Y-1118 calibration of speed control procedure not reviewed. PT-M20A - Speed of 3100 rpm with stroboscope at 3100 rpm. Turbine speed not required for acceptance criteria. IC-PM-P-1126 review found 11/15/90 data acceptable. IC-PM-P-1176S review found 11/15/90 data acceptable.
3 Pump Suction Pressure	DBD 3.17/3.18 - PT/PI-1263/64/65 provides AFWP suction pressure, range 0 to 60 psig, to CCR.	(Not described in FSAR)	3.4.A(2) and (4) - The Rx shall not exceed 350°F unless 3 AFW pumps and their associated valves and piping are operable	IC-PM-P-1263/4/5 - Calibrates suction PT-1263/4/5 & CCR PIs.	IC-PM-P-1265 review found 3/11/90 data acceptable.
Pump Flow	DBD 3.19 - FE/FC-1121/1123-S/AS provides flow, range 0 to 90 gpm for "S" & 0 to 200 for "AS", for indication, alarm, opens & closes recirc valves, & trips AFWPs at low flow. Alarms set at ≤75 gpm, open recirc at 40 gpm & close recirc at ≥170 gpm.	(Not described in FSAR)	Sec 4.1-1.28 - Instrument channel check, calibration, or test.	PT-R7 - Pump low flow alarm at about 75 gpm.	PT-R7 12/15/90 test checked low flow alarms at 75 & 73 gpm for FC-1135AS and 1136AS.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR DESCRIPTIONS/ BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Pump Discharge Pressure	DBD 3.20/21 - PI/PT-1260/1261/1262 & R and PT-406AtoD provide AFWP discharge pressure & PT-406AtoD control of FCV-406s. The range of all is 0 to 1500 psig	(This instrument not described in the FSAR)	Sec 4.1-1.28 - Instrument channel check, calibration, or test.	IC-PM-P-1260/1/2 - Calibrates discharge PT-1260/1/2 & CCR PIs. IC-PM-P-406A/B - Calibrates & tests PIs/PCs/PMs/HCs-406A/B/C/D/E/F (AFW to SG control functions). PT-R7 - Discharge pressure of AFWPs 31 and 33 is recorded.	IC-PM-P-1261 performed on 10/7/90 was acceptable. IC-PM-P-406A performed on 11/2/90 was acceptable. PT-R7 12/15/90 test results: AFWP 31 - 1600 psig 33 - 1580 psig.
AFW Flow to SGs	DBD 3.23 - FE/FT/FI-1200/01/02/03 provide AFWP flow to each SG. The range is 0 to 450 gpm with CCR & AFWP room accuracy of ±10%.	(Not described in FSAR)	Sec 4.1-1.28 - Instrument channel check, calibration, or test. Sec 4.8.1.a/b/c & 2 - Monthly testing of pump start (head reached, operate for 15 min), refueling check of SG feed; six-month discharge valve check and refueling check of CWS.	IC-PM-F-1200/1/2/3 - Calibration of FI-1200 series instruments. PT-R7 - Checks FI-1200 series flows with FC-1135/1136 local indicators.	IC-PM-F-1200 11/2/90 test reviewed. PT-R7 12/15/90 test showed good agreement.
Steam Generator Wide Range Level	(Not described in DBD)	Sec 10.2.6 - SG wide range level, cal. for cold conditions, recorded in CR on two 2-pen recorders. Local SG level indicators provided.	Sec 4.1.A - Calibrate, test, & check as specified in Table 4.1-1.	PC-R07A/B/C/D - LTs-417D, 427C, 437C, 447D are calibrated by R07A and LTs-417A, 427A, 437A and 447D are calibrated by R07D. R07E is the analog components' check and calibration.	PC-R07A, performed on 9/27/90 to calibrate LTs-417D, 427C, 437C, 447D was reviewed. PC-R07D, performed on same date calibrates LTs-417A, 427B, 437C, & 447D was also reviewed.

Attachment D

Station Batteries

System Description

(Figure D provides a system diagram). Batteries 31 and 32 consist of 58 cells providing 2550 ampere-hour (AH) of power at greater than 105 VDC. Batteries 33 and 34 are smaller units consisting of 60 cells providing 425 and 440 AH of power at greater than 105 VDC. Each of the batteries has been sized to carry its expected shutdown loads following a plant trip and a loss of all AC power for a period of two hours without battery terminal voltage falling below 105 VDC. Derating factors for temperature and for aging were considered in battery sizing.

A battery charger is available to maintain each battery fully charged and ready to start the emergency diesel generators (EDGs) and supply other emergency loads. A fifth battery charger can supply all batteries through a jumper cable to a single power panel. Battery chargers 31, 32, and 35 (the spare) are rated at 400 amperes, and the smaller batteries, 33 and 34, have 200 and 150 ampere battery chargers, respectively. The battery chargers are sized to recharge a partially discharged battery within 15 hours while carrying its normal load.

The DC distribution system is redundant from battery to actuation devices which are powered from the batteries. The four batteries feed four DC power panels (PPs), which in turn feed major loads, such as the four instrument bus inverters, switchgear control circuits, DC motors, and plant lighting needs. PP-31 and PP-32 sub-feed six distribution panels (DPs) for relaying and instrumentation loads. Redundant safeguards relays and devices which use DC as a power source receive their power from one of three DC distribution panels. Safeguards pump starters which are DC actuated receive power from their associated DC DP.

(NOTE: Batteries 31 and 32 are scheduled to be replaced next refueling outage - 3/92)

MATRIX CHARTS

The following matrix charts provide a graphic representation of the identified safety functions of the Station Batteries. The entries contained in each column are not exact quotes from the referenced documents, but are somewhat abbreviated for the sake of brevity so that the essential technical content is accurately represented as it existed.

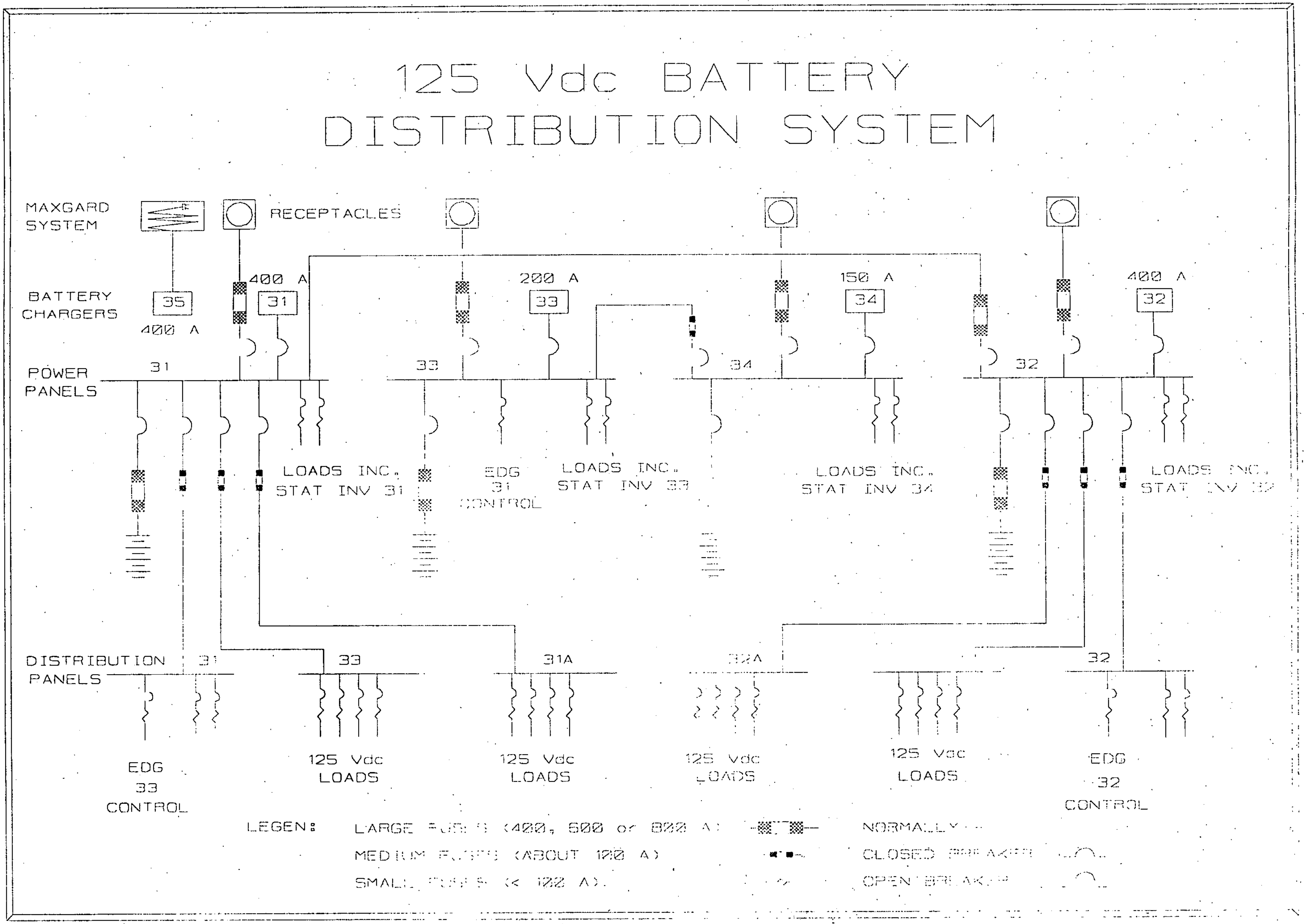
The numbering scheme used for surveillance test procedures provide a code for identifying the type of test and its frequency of performance in accordance with the following:

PT = Periodic Test
PC = Periodic Calibration
ARP = Alarm Response Procedure
COL = Checkoff List
ENG = Special Engineering Test

W = Weekly
M = Monthly
Q = Quarterly
SA = Semi-annual
CS = Cold Shutdown
Y = Yearly
R = Refueling
V = Variable

Attachment G contains a complete list of abbreviations and acronyms.

Figure D



125 Vdc BATTERY
DISTRIBUTION SYSTEM
MAXGARD
SYSTEM
RECEPTACLES
BATTERY
CHARGERS
35
400 A
31
400 A
33
200 A
34
150 A
32
400 A
POWER
PANELS
31
33
34
32
LOADS INC.
STAT INV 31
EDG
31
CONTROL
LOADS INC.
STAT INV 33
LOADS INC.
STAT INV 34
DISTRIBUTION
PANELS
31
33
31A
32
EDG
33
CONTROL
125 Vdc
LOADS
125 Vdc
LOADS
125 Vdc
LOADS
125 Vdc
LOADS
EDG
32
CONTROL
LEGEND:
NORMALLY
CLOSED

Attachment D

STATION BATTERY SYSTEM SURVEILLANCE TEST BASES

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR/IEEE 450 GUIDANCE BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
General System					
General Functional Requirements	Draft DBD - The 125 VDC system consists of 4 Station Batteries, 4 Power Panels, and 5 Battery Chargers.	FSAR 8.1-1 - The Electrical system design has sufficient independence so that DC power is available after loss of all auxiliary power. System components are suitably protected against accident or severe environmental phenomena to remain operable. The emergency power supply for the electrical system is from the four 125 Vdc station Batteries.	3.7.A.6 - The reactor shall not be brought above the cold shutdown condition unless 3 batteries plus 3 chargers and the distribution systems are operable.	No routine test of Batteries after a LOOP.	
Cells					
Physical Condition	No Draft DBD requirements.	IEEE 4.4.1 - When any cell electrolyte reaches the low-level line, water should be added to bring all cells to the high-level line. IEEE 4.3.1 - General appearance & cleanliness, monthly; also check and record cell electrolyte level. IEEE 4.4.1 - When any intercell connection or terminal connection resistance exceeded its installation value by >20%, disassemble, clean, reassemble, and test. IEEE 4.3.3 - Check and record cell condition yearly against manufacturer's recommendations.	4.6.B - 1. Cell voltage, s.g., and temperature are measured every month 2. 24 hr. equalization charge, cell s.g., temperature, electrolyte level, and additional water performed every 3 months 3. Compare all new data with old data 4. Load test and visually inspect each battery after each refueling	PT-W13 - Visual inspection of all battery systems. The electrolyte height is ≥ the low level mark. PT-M21 - Perform a visual inspection of battery cells. PT-Q01 - Cells electrolyte above plates & not overflowing. PT-R29 - Check 11 conditions while Bat is recharging. PT-M72 - New station battery impedance test. PT-M73 - Used if a dry cell is put into service.	PT-W13 was last performed on 11/7/91. Battery cells had some corrosion; MWRs issued. PT-M21 did not have explicit acceptance criteria defined for battery condition. PT-Q01 good test. PT-R29 is good overall condition check. PT-M72 uses a newly developed instrument (BITE) - good initiative. PT-M73 has not been used as no dry cells have been replaced.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR/IEEE 450 GUIDANCE BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Voltage	Draft DBD - Batteries 31/32/33: Float 2.17 to 2.25 ±.04 Equalize to 2.39 Battery 34: Equalize to 2.15 to 2.22	IEEE 4.3.1 - Check and record pilot cell voltages, monthly. IEEE 4.3.2 - Check and record each cell voltage, quarterly.	4.6.B.1 - Measure & record cell voltages, monthly.	PT-M21 - Measure & Record cell voltage; each cell ≥2.13 Vdc to meet Acceptance Criteria. PT-Q01 - Cell average voltage ≥2.07. PT-R29 - Cell data taken as listed under Batteries.	PT-M21 has appropriate acceptance criteria. PT-Q01 acceptable. PT-R29 acceptable.
Specific Gravity	Draft DBD - All Bateries: 1.215 s.g.	IEEE 4.3.2 - Check and record pilot cells specific gravity, quarterly.	4.6.B.1 - Measure & record pilot cell specific gravity, monthly.	PT-M21 - The s.g. of each pilot cell ≥2.13. PT-Q01 - Cell average corrected s.g. ≥1.195 with all cells ≤.02 below average but ≥1.175. AC values were also provided. PT-R29 - Cell data taken as listed under Batteries. S.G. of all cells to be <.01 from the average of all.	PT-M21 has appropriate accpetance criteria. PT-Q01 acceptable. PT-R29 acceptable.
Temperature	Draft DBD - Battery 31/32/34: ≥60°F Battery 33 (EDG Rm): ≥35°F	IEEE 4.3.2 - Check and record pilot cell temperatures quarterly. IEEE 4.4.1 - When cell temperatures deviate more than 3°C (5°F) from each other, determine the cause and correct.	4.6.B.1 - Measure and record pilot cell temperatures, monthly.	PT-M21 - Battery average electrolyte is ≥60°F. The pilot cells are within 5°F of each other. PT-Q01 - Battery average electrolyte is ≥60°F. PT-R29 - Cell data taken as listed under Battery.	PT-M21 has appropriate acceptance criteria. PT-Q01 acceptable. PT-R29 acceptable.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR/IEEE 450 GUIDANCE BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Battery					
General Functional Requirements	No Draft DBD requirements.	FSAR 8.2.3 - Supply shutdown Loads for 2 hrs with Voltage ≥105 Vdc	No specific TS requirement.	No specific PT to determine this.	Profile test not done.
Condition	No Draft DBD requirements.	IEEE 4.3.1 - Check good general appearance & cleanliness monthly. No cracks in cells or any leakage. No terminal or connection corrosion. IEEE 4.3.4 - If the battery has experienced an abnormal condition (such as a sever discharge or overcharge), an inspection should be made to assure that the battery has not been damaged.	3.7.B.4 - One battery may be inoperable for 2 hours if the other batteries & 3 chargers remain operable with one carrying the dc loads of the failed battery supply system.	PT-M21 - Cells clean; terminals & connections dry & clean. Battery caps & vents are in place.	PT-M21 had no explicit acceptance criteria for battery condition.
Voltage	Draft DBD - Bus / Cells / Float Voltage Vdc 31/32 / 58 / 125.9-130.5 33 / 60 / 130.2-135.0 34 / 60 / 129.0-132.2	IEEE 4.3.1 - Quarterly check and record total battery terminal voltage.	4.6.B.1 - Measure & record Battery voltage monthly.	PT-W13 - Measure and record Station Battery voltages; Operability and acceptance criteria required: Bat 31/32 128 to 130.5 Bat 33 129 to 130.2 Bat 34 132 to 134.5 PT-M21 - Measure and record Battery voltages. Must be ≥125.9 for Bat 31/32 & 129.0 for Bat 33/34 to meet operability criteria. Gen. acceptance criteria for battery bank voltages are: Bat / AC Voltage 31/32 / 128 to 130.5 Vdc 33 / 129 to 130.2 34 / 132 to 134.5 PT-Q01 - Each Battery receives at least a 24 hour equalizing charge. The as-found Battery float voltage reading ≥125.9 (Bat 31/32) & 129.0 (Bat 33/34).	PT-W13 was last performed on 11/7/91. Voltages were within acceptance criteria allowances. PT-M21 has appropriate acceptance criteria. PT-Q01 test results acceptable.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR/IEEE 450 GUIDANCE BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Equalization Charge	No Draft DBD requirements.	IEEE 4.4.2 - An equalization charge should be performed if: - The corrected s.g. of an individual cell is >10 points (0.010) from the average of all cells; - The corrected s.g. of all cell is >10 points (0.010) from the average installation value; - Any cell voltage is <2.13 Vdc at the time of the inspection; and, - Perform at least once each 18 months.	4.6.B.2 - Every 3 months, each battery shall be subjected to a 24 hour equalizing charge & measure all cells s.g., temp of every 5th cell, electrolyte level & water added.	PT-R29D - Equalize at 139 ±1 Vdc for 35 to 70 hours. Measure and record cell voltage, s.g., temperature, electrolyte level, & cell-to-cell resistance. Place Battery on a float for 3 days. Connection resistance must be <20% above the last recorded value.	PT-R29D test results acceptable.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR/IEEE 450 GUIDANCE BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Load Test	NYPA Nuc Engr Calculation IP3-Calc-EL-00185, "Component Sizing" - Total calculated load profile for 2-hours following LOOP.	IEEE 6.1 - Initial conditions for battery capacity test: 1. Equalizing charge completed more than 3 days before and test starts not more than 7 days after; 2. Ensure connectors are clean, tight, and free of corrosion; 3. Read and record pretest specific gravity and float voltage; 4. Read and record electrolyte temperature (recommend every 6'" cell); 5. Read and record battery terminal float voltage; 6. Disconnect charger from battery; and, IEEE 485; 4.2.3 - Although momentary loads may exist for only a fraction of a second (following a LOOP) each load is considered to last for a full minute. The total load shall be assumed to be the simple sum of all momentary loads occurring within that minute. IEEE 6.6.2 - The discharge rate and test length should correspond as closely as is practical to the design requirements (battery duty cycle) of the dc system.	4.6.B.4 - At each refueling outage, each battery shall be subjected to a load test and a visual inspection of the plates.	PI-R29D - Calculate the discharge rate based on cell average temperature. Isolate the battery, take initial data & start the discharge test. Monitor the battery voltage down to 105 Vdc. Place the battery on equalization for 35 to 70 hrs. Evaluate the data and return to service if acceptable.	Discharge rate is not based on the calculated design basis load profile.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR/IEEE 450 GUIDANCE BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Capacity Rating (Ampere Hours).	<u>Draft DBD</u> - <u>Bus</u> <u>Color</u> <u>Rating</u> 31 White 2550 AH 32 Red 2550 AH 33 Yellow 425 AH 34 Blue 440 AH Derating Factors Temp: Bat 33 - 1.35 Others - 1.10 Aging: All - 1.25	<u>IEEE 5.1</u> - An acceptance test of the battery capacity should be made either at the factory or upon initial installation as determined by the user. The test should meet a specific discharge rate and duration relating to the manufacture's rating or to the purchase specification's requirements. <u>IEEE 6.2</u> - The recommended procedure is to make a capacity test for approximately the same length of time as the critical period for which the battery is sized. <u>IEEE 6.4</u> - Acceptance and Performance Tests: 1. Set up a load with an ammeter and a voltmeter with the provisions that the load be varied to maintain a constant current discharge equal to the rating of the battery at the selected rate. 2. Maintain the discharge rate until the battery terminal voltage decreases to a value equal to the specified average voltage per cell (usually 1.75 V times number of cells). 3. Read and record individual cell voltages and the battery terminal voltage. The readings should be taken while the load is applied at the beginning and the completion of the test and at specified intervals (minimum of 3 during test). 4. If the individual cell is approaching reversal (plus 1 V or less) but the terminal voltage has not yet reached its test limit, the test should be continued with a jumper across the weak cell.	No TS requirement exists for battery capacity.	(Periodic surveillance testing for battery capacity is not performed.*)	*These criteria are used for Battery sizing for procurement only.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR/IEEE 450 GUIDANCE BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Service Life	Draft DBD - Bat 31/32 <1.81 Vdc/Cell Bat 33/34 <1.75	IEEE 5.2 - Annual performance tests of battery capacity should be given to any battery that shows signs of degradation or has reached 85% of the service life expected for the application. IEEE 6.6 - Service Test (special battery capacity test to determine is the battery will meet the design duty cycle): 1. Initial conditions like IEEE 6.1; 2. The discharge rate and test length should correspond as closely as is practical to the design requirements (duty cycle) of the dc system; 3. If the battery does not meet the design requirements of the dc system, review its rating, equalize the battery, inspect the battery, and take corrective actions.	4.6.B.3 - Each time data is recorded, new data shall be compared with old to detect signs of abuse or deterioration.	Battery condition is checked by during multiple tests. Battery performance is trended and used to predict end of service life	Performance Engineering monitors Battery condition & predicts replacement in advance of failure.
Battery Chargers					
General Functional Requirements	Draft DBD - 480 Vac, 3-phase, 60 Hz, Voltage Variation ±10%.	FSAR 8.2-2 - IP3 has a 4 battery dc system. Each of the 3 - 480 Vac safeguards circuits receives dc control power from an individual battery (No, 31, 32 &33). Battery 34 feeds instrument bus 34. FSAR 8.2-20 - Solid-state type; recharge in <15 hours; Powered by EDGs. FSAR 8.2-22 - One Battery charger for each Battery, so 4 Batteries will always be at full charge for a LOOP.	TS Bases 3.7-4 - One battery charger shall be in service on each battery so that the batteries will always be at full charge in anticipation of a LOOP incident.	PT-R29 - Recharges the Batteries.	No test could be found that confirms 15 hour recharge rate specified in the FSAR.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR/IEEE 450 GUIDANCE BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Voltage	Draft DBD - Bat Floating Equalization 31/2 115-140 124-150 33 118.2-139.5 128.2-144.5 34 118.2-139.5 128.2-144.5 35 115-140 124-150	IEEE 4.3.1 - Check & record Battery charger current & voltage monthly. IEEE 4.4.1 - When the float voltage is measured at the battery terminals and is outside of its recommended operating range, it should be adjusted.	No specific TS requirements.	PT-M21 - The control room & Battery Charger indication is within 2 Vdc of the test meter reading.	PT-M21 has appropriate acceptance criteria.
Rating	Draft DBD - Bat MCC Rating 31 39 400 amps 32 37 400 33 36C 200 34 32 150 35 39 400	(Not specifically addressed)	(No specific TS requirements)	(Specified under the Battery Equalization function, above)	
Control Room Alarms: AC Power Failure; DC Undervoltage; Ground Detection; Overheating (31/32 only); Battery Discharge; Battery Room Ventilation Loss	No Draft DBD requirements.	FSAR 8.2-21 - One annunciator alarm for: 1) Low DC Voltage (All) 2) Ground Detection (All) 3) AC Failure (All) 4) Low Air Flow (31/32) 5) High DC Volts (31/32)	No specific TS requirements.	ARP11 - Alarm 43 "Battery Charger Trouble" alarms on: 1) AC Failure 2) Ground 3) Low DC Voltage (116 V) 4) Loss of Air Flow (33/34 only) 5) Overheating (31/32 only), set at 160°F 6) High Voltage Shutdown, set at 146 Vdc	

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	FSAR/IEEE 450 GUIDANCE BASES/EVALUATIONS	TECHNICAL SPECIFICATIONS	SURVEILLANCE TESTS AND PLANT PROCEDURES	NOTES AND COMMENTS
Distribution System					
Battery Service Test	No Draft DBD requirements.	IEEE 5.3 - A service test of the battery capacity may be required by the user to meet a specific application requirement upon completion of the installation. This is a test of the battery's ability to satisfy the design requirements of the dc system.	Not a TS requirement.	No Service Test of battery capacity is performed.	Inspector reviewed tests for future replacement batteries.
Fuses	Draft DBD - Bat 31/32/33 - Two (1 per Pole) Bat 31 to PP 31 - 800 amp Bat 32 to PP 32 - 800 Bat 34 to PP 34 - 400	No specific requirements.	No specific requirements.	Not tested.	
Breakers	Draft DBD - Bat 31 to PP 31 - 800 amp Bat 32 to PP 32 - 800 Bat 33 to PP 33 - 400 Bat 34 to PP 34 - 600 Tie 31 to 32 - 800 Tie 33 to 34 - 100 Chrgr 35 to Bus - 400 ("Maxgard" connection to any bus)	No specific requirements.	No specific requirements.	Not tested.	
Battery Room					
Condition	Draft DBD - Clean, Dry Area	No specific requirements.	No specific requirements.	PT-M21 - Battery room clean & free of debris.	PT-M21 had no explicit acceptance criteria for battery room condition.
Ventilation	Draft DBD - Adequate to keep H_2 <4%	IEEE 4.3.1 - Check & record vent system condition, monthly.	No specific requirements.	PT-M21 - Ventilation system is functional with ample airflow.	PT-M21 had no explicit acceptance criteria for battery ventilation system condition.
Temperature	Draft DBD - Bat 31/32/34 - 60-104°F Bat 33 - 35-104°F	IEEE 4.3.1 - Check & record room ambient temperature, monthly.	No specific requirements.	PT-M21 - Room ambient temperature between 65 & 80°F.	PT-M21 had no explicit acceptance criteria for battery room temperature condition.
Relative Humidity	Draft DBD - Between 30-90%	No specific requirements.	No specific requirements.	Not tested	Not checked, normal conditions.
Access	Draft DBD - Front Door Only	No specific requirements.	No specific requirements.	Not tested	Confirmed available

Attachment E

Persons Contacted

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*Attended Exit Meeting at IP-3 on 11/22/91

Attachment F

Documents Reviewed

Design Basis Documents:

IP3-DBD-306, Safety Injection System, Rev 0 (Proprietary)
Document I.D. No. 21.2, Auxiliary Feedwater System, Rev 0 (Proprietary)
Document I.D. No. 24.0, Service Water System, Rev 0 (Proprietary)
Document I.D. No. 27.1, Safety Related Electrical Power Distribution System, (Draft) (Proprietary)

Acceptance of Test Results for INT-TP-4.5.9 Containment Spray and Filter Dousing Air, Con. Edison (IP#3 Construction) to WEDCO Corporation, R. Barclay, 5/12/75

Electrical Load Study, 480V Emergency Diesel Generators 31, 32 and 33 Loading, Attachment 4.1, Procedural Flow Chart, Calculation No: IP3-CALC-ED-00204, Rev 0, 7/10/91

Report on the Service Water System Evaluation, by UE&C for NYPA IP3, Doc. No. S-M-2, 12/28/90, Rev 6

Transmittal of UFSAR Pages Affected by the SWS and IAS DBD Development, UE&C Memo to NYPA, S. Munoz, 4/9/91

WCAP-12313, Safety Evaluation for an Ultimate Heat Sink Temperature Increase to 95°F at IP-3, July 1989

Technical Manual NYPA 439-100000418 - Westinghouse Reactor Containment Fan Cooler Unit

Safety Evaluation Checklist SECL-89-508, Adequacy of Safety Related Auxiliary Pumps Minimum Flow Requirements.

NUREG-0452 (Rev. 4), Standard Technical Specifications for Westinghouse Pressurized Water Reactors, Fall 1981

IEEE 450-1980 and 1987, IEEE Recommended Practice for Maintenance, Testing, and Replacement of Large Lead Storage Batteries for Generating Stations and Substations, no date and November 17, 1986

IEEE 485-1983, IEEE Recommended Practice for Sizing Large Lead Storage Batteries for Generating Stations and Substations, September 30, 1983

Administrative Procedures:

AP-17, Calibration of Measuring and Test Equipment, Rev 5
AP-19, Surveillance Test Program, Rev 10
AP-25, Conduct of Technical Services, Rev 6
AP-42, Master Equipment List (MEL) Program, Rev 1

IC-AD-3, Preventative Maintenance Program, Rev 6
IC-AD-4, Periodic Calibration Program, Rev 5

Modification Control Manual, Procedure MCM:6B - Classification of Structures, Systems, Components and Subcomponents - IP3

Configuration Management Program Manual, Procedure CMM 1.1 - Configuration Management Program Description, Rev 0

Surveillance Test Procedures:

3PT-W5, Verification of Valve Position for Emergency Core Cooling System, Rev 6
3PT-W13, Station Battery Visual Inspection, Rev 5

3PT-M14A, Safety Injection System Logic Functional Test, Train A, Rev 15
3PT-M16, Safety Injection System Pump Functional Test, Rev 16
3PT-M20, Surveillance and Inservice Test Auxiliary Feed Pump Functional Test, Rev. 3
3PT-M21, Station Battery Surveillance, Rev 11
3PT-M36, Process Radiation Monitor, Rev 21

3PT-Q1, Station Battery Surveillance and Charging, Rev 10
3PT-Q11, Process Radiation Monitors' Calibration Check, Rev 10
3PT-Q16, Emergency Diesel Generators and Containment Temperature Service Water Control Valves SWN-FCV-1176, 1176A and SWN-TCV-1104, 1105, Rev 6
3PT-Q20, Surveillance and Inservice Test Auxiliary Boiler Feed Valves Testing, Rev. 5
3PT-Q77, Containment Fan Cooler Units Manual Isolation Valves, Rev 0

3PT-SA33, Refueling Water Storage Tank Lo-Lo Level Instrumentation System Check and Calibration, Rev 1

3PT-CS01, Main Steam Valves PCV-1310A and PCV-1310B, Rev. 5
3PT-CS4, Low Head Injection Line, Accumulator, and RHR Check Valve Leakage Test, Rev 8
3PT-CS8, Safety Injection RWST Valves, Rev 5
3PT-CS9, Safety Injection to Hot Leg, Rev 5
3PT-CS11, Condensate Storage Tank Low Level Isolation Valve LCV-1158-1 and LCV-1158-2, Rev. 7
3PT-CS15, Auxiliary Boiler (Motor Driven) Feed Water Pump & Valve Test, Rev. 7

3PT-CS19, Steam Driven Auxiliary Boiler Feed Pump Operability Test, Rev. 5
3PT-CS23, High Head S.I. Valves, Rev 5
3PT-CS24, High Head Safety Injection Operated Valves, Rev 4

3PT-R003A, Safety Injection System Test Recirculation Switches, Rev 7
3PT-R003B, Safety Injection System Test - Breaker Timing / Bus Stripping, Rev 8
3PT-R3D, Safety Injection Test, Rev 5
3PT-R7, Auxiliary Boiler Feed Water Pumps Full Flow Test, Rev. 10
3PT-R15, S.I. Hi-Head Check Valve Test 857's, Rev 7
3PT-R21, 32 Safety Injection Pump Suction Isolation Valves SI-MOV-887A and SI-MOV-887B, Rev 0
3PT-R24, Containment Fan Cooler System Coil Fouling Inspection, Rev 5
3PT-R27, City Water Makeup Supply to ABFPs - CT-PCV-1187, 1188, 1189, Rev. 5
3PT-R29A-D, 31 through 34 Station Battery Load Tests, all Rev 9
3PT-R32B, Containment FCU Filtration Systems, Rev 3
3PT-R35, Containment Isolation Valve Leakage Test, Enclosure 3.2, Rev 5
3PT-R41, Charcoal Filter Dousing Inspection, Rev 4
3PT-R43, FCU Heat Detectors, Rev 3
3PT-R53, Containment Sump Pump Operation and Level Sensor Check, Rev 5
3PT-R64, High Head Safety Injection Check Valves, Rev 5
3PT-R67, Low Head to High Head Recirculation Stop Valves SI-MOV-888A and 888B, Rev 3
3PT-R90B, Emergency Local Operational Test of the Fan Cooler Units, Rev 3
3PT-R90D, Emergency Local Operation of Auxiliary Boiler Feed Pumps, Rev. 3
3PT-R90E, Emergency Local Operation of Auxiliary Boiler Feed Pump # 32, Rev. 2
3PT-R106, FCU Inlet Safety Relief Valves SWN-42's, Rev 1
3PT-R108, Accumulator Safety Relief Valves 892A, B, C, & D, Rev 0

3PT-V8B, Auxiliary Boiler Feed Pump Turbine Mechanical Overspeed Trip Test, Rev. 5
3PT-V29, Full Flow Through BIT Tank Check Valve Test, Rev 1
3PT-V33, Recirculation Fan Cooler Unit Flush, Rev 1

3PT-3Y3, Fan Cooler Unit Dousing Air Flow Test, Rev 4

3PT-TY-A13, Inservice Pressure Test 31 Safety Injection Pump Coolers, Rev 0
3PT-TY-A14, Inservice Pressure Test 32 and 33 Safety Injection Pump Coolers, Rev 0
3PT-TY-M49, Inservice Pressure Test ABFP 32 Steam Supply, Rev. 1
3PT-TY-M50, Inservice Pressure Test ABFP 32 Turbine and Exhaust, Rev. 0

IC-PC-1-T-1178/22, Service Water Temperature Indicators, Rev 0
IC-PM-F-1123, Containment Fan Cooling Unit No. 33 Service Water Flow, Rev 3
IC-PM-F-1200, Auxiliary FeedWater Flow to Steam Generator No. 31, Rev. 8
IC-PM-L-1128, Condensate Storage Tank Level, Rev. 5
IC-PM-L-1128A, Condensate Storage Tank Level, Rev. 0
IC-PM-P-406A, Auxiliary Boiler Feed Pump No. 31 Discharge Pressure, Rev. 5
IC-PM-P-1126, Auxiliary Boiler Feed Pump No. 32 Steam Supply Pressure, Rev. 2

IC-PM-P-1176S, Auxiliary Boiler Feed Pump No. 32 Low Steam Pressure Switch, Rev 1
IC-PM-P-1205, Auxiliary FeedWater Pump City Water Supply Pressure, Rev. 4
IC-PM-P-1261, Auxiliary FeedWater Pump No. 32 Discharge Pressure, Rev. 4
IC-PM-P-1265, Auxiliary FeedWater Pump No. 33 Suction Pressure, Rev. 4
IC-PM-T-917, Boron Injection Tank Temperature, Rev 3
IC-PM-T-918, Boron Injection Tank Heater Control, Rev 3
IC-PM-T-1116S, Refueling Water Storage Tank Temperature Control, Rev 1

3PC-R07A, Steam Generator Level Control System Transmitters' Check and Calibration - Channel I, Rev. 1
3PC-R07D, Steam Generator Level Control System Transmitter Check and Calibration - Channel IV, Rev. 0, February 3, 1989
3PC-R07E, Steam Generator Level Control System Analog Components' Check and Calibration, Rev. 0
3PC-R13, Process Radiation Monitor Calibration (PRM), Rev 6
3PC-R16A, 31 Accumulator Level System Check and Calibration, Rev 8
3PC-R21, Calibration Check of Boron Injection Tank Recirculation Flow Indicator, Rev 6
3PC-R37, Containment Temperature Calibration, Rev 1
3PC-R38A, Containment Sump Level Transmitters Check and Calibration, Rev 2
3PC-R42, Containment Fan Cooler Units Service Water Delta T Calibration, Rev 1

PFM-23, Air Flow Traverse, Rev 0
PFM-24, Visual Inspection of Filters, Mounting Frames, and Housing, Rev 0
PFM-25, In-Place Leak Test, HEPA Filter Bank, Rev 0
PFM-26, In-Place Leak Test, Adsorber Stage, Rev 1
PFM-28, Representative Charcoal Sample, Rev 0
PFM-61, Plant Preparation for Cold Weather Conditions, Rev 0
PFM-62, Trending of surveillance Components, Rev 1
PFM-64, Plant Instrument Calibration List, Rev 0
PFM-66, Relief Valve Testing, Rev 0
PFM-72, Station Battery Impedance Test, Rev. 0
PFM-73, Initial Testing of Station Battery Cells, Rev. 0

Engineering Test Procedures:

ENG-333, SI Pump Discharge and suction Pressure Transmitter Calibration, Rev 0
ENG-397A, Safety Injection Time Delay Functional Test, Rev 0
ENG-431, Differential Pressure Test of SI Pumps Supply Valve SI-MOV-1810, Rev 0
ENG-433, ABFP 31 Recirculation Flow Switches Functional Test (FC-1135S and FC-1135AS) MOD 89-03-199AFW, Rev. 0
ENG-433A, ABFP 33 Recirculation Flow Switches Functional Test (FC-1136S and FC-1136AS) MOD 89-03-199AFW, Rev. 0

Maintenance Procedures:

HTX-001-GEN, Inspection & Cleaning Heat Exchanger, Rev 2

LUB-001-GEN, Lubrication of Plant Equipment, Rev 2

Maintenance Work Requests:

M-23010-4F, VS-FCU-31 Fan Cooler Unit, Open Water Box for Inspection and Cleaning, 7/8 Refuel Outage

M-31829.4a, VS-FCU 31-35 Operating Hours of the FCUs approaching 2000 hours-lubrication required

Radiological and Environmental Services Procedures:

RE-CS-012.1, Chemistry Specifications and Frequencies For The Reactor Coolant System and Primary Auxiliaries

RE-CS-033, Sample Locations in Controlled Areas

Operational Procedures:

ARP-14, Alarm Response Procedure - Panel SLF #28, Recirc Fan Carbon Filter Flow Low

COL-EL-1, 6900 and 480 Volt AC Distribution, Rev 7
COL-LV-1, Locked Valve Check off List
COL-RW-2, Service Water Systems
COL-RWV-1, FCU Service Water Verification
COL-SI-1, Safety Injection System, Rev 14

SOP-CB-10, Containment Recirculation Fan Cooler Unit Operations, Rev 6

Drawings:

9321-F-20173, Flow Diagram, Main Steam, Rev 34

9321-F-20183, Flow Diagram, Condensate & Boiler Feed Pump Suction, Rev 12

9321-F-20193, Flow Diagram, Boiler Feedwater, Rev 30

9321-F-27223, Flow Diagram, Service Water System, Nuclear Steam Supply Plant, Rev 7

9321-F-27233, Flow Diagram, Nitrogen to Nuclear Equipment, Rev 25

9321-F-27353, Flow Diagram, Safety Injection System, Sheet 1, Rev 20

9321-F-27503, Flow Diagram, Safety Injection System, Sheet 2, Rev 24

9321-LL-31343, Schematic Diagram Supervisory Annunciator Sheet 15, Containment Recirculating Fans Air Flow Alarms

9321-F-33633, Front View of Control Board, Section D, Rev 7

9321-F-40223, Flow Diagram Ventilation System for Containment, Primary Auxiliary and Fuel Storage Buildings, Rev 19

9321-F-40243-5, Containment Air Recirculation System Plan Above El 35', Rev 5

Miscellaneous Documents:

IP-3 Technical Specifications

IP-3 Updated Facility Safety Analysis Report (UFSAR)

IP-3 Master Equipment List, Q-Lists for SI, FCU, AFW, Batteries, and numerous Data Verification Reports for system components

IP-3 Response to NRC Generic Letter 89-13, Service Water System Problems Affecting Safety-Related Equipment, NYPA to USNRC, 2/6/90 (IPN-90-004).

IP-3 Rotating Equipment Status Report for October 1991, Performance Group Maintenance Engineering

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Nuclear Safety Evaluation, NSE 86-03-018 SWS, Rev 0, Reg. Guide 1.97 - Containment Fan Cooling Units Service Water Outlet Flow, 4/21/87

Nuclear Safety Evaluation, NSE 86-03-019 SWS, Rev 1, Reg. Guide 1.97 - Containment Fan Cooling Units Service Water Delta T, 8/5/87

Request for Nuclear Safety Evaluation, NSE 84-03-052 SWN Rev 0, Installation of Service Water Sampling and Calibration Taps for R-16, R-23, 10/4/84

Request for Nuclear Safety Evaluation, NSE 85-3-113 FCU, Rev 0, Replacement of Containment Fan Cooler Motor Coolers, 7/28/85

System Description No. 10.1, Safety Injection System, Rev 1, 12/88

System Description No. 10.3, Containment Air Recirculation Cooling and Filtration System, Rev 0, 9/85

System Description, Auxiliary Feedwater System

System Description No. 24, Service Water System

IP3-CALC-EL-00108, 125 VDC Power Panel 32 and Associated Loads - Voltage Drop, Rev 0

IP3-CALC-EL-00185, Component Sizing - 125 VDC - 32 Battery, Charger, Panels and Cables, Rev 0

Westinghouse Memo, Molded Case Circuit Breakers, Type FB, June 20, 1991

Attachment G

Table of Acronyms

AC -	Alternating Current
AFW -	Auxiliary Feedwater
AFWP -	Auxiliary Feedwater Pump
AFWS -	Auxiliary Feedwater System
AH -	Ampere-Hours
ANSI -	American National Standards Institute
AOV -	Air Operated Valve
AP -	Administrative Procedure
ARP -	Alarm Response Procedure
ASME -	American Society of Mechanical Engineers
ASTM -	American Society for Testing and Materials
BIT -	Boron Injection Tank
B&PV -	Boiler and Pressure Vessel (ASME Code)
BTU -	British Thermal Unit
C -	Centigrade
CB -	Containment Building
cc -	cubic centimeters
CCR -	Central Control Room
CFM -	Cubic Feet per Minute
CFMS -	Critical Functions Monitoring System
CFR -	Code of Federal Regulations
CIV -	Containment Isolation Valve
COL -	Checkoff List
CS -	Cold Shutdown Test Interval (specified in procedure no.)
CST -	Condensate Storage Tank
DBD -	Design Basis Document
DC -	Direct Current
DOP -	Dioctylphthalate Particles
DP -	Distribution Panel
d/p -	differential pressure
E-Spec -	Equipment Specification
ECCS -	Emergency Core Cooling System
EDG -	Emergency Diesel Generator
ENG -	Engineering Test
EQ -	Equipment Qualification
ESF -	Engineered Safety Feature
F -	Fahrenheit
FC -	Flow Controller
FCU -	Fan Cooling Unit
FCV -	Flow Control Valve
FE -	Flow Element
FI -	Flow Indicator

FPM -	Feet Per Minute
FSAR -	Final Safety Analysis Report
FT -	Flow Transmitter
FW -	Feedwater
GDC -	General Design Criterion
gpm -	gallons per minute
H -	High
HEPA -	High Efficiency Particulate Analysis
HHSI -	High Head Safety Injection
HP -	Horsepower
HTX -	Heat Exchanger
IA -	Instrument Air
IAS -	Instrument Air System
iaw -	in accordance with
I&C -	Instrumentation and Control
IEEE -	Institute of Electrical and Electronic Engineers, Inc
IP-3 -	Indian Point - Unit 3
ISI -	Inservice Inspection
IST -	Inservice Test
j -	imaginary unit (square root of -1)
K -	One Thousand
KI -	Potasium Iodide
KW -	Kilowatts
LBLOCA -	Large Break Loss of Coolant Accident
LC -	Level Controller
LCO -	Limiting Condition for Operation
LCV -	Level Control Valve
LI -	Level Indicator
LIC -	Level Indicator Controller
LOOP -	Loss of offsite power
m -	meter
m^3 -	cubic meters
MOV -	Motor Operated Valve
MS -	Main Steam
MSLB -	Main Steam Line Break
MW -	Megawatts
MWR -	Maintenance Work Request
N_2 -	Nitrogen Gas
NPSH -	Net Positive Suction Head
NPSHa -	Net Positive Suction Head available
NPSHr -	Net Positive Suction Head required
NRC -	Nuclear Regulatory Commission
NSE -	Nuclear Safety Evaluation
NYPA -	New York Power Authority
ODCM -	Offsite Dose Calculation Manual
O.D. -	Outside Diameter

OL -	Operating License
OI -	Open Item
PC -	Periodic Calibration
PCV -	Pressure Control Valve
PE -	Pressure Element
PI -	Pressure Indicator
PIC -	Pressure Indicator Controller
PM -	Preventive Maintenance
ppm -	parts per million
PRM -	Process Radiation Monitor
psi -	pounds per square inch
psia -	pounds per square inch absolute
psid -	pounds per square inch differential
psig -	pounds per square inch gauge
P -	Pressure
PT -	Periodic Test
PT -	Pressure Transmitter
Q -	Quarterly Test Interval (specified in procedure no.)
QSPDS -	Qualified Safety Parameter Display System
R -	Refueling Test Interval (specified in procedure no.)
RC -	Reactor Coolant
RCS -	Reactor Coolant System
RE -	Radiation Elements
Reg. -	Regulatory
RETS -	Radiological Technical Specifications
RHR -	Residual Heat Removal
R/I -	Electrical Resistance/Current
rpm -	revolutions per minute
RTD -	Resistance Temperature Detector
RWST -	Refueling Water Storage Tank
Rx -	Nuclear Reactor
SA -	Semi-annual Test Interval (specified in procedure no.)
SBLOCA -	Small Break Loss of Coolant Accident
SCF -	Standard Cubic Feet
SCFM -	Standard Cubic Feet per Minute
SECL -	Safety Evaluation Checklist
s.g. -	specific gravity
SG -	Steam Generator
SI -	Safety Injection
SIS -	Safety Injection System
SOP -	Standard Operating Procedure
SOV -	Solenoid Operated Valve
SV -	Safety Valve
SW -	Service Water
SWN -	Service Water System Component Designator
SWS -	Service Water System

T-ave -	Average reactor coolant temperature
TCV -	Temperature Control Valve
TD -	Turbine Driven
TE -	Temperature Element
TEDA -	Triethylene Diamine (Charcoal activation agent)
TIC -	Temperature Indicator Controller
TS -	Technical Specifications
TY -	Ten Year Test Interval (specified in procedure no.)
3Y -	Three Year Test Interval (specified in procedure no.)
UE&C -	United Engineers and Constructors
UFSAR -	Updated Final Safety Analysis Report
USAS -	United States of America Standard
V -	Variable Test Interval (specified in procedure no.)
V -	Volts
W -	Weekly Test Interval (specified in procedure no.)
W -	Width
w/ -	with
WCAP -	Westinghouse technical publication designator
# -	Pounds
≈ -	approximately equal to
> -	greater than
< -	less than
≥ -	greater than or equal to
≤ -	less than or equal to
Δ -	delta (change in)