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Licensee: Duquesne Light Company
P.O. Box 4
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Facility Name: Beaver Valley Power Station, Unit 1

Inspection At: Shippingport, Pennsylvania

Inspection Conducted: January 27 - February 7, 1992

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Areas Inspected: This inspection was performed to determine the ability of surveillance tests to demonstrate the design safety functions of the Safety Injection System, the Supplementary Leak Collection and Release System, and the Auxiliary Feedwater System. 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. Periodic surveillance testing performed on these systems is one measure of their ability to perform satisfactorily, and to provide protection to public health and safety during abnormal plant conditions or events.

Inspection Results: The current surveillance testing performed on the Safety Injection (SI) and Auxiliary Feedwater (AFW) systems adequately demonstrated that the systems' design basis safety functions would be fulfilled under accident conditions and was in conformance with Technical Specification requirements. Overall, the licensee's surveillance test 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. Deficiencies existed in the adequacy and timeliness of corrective actions for deficiencies identified by the licensee in the documented design basis of the Supplementary Leak Collection and Release (SLCR) system which hampered proper surveillance testing to demonstrate that all of the SLCR's safety functions could be fulfilled. These functions require adequate air flow to prevent overheating of safety related charging pumps during accident conditions. These deficiencies resulted in a violation of NRC requirements for adequate and timely corrective actions.

Other concerns were identified which relate to HHSI charging pump performance curves used in surveillance tests which could not be traced directly to certified pump curves. Also, data used to establish Turbine Driven AFW pump performance curves was not consistent with data obtained during testing because of the differences in the instrumentation used in each case. These concerns were presented to the station management for resolution.

The reconstituted design bases documents and the Safety System Functional Evaluations developed for the SLCR and AFW systems were positive initiatives which clearly set forth the principal design requirements applicable to these safety systems. The Design Basis Documents were found to be useful references for the source engineering materials which comprise the design bases of these systems.

EXECUTIVE SUMMARY

This inspection was 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 demonstrated 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 Beaver Valley Power Station, in Shippingport, Pennsylvania, from January 27 through February 7, 1992.

The systems reviewed included the Safety Injection (SI) System, the Supplementary Leak Collection and Release (SLCR) System, and the Auxiliary Feedwater (AFW) System. 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. These documents were examined for an item-by-item comparison of the current requirements in each of the critical functional areas. The matrix charts contained in Attachments A, B, and C were developed for this purpose.

The inspection centered upon the major thermal-hydraulic, mechanical, and electrical parameters such as fluid flow, pump head and differential pressure, net positive suction head, and MOV stroke times which characterize the performance of systems and their major components. The surveillance testing of system actuation circuits was not reviewed, and the inspectors did not cover the systems' total (i.e., safety and normal) functional design bases. Also, the overall adequacy of the surveillance requirements contained in the Technical Specifications was not determined. 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. Where possible, the reconstituted design bases and the safety system functional evaluations for the AFW and the SCLR 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 test program requirements.

Overall, the inspectors found that the periodic surveillance tests currently performed on these systems met the required testing specified by the Technical Specifications. Deficiencies not in accordance with NRC requirements existed in the adequacy and timeliness of corrective actions for deficiencies in the documented design basis of the SLCR system which prevented proper surveillance testing to demonstrate that all of the SLCR's safety functions could be fulfilled. These functions provide adequate air flow to prevent over heating of safety related charging pumps during accident conditions.

Additional concerns were identified which related to the HHSI charging pump performance curves used for surveillance tests which could not be directly traced to certified test curves. Also, Turbine Driven AFW pump performance curves were not consistent with the performance data obtained during surveillance testing because the instrumentation used to establish baseline performance curves was different from that used during testing. In both cases, actual pump performance was above the minimum operating characteristics required for their safety functions.

Surveillance testing often extended to cover functional parameters which were not explicitly defined or required to determine system operability as defined by the TS. The test program prescribed sufficient system testing to ensure that critical parameters which support the overall safety functions were adequately demonstrated. With the exception of test and design control issues in the SLCR System, inspectors were able to extrapolate test results to the design basis conditions with confidence and with adequate engineering justification where necessary.

DETAILS

1.0 INTRODUCTION

1.1 Persons Contacted

See Attachment D

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 may be inadequate, although they may 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 changing 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 exist because integrated system testing often 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 the 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 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.

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

The second part, the matrix charts in Attachments A, B, and C 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 Technical Specification and test procedure requirements and parameters 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 reviewed the critical functional parameters of active mechanical and electrical system components (motors, pumps, valves, fans, instruments, etc.) of three engineered safety feature systems at Beaver Valley Unit 1 (BV-1). The Safety Injection System, the Supplementary Leak Collection and Release System, and the Auxiliary Feedwater System were reviewed to compare their design basis safety requirements to acceptance criteria and actual test data in both TS and non-TS surveillance tests. Parameters were reviewed such as pump flow, differential pressure, and net positive suction head which are associated directly with safety functions defined in the design basis for the system. Other parameters such as pump run times, valve stroke times, and motor horse power were also examined because they directly affect a system's or component's ability to meet thermal-hydraulic, mechanical, or electrical design requirements. System actuation circuitry and MOVATS testing of motorized valve actuators were not included in the scope of this inspection. Valve stroke times and flow rates 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. 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 which closely match the normal function of the system. For example, some safety system pumps, which fall under the ASME Code Section XI requirements, were tested at "normal" system conditions. The test data were then related to a pump performance curve which required an extrapolation to accident conditions. This method of data analysis is a generally accepted industry practice. Likewise, some leak testing was performed below normal operating pressure, but the data were properly corrected in accordance with ASME Section XI methods to obtain accurate leakage information for higher pressures.

The entire functional design bases for these systems are not represented in the attached matrix charts. However, the critical safety functions are represented as they existed in source documents available during the inspection. The existing design basis documents (DBDs), Updated Final Safety Analysis Report (UFSAR), manufacturers equipment specifications, etc., were used as valid engineering bases for the safety functions of these systems.

1.5 BV-1 Surveillance Test Program

Technical Services Department Administrative Procedure TSAP-1.5.3, "Administrative Guidelines for Performing Tests" specified the existing test program requirements and defined the management controls and individual responsibilities applicable to the performance of Beaver Valley Test (BVT) procedures. The Operations Departments also performed surveillance testing through Operations Surveillance Tests (OSTs) and maintained overall responsibility for the performance of plant tests at BV-1. Both departments had responsibilities which included writing test procedures, participating in the performance of tests, and conducting engineering reviews of recorded test data. The Technical Services Department was primarily involved in the resolution of test discrepancies to ensure that safety system functional criteria were met. The Operations group was also responsible for ensuring that surveillance tests satisfied the Technical Specification operability requirements for plant systems. The Technical Services Department initiated a system engineer program which will eventually assume responsibilities with a system focus. System engineers had been assigned to the SLCR System and the AFW System.

Some system and component tests (primarily BVTs) were performed as necessary on a specialized and 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 were to demonstrate the operability of a component under design conditions.

2.0 SAFETY INJECTION (SI) SYSTEM

2.1 System Purpose

This inspection reviewed the subsystems of the SI System which provide the active high head safety injection (HHSI) and the low head safety injection (LHSI) functions, as accomplished by the HHSI pumps and the LHSI pumps and accumulators, respectively. A system description is provided in Attachment A.

2.2 SI System Design Basis and Safety Function

As an engineered safety feature (ESF), the SI System was designed to protect against and mitigate the consequences of design basis accidents (e.g., a loss of coolant accident coincident with a loss of offsite power) by providing emergency cooling water to the reactor vessel during blowdown following a pipe rupture before the RCS is fully depressurized and the core is uncovered. Following a small pipe rupture, the SI System controls the reduction in reactor coolant system (RCS) pressure and temperature. The SI System assures that the core will remain intact and in place with its essential heat transfer geometry preserved.

By design, the SI System is capable of supplying the required borated water 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 SI System maintains the core flooded or rapidly refloods the reactor vessel if the core is uncovered. To achieve a high flow rate, the accumulators and two LHSI pumps provide immediate 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 below 661 psig. Flooding the core limits a 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 HHSI and LHSI pumps maintain RCS inventory and provide sufficient shutdown margin to the reactor. Following a MSLB, the SI System will arrest an excursion in reactor power and a rapid introduction of negative reactivity from the boron injection tank (BIT) will prevent the reactor from returning to power.

The inspector categorized the critical safety functions of the SI System in several functional areas which are detailed in the matrix charts in Attachment A. These functions were those which provide the immediate accident mitigating capabilities of the SI System, and those which protect the integrity of the SI System. The major functions are:

1. Availability of SI System flow paths to the RCS
2. Adequate SI pump and accumulator flow rates
3. Adequate NPSH to the HHSI and LHSI pumps
4. Operational readiness of system MOVs
5. Full flow capability of system check valves
6. Leak tightness of SI System/RCS high pressure boundary check valves
7. SI System overpressure protection

2.3 UFSAR and TS Contents

The licensee had not developed a Design Basis Document (DBD) for the Unit 1 Safety Injection System. Although one was completed for Unit 2, its contents did not apply directly to Unit 1. The licensee stated that a DBD would be written after sufficient engineering information relating to the Unit 1 SI System was compiled; however, this was not planned for the near future. Equipment specifications provided by the original NSSS vendor (Westinghouse) provided many detailed descriptions of original design specifications related to the SI System and the critical functional requirements that the system was designed to meet. However, other engineering resources were needed to obtain the current design basis in order to include the effects of modifications which may have altered the original system design. The inspector also used many component manufacturers' specifications as source documents for defining the current design bases for the SI system.

The Updated Facility Safety Analysis Report (UFSAR) sections describing the SI System contained references to 10 CFR 50 General Design Criteria (GDC) applicable to the system. Explicit statements in the UFSAR described capabilities designed into the SI System to demonstrate the GDC requirements that design basis functions be testable.

The Technical Specifications (TS) for BV-1 were standardized in format and customized in content. The surveillance requirements contained in them emphasized specific system and component operability requirements. The sections which addressed the Emergency Core Cooling System defined certain primary plant conditions which must not be exceeded unless the major SI System components are operable (e.g., RWST water level, BIT boron concentration, MOV power deenergized, etc.) whenever RCS temperature was at a specified level. The TS surveillance requirements also specified plant conditions which could not be exceeded until system testing was performed to demonstrate operability. The TS Bases section clearly indicated that the surveillance requirements ensure that overall system functional capability is maintained comparable to the original design standards. Some specific tests with acceptance criteria were described in the TS, such as specific check valves which must meet specific leak rates, and various pump flows and discharge pressures. In most cases, detailed acceptance criteria, or the specific components required to be tested for system operability, were well detailed in the TS. The determination of which components were applicable and the precise test acceptance criteria for operability were often specified in the TS. The Bases Sections in the TS often made explicit reference to the design basis functional requirements of the SI System. Certain tests which were specified (e.g., RCS boundary check valve leak tests) were clearly prescribed to confirm the adequacy of design requirements. However, there was no explicit reference to design basis functional requirements in the TS.

2.4 SI System Surveillance Testing

The existing surveillance testing of the injection function of the SI System was provided by a series of test procedures designed primarily to satisfy the system and component operability requirements prescribed by the TS for normal plant operations. Most of the SI System active components (pumps, MOVs, check valves, etc.) were subjected to the periodic testing requirements 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 UFSAR, or the TS; however, they provide a convenient way to group the functions of the major active components and to describe the surveillance tests which verify that these functions can be achieved.

This inspection reviewed the larger system parameters which, when tested, confirmed the SI System capability to meet its design safety functions. To assure continued reliability, the SI System 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 SI System/RCS high pressure boundary valves to permit leak testing, and test flow lines were installed to permit pump testing without injecting water to the RCS during normal plant operation. Certain tests, could not be performed during plant operations since plant conditions would not be appropriate or because too much of the SI System would have to be made inoperable when it is required to be available. For example, the test performed to demonstrate full SI System flow to the reactor vessel requires the plant to be shutdown with the RCS depressurized. The inspector considered that the system surveillance tests were performed under appropriate plant conditions to demonstrate the required safety functions.

The SI System is normally configured so that a minimum number of component actions are required to accomplish injection flow to the RCS. For the BIT flow path (preferred), MOVs must reposition to align the BIT with the primary HHSI flow path. For the non-BIT flow path, realigning the HHSI pump discharge header is required. 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 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 SI System injection flow paths are stroke tested periodically to verify that they meet their maximum cycle times defined by the IST program. In addition, all SI valve positions are verified weekly by plant operators.

Manual valves in the injection header branch lines were set to positions required to obtain HHSI pump flows and discharge head data over the entire range of the pump performance curves. This also provided a convenient means to assure correct flow balancing in the injection header.

Confirmation of the availability of the injection flow paths also required testing of system check valves to demonstrate their full stroke or full flow capability. The licensee performed surveillance tests for full stroking of all SI System (ASME Section XI, Category A) check valves required to pass the minimum flow during safety injection. This testing adequately demonstrated that these valves could meet their minimum design flow requirements.

The HHSI and LHSI pump flows were also tested on a monthly basis in accordance with the IST program. Performance parameters stipulated by ASME, Section XI, such as suction pressure, discharge head, and pump d/p were clearly tested by surveillance procedures. Pump flow tests included data for the adequacy of recirculation minimum flow required to ensure that the pumps could operate for a specified minimum time without overheating. The test data obtained were compared to pump performance characteristic curves. The inspector was concerned that the HHSI pump performance curves used in OST 1.11.14, "Safety Injection System Full Flow Test" could not be traced to the actual certified curves contained in the Vendor's Tecnnical Manual (VTM). The VTM contained only one certified curve for the installed pumps. One VTM curve represented an old pump not currently installed. NED personnel stated that the unique serial numbers were unknown for two of the HHSI pump rotating assemblies replaced several outages ago. This prevented them from obtaining the vendor's certified test curves and hence, they were not available in the VTM. One serial number was obtained during the last refueling, but neither its curve or the unknown pump curve was entered into the test procedure. The reference curves contained in the test procedure were computer generated and represented the "best fit" to several data points obtained from test runs for three different pumps operating in a limited test flow region. NED was currently regenerating new baseline pump curves for all three pumps from actual performance data over a broad range of flows.

In response to NRC Generic Letter 89-04, "Guidance on Developing Acceptable Inservice Test Programs," the licensee performed recent HHSI pump testing to obtain flow data under simulated accident conditions. The inspector considered that the results did not indicate the pump would meet the ASME limits for pump differential pressure in this region based on projections of the computer generated baseline performance curves. These curves did not extend into the high flow region expected during accident conditions. However, the test procedure did contain Minimum Operating Point (MOP) curves which extended over the full range of pump flow. The MOP curves were produced from a Westinghouse safety analysis and confirmed that actual pump flow data was above the minimum performance requirements for adequate safety injection flow.

The licensee acknowledged that the reference curves contained in test procedures should be traceable to certified baseline pump performance and also confirmed that future test procedures will contain new baseline performance data which extends into the high flow regions. To further ensure adequate pump performance under accident conditions, the MOP curve generated by the recent safety analysis will be used to establish minimum pump flows even if the MOP limit is above the ASME limit. Current surveillance procedures for SI pump performance contain acceptance criteria which stipulate that both the ASME and the MOP limits must be satisfied in order for the pumps to be declared operable. These requirements will assure that tests will demonstrate adequate safety performance when testing is conducted in the high flow regions.

Accumulator discharge flow rates were tested each refueling outage. The resulting flows were 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 accumulator isolation MOVs to test their stroke times.

Various LHSI System/RCS high pressure boundary valves provide protection to the SI System by preventing backleakage from the RCS which operates at several hundred pounds above LHSI System design pressure. These boundary valves were tested by detailed surveillance procedures which recorded leakage rates 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. Leak test procedures performed at pressures below normal contained detailed calculations, based on ASME Section XI methods, to correct leakage data at test pressures to equivalent values for normal operating pressure.

Overpressure protection in the LHSI System was provided by three relief valves installed at various locations which ensure that all LHSI System piping is protected. The HHSI and charging systems are protected from overpressure through installed relief valves; however, the HHSI pump discharge piping is designed for RCS system pressure. Both the BIT and the non-BIT injection paths relieve directly to the RCS. The HHSI charging header also contains a relief valve outside the normal injection path. All relief valves were subjected to IST program requirements for periodic setpoint testing and adjustment to system design pressures. All relief valves were maintained on a testing schedule which ensured that their setpoints were tested and adjusted at least once every 3 years (a maximum 5 year frequency is allowed by Section XI).

The inspector considered the existing procedure requirements and acceptance criteria together were well specified. They demonstrated that design basis functional requirements were being tested. Test acceptance criteria did not lack specificity and always provided the acceptable range of tolerances for test data. Some procedures required test personnel to record various data (e.g., lube oil level) without any specification for what was acceptable. However, the data were later reviewed for acceptability by the Technical Services Department and were used as trending information for predicting component degradation. With these minor exceptions, there appeared to be ample specificity in test acceptance criteria used for determining component and system performance. Test procedures adequately tested the design basis functions specified for the SI System.

2.5 Calibration of SI System Instrumentation

The temperatures and volumes of water contained in the large SI System vessels (RWST, BIT, and accumulators) are specified by TS operability requirements and typically verified by surveillance procedures. During normal plant operations, water temperature and volumes are verified on a frequent basis (each shift) by observing the installed instrumentation. In addition, minimum water volumes are also assured through active system alarms. 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, pressure, and temperature instruments on the large vessels to verify that the calibrations were appropriate to the parameter monitored. The current status of these calibrations was also reviewed and all were found to be within their valid time period.

The inspector reviewed the status of calibrations in all of the SI System instruments recorded in test procedures. All instruments used were documented to have current calibrations. The M&TE used for the collection of acceptance test data was also verified to be within current calibration for the completed test procedures reviewed.

2.6 Conclusions

Surveillance testing of the SI System at BV-1 was well specified. The testing demonstrated the ability to fulfill the system design basis safety functions. The overall content of test results were sufficiently detailed and the test results verified that design safety functions were adequately tested. The application of non-specific computerized pump curves did not appear to be appropriate. However, the licensee stated that when HHSI pump performance testing is extended into the higher flow regions and specific pump performance data are developed for test acceptance criteria, unique curves will be used for each pump. Although the current TS operability requirements apply the ASME criteria for pump performance, the pumps tests assured that these pumps always meet the minimum flows required by the safety analysis.

3.0 SUPPLEMENTARY LEAK COLLECTION AND RELEASE SYSTEM (SLCRS)

3.1 System Purpose

The SLCRS is a ventilation exhaust system which maintains a negative pressure in the Primary Auxiliary Building during accident conditions to collect leakage of airborne radioactive contamination and discharges potentially contaminated air through charcoal filters. In addition, the volume of air moved is sufficient to cool safeguards equipment in the event of a loss of offsite power coincident with a design basis LOCA.

3.2 Design Safety Functions and Content of Design Basis Documentation

The Supplementary Leak Collection and Release (SLCR) System is a large ventilation system designed to provide post-accident ventilation for cooling and filtration of air contained in equipment spaces immediately adjacent to the containment building. The system also provides a filtration path for containment air during refueling operations. The design functions stated in the UFSAR, Technical Specifications, and Design Basis Document are as follows:

> In order to prevent the release of contaminated air, the system must maintain 0.125" water gauge (W.G.) negative pressure in most areas contiguous to the containment, i.e., the fuel building, and the waste gas storage area. This function is also provided to the containment building during refueling. Potentially contaminated air in these areas is drawn into the SLCR system and is filtered through impregnated charcoal beds for the removal of radioactive iodine. The filtered air is then released through a monitored release path to the atmosphere at the SLCRS vent.

The system provides redundant filter banks and exhaust fans with emergency power available to the fans if needed. In order to assure that the system can meet its design functions, the equipment and system were designed to be capable of withstanding a design basis earthquake without a loss of function.

In response to a containment isolation signal phase A or an actuating signal from one of several radiation monitors, the system will realign the flowpath through charcoal filters. In response to an auxiliary building Hi-Hi radiation signal, the system will align the auxiliary building shielded areas exhaust to the SLCRS, as well as align the SLCRS through its charcoal filters. The system shuts the containment purge and exhaust isolation valves in response to containment or fuel handling building Hi-Hi radiation signals and dampers will open to allow outside air to be drawn into the areas served by SLCRS in response to high room temperatures.

Various design calculations were done to demonstrate an additional safety function which was to provide an adequate volume of airflow for equipment cooling during a design basis loss of coolant accident coincident with a loss of offsite power.

The following safety functions were evaluated by the inspector and are detailed in Attachment B:

1. Post-accident HEPA filter bank operation
2. Actuation of motor operated dampers
3. Operation of SLCRS containment isolation valves
4. Air flow requirements of the SLCRS fans
5. SLCRS flow balancing requirements
6. Normal isolation of filter bed deluge system valves

3.3 Surveillance Testing

The testing needed to assure system functionality included both Technical Specification (TS) and non-TS required surveillances of safety functions. SLCRS associated testing is detailed in Attachment B and is summarized below.

Technical Specification Testing:

The BV-1 TS specified testing to verify the operability of the charcoal filter banks. Operability was defined in terms of detailed functional requirements which closely paralleled the design bases. These functions were explicitly written as system parameters which demonstrated the following functions:

- the ability of the fans to draw the required flow volume through the filters, and the actuation of the system in response to a containment isolation phase A signal (TS 4.7.8.1).

- the ability of the system to maintain negative pressure in the spent fuel storage area and to swap to the charcoal filters in response to a fuel area radiation monitor signal (TS 4.9.13).

- proper actuation of the system in response to certain radiation monitors (TS 4.3.3.1).

- proper stroke times for containment purge supply and exhaust valves (TS 4.6.3.1).

The test procedures used to accomplish these TS requirements are also described in Attachment B. The last performance copy of each of these procedures was reviewed by the inspector. The acceptance criteria were in accordance with the appropriate Technical Specification. The most recent testing performed was also reviewed and the inspector determined that acceptance criteria were satisfactorily met.

Non-Technical Specification Testing:

Other safety functions were not addressed in TS but were specified in non-TS surveillance tests. These included the following:

- Actuation of the system in response to certain non-T.S. radiation monitors.

- Actuation of charging pump cubicle dampers in response to a containment isolation phase B signal.

- Actuation of pump cubicle and outside air inlet dampers in response to area high temperatures.

- Balancing of system flows to maintain negative pressure for leak collection and sufficient volumes of flow for post-accident safety equipment cooling.

The procedures used to accomplish these tests are briefly described in Attachment B. The last performance copy of these procedures was reviewed by the inspector to ensure that the acceptance criteria were met. For actuation testing, the procedures and acceptance criteria adequately tested the specified functions and the most recent results were satisfactory.

The inspector identified concerns in SLCR system flow balancing criteria used by the licensee. The original system design calculations generated certain minimum flows required for safety equipment room cooling, and the system was initially balanced for these flows. In 1980, a major design change was performed on the system which required rebalancing flows to prevent exceeding filter bank capacity. The new flows for safety-related equipment areas were approximately 2/3 of the original design flows. It appeared that no calculations were done at this time to verify the adequacy of the new flows to satisfy the post-accident equipment cooling function with loss of offsite power. The licensee began to realize this as a result of previous NRC questions (Inspection Report 50-334/89-04) and during the licensee's development of the design basis document.

Over approximately the past two years, the licensee has done calculations to verify the adequacy of existing or obtainable ventilation flow for various areas as they have become aware of the problem. These calculations showed that the current flow balance numbers were adequate, but there was little or no cooling margin demonstrated under extreme conditions. At the time of this inspection, the Nuclear Engineering Department was performing new detailed calculations to determine flow balance minimum requirements. The final review of these calculations must verify that the analytical assumptions are justified and that the system lineup assumed in the calculation matched the actual system lineup used for testing.

The inspector reviewed the last recorded performance of the current flow balancing procedures. The acceptance criteria in these procedures have been verified adequate by the various calculations described above. Flow from one area was approximately 2% low; however, the other results were satisfactory.

SLCRs flow in the charging pump cubicles is not presently included in a periodic surveillance test. A Temporary Operating Procedure (TOP) was performed to investigate charging cubicle flows in response to the ventilation calculations performed. This test revealed a failed damper which prevented adequate charging pump cubicle ventilation flow. Corrective action for this event consisted of new calculations and the development of a new periodic flow balancing procedure, and repair of the failed damper.

The existing flow balancing design basis information appeared to be piecemeal in nature. The current periodic flow balance surveillance testing omits the charging pump cubicles. However, this situation is being corrected by the licensee, and the system has been adequately balanced in the interim by the TOP mentioned above.

3.4 Charging Pump Cubicles Ventilation/Improper Mode Change

The inspector reviewed Engineering Calculation 13387.13-B-78 (12/23/83) which predicted that the charging pump cubicles would reach 170°F with ventilation exhaust through the SLCRS at 2000 cfm. This was the flowrate to which the system was balanced after the 1980 design change (DCP 210/202) described in section 3.3. The calculation assumed that temporary ventilation would be provided to assure that the 120°F environmental qualification temperature was not exceeded. The facility provided the inspector a copy of Incident Report 1-91-74 which described the following sequence of events:

- The licensee reviewed the "B-78" calculation in October 1990 and realized that the procedural actions assumed in the calculations were not in effect and adequate cooling could not be assured.

- In October 1991, the licensee realized that the charging pump ventilation issue still had not been resolved and was a potential unit startup issue.

- On 11/20/91, the licensee determined that required ventilation flows were 2000 cfm for the A&C pumps, 2200 cfm for the B pump.

- On 11/24/91, ventilation flow measurements were made to determine actual and obtainable charging pump cubicle flowrates. The stated criteria were not met for 2 of the 3 pumps. There was then an apparent miscommunication between Nuclear Engineering, the testing crew, and the Unit 1 Operations Manager concerning pump operability.

- On 11/25/91, the plant escalated the operating mode from Mode 4 to Mode 3 with only one charging pump operable. The other two pumps were inoperable due to the inadequate SLCRS flow which is a required support function. This was not in accordance with the requirements of Technical Specification 3.5.2 Limiting Conditions for Operation.

- On 11/27/91, the licensee declared 2 of the 3 charging pumps inoperable and halted further mode escalation. The low flow was determined to be due to a failed damper which was subsequently repaired.

- Additional corrective action implemented included evaluation of existing SLCRS flows for adequacy and new calculations of minimum flows. The most recent calculation resulted in 2800/2900 cfm as the minimum required charging pump cubicle flows. However, no corrective action for the communication/evaluation problem was identified. The licensee submitted LER 91-032-00 on 12/3/91 to report the inoperable charging pumps and the improper mode change.

Review of these events leads to a conclusion that the licensee did not conform to the requirements of 10 CFR 50, Appendix B, Criterion 16 "Corrective Action," which states, in part that "measures shall be established to assure that conditions adverse to quality are promptly identified and corrected." For a 13 month period, the licensee did not take adequate corrective action for inadequate ventilation and the potential inoperability of the charging pumps. No special or periodic testing was performed which could have identified a failed damper. Charging pump cubicle ventilation flow was last determined in January 1985. At that time, the as-found flow condition was also inadequate, although it was due to a different cause than the more recent event. Further, data taken on 11/24/91 demonstrated that 2 of 3 charging pumps did not have adequate ventilation flow, but an adequate evaluation of this data was not performed prior to an escalation from Mode 4 to Mode 3. Charging pumps are required to be operable in Mode 3; this operability includes adequate ventilation in accident circumstances.

An opportunity for an earlier discovery of this problem was provided when combined NRC Inspection Reports 50-334 & 442/89-04 (March 1989) and 50-334&442/89-[illegible] October 1989) questioned the adequacy of SLCRS ventilation in the safeguards areas. The facility performed calculations to verify SLCRS adequacy in the specific area identified as a concern in these reports. However, the flowrates used as input data for part of these calculations were the original design values, and not the post DCP 201/202 values used as test acceptance criteria. A corrected calculation was performed during this inspection and was considered to be acceptable by the inspector.

This event was safety significant in that the delay in adequate corrective action for the design deficiency found in October 1990 and the improper evaluation and communication of the 11/24/91 test results which allowed a mode change to take place with required safeguards equipment potentially inoperable. These actions represent a violation of 10 CFR 50, Appendix B, Criterion 16, "Corrective Action" (NOV 50-334/92-02-01).

The inspectors reviewed Nuclear Engineering Department Administrative Procedure 7.1, "Corrective Action," and Nuclear Group Administrative Manual Directive 1.2.3, "Corrective Action Response." These documents require that corrective action be tracked and that it be completed "as expeditiously as possible". They do not themselves describe tracking or review systems, but refer instead to various other station documents.

3.5 **Calibration of System and Test Instruments:**

The surveillance procedures reviewed were evaluated for the use of calibrated system instrumentation and portable M&TE. For technical specification surveillances, installed instrumentation consisted of filter differential pressure gauges, the spent fuel area differential pressure gauge, and radiation monitoring instrumentation. The gauges were verified to be within their required calibration frequency as of the last procedure performance. Radiation monitors were calibrated in accordance with their associated Technical Specifications. Portable M&TE consisted of flow measurement and contaminant concentration measurement instruments; these were verified to be calibrated and appropriately ranged for the measurements taken.

For non-Technical Specification surveillances, the portable M&TE used was calibrated, but the installed instrumentation used for measuring area negative pressure indicates that the last calibration date was the original date of installation. For the last procedure performed, the installed instrumentation was checked with a portable instrument to verify results. The licensee committed to using calibrated instrumentation for future tests, either with calibrated M&TE or with the calibrated differential pressure gauges maintained in the calibration program.

3.6 **Conclusions**

The main objective of this inspection was to determine if surveillance testing is adequate to verify that the systems inspected can fulfill their safety related design basis functions. For SLCRS, this is presently not the case, but corrective action is in progress. The current deficiencies are: (1) periodic flow balance testing does not include the charging pump cubicles; (2) development of final flow balance acceptance criteria is still in progress; the current acceptance criteria have been verified to be adequate by recent calculations, but little or no margin is available under maximum conditions; and (3) the gauges specified in the current safeguards flow balance procedure to verify negative pressure have not been calibrated since their original installation.

Corrective action for item (1) was implemented in response to the charging pump damper failure identified by the licensee in November 1991. In the interim, the charging pump ventilation flow has been adjusted with a temporary procedure. Item (2) was also implemented as corrective action for the charging pump ventilation problem; review of the end result needs to ensure that the calculations are done using the correct system lineup and that assumptions are appropriate. Item (3) was previously identified in a Safety System Functional Evaluation (SSFE) performed by the Nuclear Engineering Department. The licensee committed to either calibrate these instruments or to use alternate calibrated instrumentation for data taking. Calibrated M&TE was used for the last surveillance. The inspector had no immediate concerns about the operability of equipment served by the SLCRS, pending timely completion of adequate final corrective actions.

4.0 AUXILIARY FEEDWATER (AFW) SYSTEM

4.1 System Purpose and Design Safety Functions Functions

The purpose of the AFW System is to provide adequate feedwater flow to the steam generators to remove decay heat from the reactor coolant system (RCS). Removal of decay heat prevents substantial over-pressurization of the RCS from occurring while maintaining the liquid inventory in the RCS sufficient to cover the reactor core at all times. In addition, the system provides a means of cooling the primary plant to 350°F so that the residual heat removal system can be made operable.

The AFW System functions as an emergency source of feedwater to the steam generators when the normal feedwater system is unavailable. The minimum flow required by the system is based on the analyses of anticipated transients and accidents as well as cooldown following theses events. Based on these analyses, the system must provide an AFW flow of 350 gpm to at least two of the three steam generators within one minute of the initiating event.

Each of the three auxiliary feedwater pumps (AFWPs) develops sufficient head to overcome the system resistance and the head equivalent to the pressure encountered at the steam generator inlet for the condition when the second lowest main steam safety valve (MSSV) actuates. Each of two motor-driven auxiliary feedwater pumps (MDAFWPs) are designed to provide a minimum of 350 gpm total flow to the steam generators, while the turbine-driven auxiliary feedwater pump (TDAFWP) was designed to provide a total flow to the steam generators of 700 gpm. To ensure that at least two steam generators could be provided with adequate AFW flow, the system was designed with sufficient redundancy in pumps and flow paths to withstand any single failure in the system during a design basis accident. A description of the AFW System can be found in Attachment C of this report.

Based on a minimum total AFW flow of 350 gpm to at least two steam generators, the UFSAR states that the AFW System provides adequate capacity to mitigate the consequences of a loss of normal feedwater event or a station blackout. During the analysis of a major rupture of a main feedwater pipe, the system was determined to be adequate with a minimum total flow of 350 gpm and the flow delivered from one MDAFWP. Since the TDAFWP has a capacity equal to the combined capacity of both MDAFWPs, even with a single failure, the system was found adequate to mitigate the consequences of a major rupture of a main feedwater line. The analysis of the system design performed for accident conditions described in UFSAR Section 14 found that the system provided sufficient feedwater flow to remove the reactor decay heat via the steam generators. By removing the decay heat, over-pressurization of the RCS was prevented and RCS inventory level remained adequate to cover the reactor core at all times.

4.2 Auxiliary Feedwater System Design Basis Documentation

The licensee prepared a design basis document (DBD) for the BV-1 AFW System as part of their design basis reconstitution program. The DBD provided an adequate starting point to develop the design basis function of the system. However, additional design information from vendor manuals, equipment specifications, and manufacturing standards was also required to define some design basis requirements and to verify the adequacy of current tests. The inspector determined that there was adequate documentation to support the design basis and that the testing of the AFW System demonstrated the ability to perform its design basis functions.

Adequate analysis of AFW System performance was conducted to determine system needs during various accident conditions. The actual capacity (140,000 gallons) of the primary plant demineralized water storage tank (PPDWST) was analyzed by the licensee and found to be adequate to support the design function of the system, including the plant cooldown to 350°F required for initiation of the residual heat removal system. The DBD indicated that the required capacity of the MDAFWPs was a total AFW flow rate into the SGs of 350 gpm, at a pump total developed head of 2696 feet. The TDAFWP capacity was stated as 700 gpm into the SGs at a total pump developed head of 2696 feet.

To determine the ability of the system to perform its design function, the licensee developed minimum operating point (MOP) curves for the AFWPs. The purpose of the MOP curves was to have a basis for comparing measured pump performance to the minimum performance at which the pumps would fulfill their safety function. For the AFW System, the MOP curves were based on a service degradation of the pump performance curves. The degradation was based on the ASME lower performance limits (10% degradation). After the pump performance curves were degraded in accordance with the ASME recommendations, the required pump total developed head to overcome SG pressure during accident conditions was used to determine minimum pump flow. This minimum pump flow was then analyzed by Westinghouse to determine whether the flow was adequate to mitigate the consequences of design basis accidents.

The licensee generated new MOP curves based on a minimum flow of 315 gpm from the MDAFWPs to establish additional margin for pump performance. Westinghouse analyzed an AFW flow of 315 gpm from each MDAFWP as adequate to ensure sufficient decay heat was removed from the RCS to fulfill the safety function of the system. The MOP curve for the TDAFWP was based on a minimum required flow of 609 gpm into the SGs from the TDAFWP. Westinghouse analyzed an AFW flow of 609 gpm from the TDAFWP as adequate to mitigate the consequences of design basis accidents. The MOP curve used during testing of the TDAFWP had been revised when the licensee had determined that the recirculation flow control valve (FCV-1FW-102) was leaking about 35 gpm past its seat. To correct for this leakage, the MOP curve was adjusted to account for the additional pump flow needed to ensure adequate AFW flow was capable of being provided to the SGs (the pump flow required at a specific pump head was increased by 35 gpm). The inspector questioned the licensee regarding the method used to adjust the TDAFWP MOP curve. Based on the inspector's questions, the licensee changed the surveillance procedure to require an engineering evaluation of pump performance in the event that the leakage past the flow control valve exceeded 35 gpm. The inspector found this adequate to address the concern.

The inspector questioned the method the licensee used to develop the pump performance curve in the TDAFWP test procedure. The licensee had replaced the rotating assembly in the TDAFWP during the 8R outage and had generated a new pump performance curve. During the development of the new pump curve, temporary test gages were installed to measure the pump discharge and suction pressures. Data was obtained from both the normally installed gages and the test gages. Both the normal suction and discharge pressure gages indicated consistently lower than the test gages. To develop the pump curve, the licensee used the data from the normally installed discharge pressure gage and the temporarily installed test gage. This resulted in a pump performance curve that indicated poorer performance than would have been obtained using either the data obtained from the normally installed gages or from the temporarily installed gages. When comparing pump performance during subsequent IST testing, the measured pump performance has been consistently above the pump performance curve used in the surveillance procedure. As a result of testing performed since the 8R outage, the licensee had already began a review of the TDAFWP performance curve to determine its continued adequacy in evaluating pump performance during future testing. The inspector reviewed the data obtained during the generation of the new performance curve, discussed the issue with the licensee, and determined the licensee was taking the appropriate actions to address this issue of appropriate instrument use.

In obtaining the design bases information, the inspector had extensive discussions with personnel in the Nuclear Engineering Department (NED) and the system engineer for the system. The inspector encountered difficulty in obtaining some specific information on the various component (pumps, MOVs, check valves, etc.) design requirements; however, all of the necessary information was eventually obtained. NED engineers appeared to be concentrated on component level performance and less readily accessing overall system design basis information. The design basis reconstitution program lead by NED was a good effort to improve their ability to readily access system design bases information.

4.3 UFSAR Description of the AFW System

The inspector found the description of the AFW System contained in the UFSAR to be very limited in scope. Only broad system or component design information was available. Adequate information was contained within the UFSAR to determine the required overall system performance during testing; however, individual component information was limited to the capacity of the AFWPs and the volume of the PPDWST.

Since the minimum performance requirements for the system had been reanalyzed by Westinghouse, the licensee indicated that the UFSAR will be revised during the next update to reflect the reduction in required minimum MDAFWP flow from 350 gpm to 315 gpm. It will also reflect the reduction from 700 gpm to 609 gpm for the TDAFWP. Current minimum performance for the MDAFWPs is based on meeting the ASME Section XI limits and the new MOP curve generated using a minimum pump flow of 315 gpm at 2696 ft. head for the MDAFWPs and 609 gpm for the TDAFWP.

Section 14 of the UFSAR described the required system response to accident conditions. For a loss of normal FW event or a complete loss of electric power to all station auxiliaries (station blackout) the minimum system capacity equivalent to one MDAFWP (350 gpm in the current revision of the UFSAR) was adequate to mitigate the consequence of either event. In the event of a main feed line rupture, the system would have adequate capacity based on a minimum of 350 gpm plus the capacity of one MDAFWP. Even with a single failure in the system, it would be adequate to mitigate the effects of a main feed line rupture.

4.4 Technical Specification and ASME Section XI Requirements

Technical Specifications required the three AFWPs to be operable (two MDAFWPs and one TDAFWP) and the PPDWST to have a minimum contained volume of 140,000 gallons. To ensure the system remains operable, the AFWPs and other system components (check valves, MOVs, trip valves, etc.) are required to be tested in accordance with ASME Section XI (TS 4.0.5). Accordingly, each valve in the AFW flow path must be verified in the correct position monthly and following extended outages; flow from the PPDWST to the SGs must be verified while shutdown (every 18 months); each power operated valve in the AFW flow path, not testable during operation, must be cycled; while shutdown (every 18 months), the automatic valves in the AFW flow path must be verified to go to their correct position on a test signal; while shutdown (every 18 months) AFWP automatic starts must be verified upon receipt of a test signal, and every 12 hours the volume of the PPDWST must be verified to be greater then 140,000 gallons. In addition, the ability of the system to be operated from the remote shutdown panel is required to be tested on an annual basis.

TS Section 4.0.5 IST requirements included full flow system testing, with injection into the SGs at normal operating SG pressure, using the redundant flow paths available in the system. Valve stroke times, seat leakage, and valve full flow capability were also tested. The IST program required that information on AFWP performance be obtained during both refueling outages and quarterly during operation to allow comparison to a pump performance curve generated for each pump. The pump performance curves are based on either manufacturer certified pump curves or on test data obtained following pump overhaul.

Attachment C provides a detailed description of the TS and ASME Section XI testing requirements for the system.

4.5 AFW System Surveillance Testing

Surveillance testing of the AFW System at BV-1 was well developed. The overall ability of each MDAFWP and the TDAFWP to develop sufficient pressure and injection flow rates into the SG has been tested on a regular basis. During refueling outages, full flow testing of the system has been conducted to verify the ability of the system to inject AFW into the SGs at normal SG pressure.

The inspector found that acceptance criteria specified in surveillance test procedures were adequate to verify the ability of the tested components to perform their required functions. The PPDWST was required to be checked each shift to ensure level was greater than 140,000 gallons. For the AFWPs, their performance was compared to pump performance curves in accordance with ASME Section XI requirements and to the MOP curves generated for the MDAFWPs and the TDAFWP. Included in testing of the system was overall system response times using simulated initiation signals generated from the AFW System initiation logic subsystems. Acceptable system response times were required to be less than the one minute assumed in the accident analyses and as required by TS.

AFW System check valves were tested to verify their ability to both pass the flow required for the system to perform its safety function (i.e. sufficient steam was passed through the main steam supply check valves to the TDAFWP turbine) and to ensure that the check valves seated properly preventing backflow (partial loss of AFW flow to the SGs). Adequate acceptance criteria was specified to ensure that both functions were adequately tested.

The six motor operated AFW System discharge MOVs (1FW-151 A through F) were verified to be in the required position (open) on a monthly basis. In addition each MOV 1FW-151 valve has been cycled through a complete cycle and was verified to open from the closed position when a AFW System initiating signal was received. The valve open stroke times were required to meet ASME Section XI stroke times. The TDAFWP steam supply line MOV (1MS-105) was tested to verify that the valve was capable of cycling through a complete cycle and that the opening stroke time of the valve was within the IST program operating limits. These MOVs also function as containment isolation valves; however, no containment isolation valve closure times were specified in TS or in the UFSAR.

In order for the TDAFWP to function, the trip valves in the main steam supply line header (TV-1MS-105A/B) are required to open upon receipt of a TDAFWP initiation signal. Each of the trip valves has been tested to verify that upon receipt of any TDAFWP initiation signal, the valves open and the TDAFWP successfully starts. Additional testing has been performed as required to verify that the valve open stroke times continue to meet IST program operating limits and to ensure the valve can be stroked through a complete cycle.

[illegible]v of the operators to control the system from the remote shutdown panel has been [illegible] his has been accomplished through the testing of the individual controls for the fol[illegible]mponents at the shutdown panel:

MOV-1MS-105A/B	steam admission trip valves
MOV-1FW-151A/B/C/D/E/F	AFW control valves
1FW-P-3A/B	MDAFWPs
1FW-P-2	TDAFWP

Each of these components were required to be operated from the shutdown panel on an annual basis.

The most recent test data indicated that the AFWPs developed sufficient flow at the required pump head to fulfill their intended function. The overall system response times were significantly lower than the sixty second times specified in TS and procedure acceptance criteria. Testing of system check valves indicates their ability to pass sufficient flow to ensure the AFW System flow has not been degraded by partially closed check valves. Leak tests and reverse direction testing of the system check valves adequately demonstrated their ability to prevent a degradation in AFW flow to the SGs. MOV stroke time testing and cycling, recently performed, demonstrated that the MOVs continue to operate within acceptable limits, with no indication of performance degradation. Testing of the system components from the remote shutdown panel has been completed satisfactorily, demonstrating the ability of the system to be operated from the remote shutdown panel. Additional details on the testing and acceptance criteria important to the safety function of each AFW System component are in Attachment C of this report.

4.6 Conclusions

Overall, the inspector concluded that the licensee had thoroughly developed the testing of the AFW System required to demonstrate its ability to perform its design safety functions. Essentially all of the necessary testing of safety functions were required by the TS and ASME Section XI. The most recent surveillance data demonstrated that the system continues to exceed the minimum system requirements necessary to perform its design safety function.

The inspector found the instrumentation used during testing was within the required calibration dates and the calibrated ranges were of acceptable scale for the parameters being measured. The system engineer was knowledgeable of the testing requirements and design functions of the AFW System. The IST coordinator understood the basis for the pump performance curves used during testing.

The design basis documentation was adequate to describe the required safety functions of the AFW System. In addition, sufficient information was available to verify that the performance of individual components remained adequate to ensure overall system function was not affected by declining component performance. The DBD (completed March 31, 1991) was found to be adequate for an initial description of system functional requirements and major component operating characteristics. However, the DBD had already become outdated in that it did not recognize the reduction of the minimum MDAFWPs capacity from 350 gpm to 315 gpm; the reduction in the minimum TDAFWP capacity from 700 gpm to 609 gpm; or the deletion of the MDAFWP start signal on the failure of the TDAFWP to develop adequate discharge head when required. The inspector concluded that the licensee should continue to verify and validate the DBDs to ensure that they remain a useful engineering tool.

The completed surveillance procedures and design basis documentation indicated that the licensee was adequately testing the ability of the AFW System to perform its intended safety functions. In addition, the TS required testing together with the IST testing required that all necessary testing be conducted to demonstrate that the system functions as designed.

5.0 Overall Inspection Conclusions

Overall, the inspectors concluded that the current surveillance testing reviewed for the Safety Injection System, the Supplementary Leak Collection and Release System, and the Auxiliary Feedwater System was in conformance with Technical Specification requirements and adequately demonstrated that the systems' design basis safety functions would be fulfilled under accident conditions. However, the lack of adequate and timely corrective actions to design and test control issues in the SLCR System are significant matters which require early attention by the licensee, particularly as higher outside air temperatures approach in early summer. The need for improved communications and interaction between the NED and Operations over the resolution of technical deficiencies was evident from this problem.

The reconstituted design bases developed for the AFW and SLCR systems and documented in the DBDs, and the Safety System Functional Evaluations were positive initiatives. In addition to consolidating available sources of design related system specifications and functional requirements, these programs also identified design basis concerns important to system operation and testing. The inspectors considered that the Design Basis Documents would be most valuable as reference sources if they were continually expanded and updated. The ongoing development of the system engineer program could be enhanced through the use of a foundation document which focuses system safety performance upon its design requirements.

No instances were identified where required surveillance tests were missed or performed incorrectly or which contained invalid test data. Overall, surveillance procedures were considered to be detailed and well developed. Some concerns were expressed related to the traceability of pump performance curves used in test procedures, but existing controls appeared to assure that validated performance curves will be accurately represented in test procedures.

The inspectors concluded that existing surveillance testing for the SI and AFW systems demonstrated their required operability and their ability to function in a manner which affords protection to public health and safety. The SLCRS system, and the equipment it services, were considered to be capable of meeting their design safety functions; however, timely completion of issues identified during this inspection are necessary to assure that these functions will be continuously maintained.

6.0 EXIT INTERVIEW

The inspectors discussed the results of this inspection with Nuclear Engineering, Technical Services, Operations, and I&C Department personnel at a preexit conference held on February 6, 1992. The final inspection results were presented to Beaver Valley Station management at an exit meeting held on February 7, 1991. Attendees are identified in Attachment D.

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

Attachment A

Safety Injection (SI) System

System Description:

Figures A1, A2, and A3 provide diagrams of the Safety Injection System.

The Safety Injection System consists of two ECCS subsystems which provide immediate post-accident emergency cooling to the reactor vessel before RCS pressure and water level drop low enough to uncover the core. The high head safety injection (HHSI) subsystem can inject to the reactor vessel at all possible pressures up to the Safety Relief Valve setting. The LHSI subsystem injects in stages starting at accumulator pressure (661 psig) and then at the maximum LHSI pump discharge pressure (180 psig). If a rapid RCS blowdown occurs following a large RCS break, the accumulators discharge their contents before the HHSI or LHSI pumps can deliver flow. When the subsystems are properly aligned, the injection function only requires automatic operation of the SI pumps and the MOVs associated with the RWST and the boron injection tank (BIT).

The HHSI and LHSI subsystems consist of both active and passive components. The active components require an outside signal and power source for their activation. These portions consist of three HHSI charging pumps, two LHSI pumps, and MOVs at the BIT and the RWST. The passive portion consists of three LHSI accumulators and their associated valves and piping. A reduction of RCS pressure is the only action required to obtain flow from the accumulators since they are pressurized with a nitrogen blanket. Automatic actuation of the SI System occurs upon high containment pressure, low pressurizer pressure, or low steam line pressure. The SI System can also be manually initiated from the control room. 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. 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. LHSI is also accomplished through two independent flow paths.

Upon actuation of the SI System, the HHSI and LHSI pumps receive a start signal and the necessary MOVs receive an open signal. All of the LHSI system MOVs in the flow paths are normally open, but still receive an open signal to ensure the flowpath is available. When RCS pressure decreases below 661 psig, the accumulators inject borated water into the RCS. When the RCS pressure drops further to the shutoff head of the LHSI pumps (≈180 psig), they inject water from the RWST directly into the RCS cold legs through the LHSI header. These actions are automatic, but indications of system actuation are monitored on the SI panels in the control room to ensure the actions are being completed.

HHSI Pumps (1CH-P-1A, 1B, & 1C):

The HHSI pumps are horizontal centrifugal pumps with a maximum flow rating of 550 gpm per pump. They each provide 100% of the capacity required to meet the system's design criteria for HHSI flow delivery to the core following a small break (≤0.375" diam) LOCA. Each pump has a recirculation line to assure minimum recirculation flow if the main flow paths become isolated, blocked, or if the pumps must operate against a discharge pressure greater than their shutoff head. The pumps are arranged in parallel taking a suction from the RWST and discharging into the RCS through two high pressure injection flow paths. The piping is arranged so that any pump can supply borated water to either injection header. With all three pumps running, RCS cold legs can be supplied through both injection headers, but the BIT header automatically aligns to allow its contents to be injected first. Motor operated valves in the discharge header allow any pump to feed either injection path. This allows a disabled path to be isolated and ensures that the pumps can feed the RCS through the other path. Upon receipt of a safety injection signal, the pump suction path realigns to the RWST through two parallel MOVs (valves CH-1150 & 1158) which are shut during normal plant operations.

In addition to normal periodic testing, the HHSI pumps are frequently operated for normal RCS charging and letdown functions which maintain a constant pressurizer level, return diverted purification flow to the RCS, and provide reactor coolant pump seal injection flow.

LHSI Pumps (1SI-P-1A & 1B):

Two LHSI pumps are normally aligned for injection taking a suction from the RWST and discharging directly to the RCS loops through a LHSI header. Each pump has a vertical shaft and a centrifugal impeller. Recirculation lines are provided for minimum flow during the time it takes for RCS pressure to reach shutoff head (≈180 psig). Each pump provides 100% capacity for LHSI flow delivery to the core and is rated for 3000 gpm at 108 psig discharge head.

Refueling Water Storage Tank (RWST):

The RWST is a large capacity water tank located outside the primary auxiliary building and provides a positive suction head to the ECCS pumps. During plant operations, the RWST is lined up to supply the LHSI pumps without repositioning any system valves. The minimum volume necessary for reactivity control during the injection phase is 424,000 gallons. The minimum volume required by the Technical Specifications when RCS temperature is >200°F is 441,000 gallons. This ensures that the minimum safety injection volume is available for reactivity control and for the minimum NPSH required by the ECCS pumps. The tank is equipped with redundant level and temperature transmitters which feed both local and control room instruments. The water in the tank is normally kept at 45-55°F.

Boron Injection Tank (BIT):

The BIT contains 900 gallons of ≈7,000 ppm borated water at a temperature of 140°F. This volume is required to provide the minimum negative reactivity insertion in the core to limit core power following a rapid RCS cooldown (e.g., after a main steam line rupture). The temperature of the tank is automatically maintained by two 6KW electric heater banks to keep the contents above the solubility limits for boric acid.

LHSI Accumulators:

The three LHSI accumulators each contain ≈7700 gallons of 2000 ppm borated water under a nitrogen gas blanket of 661 psig. Each accumulator tank is directly connected to its associated RCS cold leg. This piping contains two isolation check valves and an isolation MOV for each accumulator. The check valves provide primary RCS boundary protection during normal operations. During normal operation, the power supplies to the MOVs are locked out 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 condensed 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.

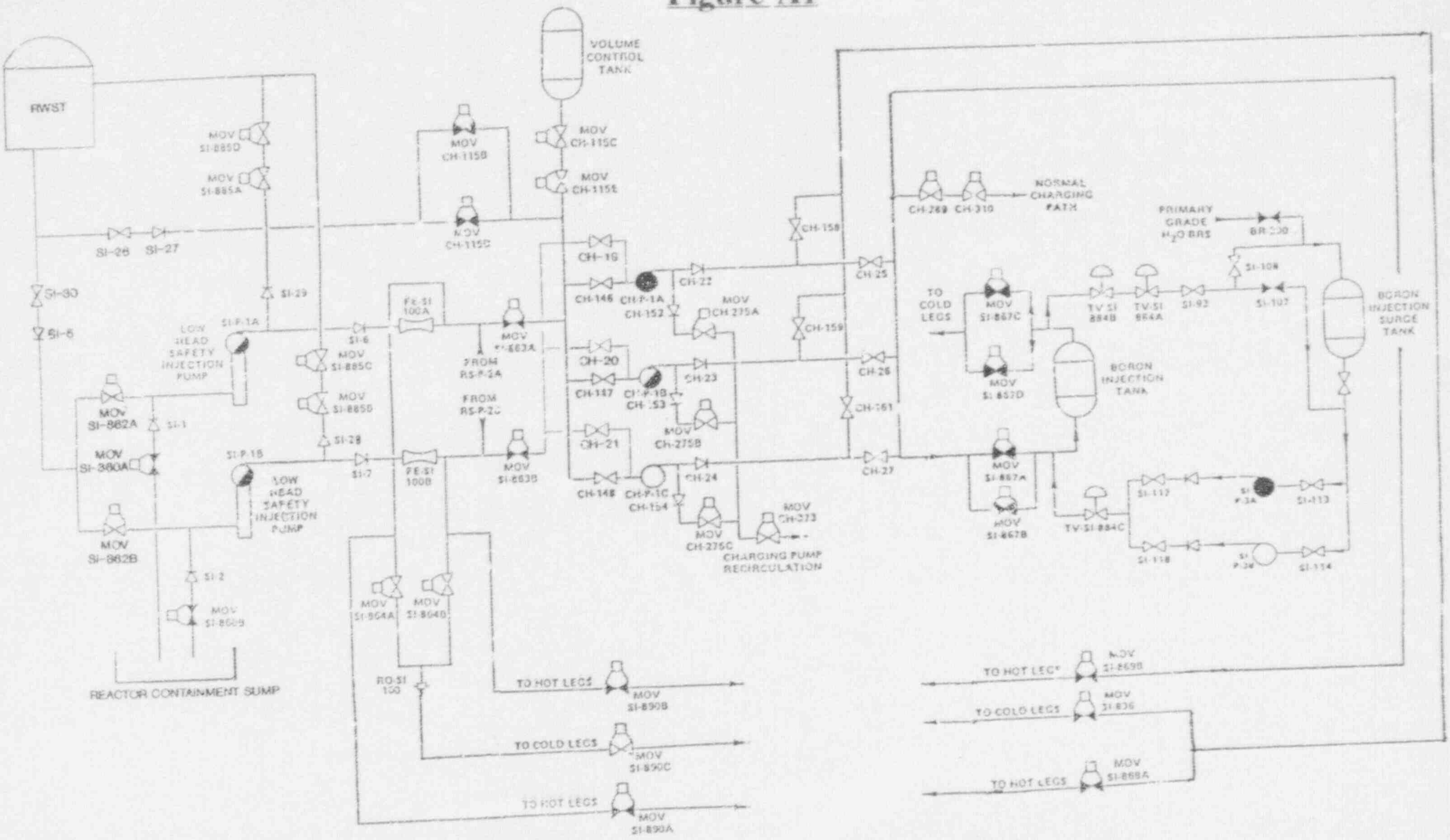
The numbering scheme used for surveillance test procedures provide a code for identifying the type of test and its frequency of performance in accordance with the following:

1BVT = Beaver Valley Test (Unit 1)
3BVT = Beaver Valley Test (common to Units 1 & 2)
OST = Operations Surveillance Test
OM = Operations Manual Procedure

(R) = Performed each refueling
(Q) = Performed quarterly
(M) = Performed monthly
(S) = Performed each shift
(CSD) = Performed at cold shutdown
(S/U) = Performed during startup

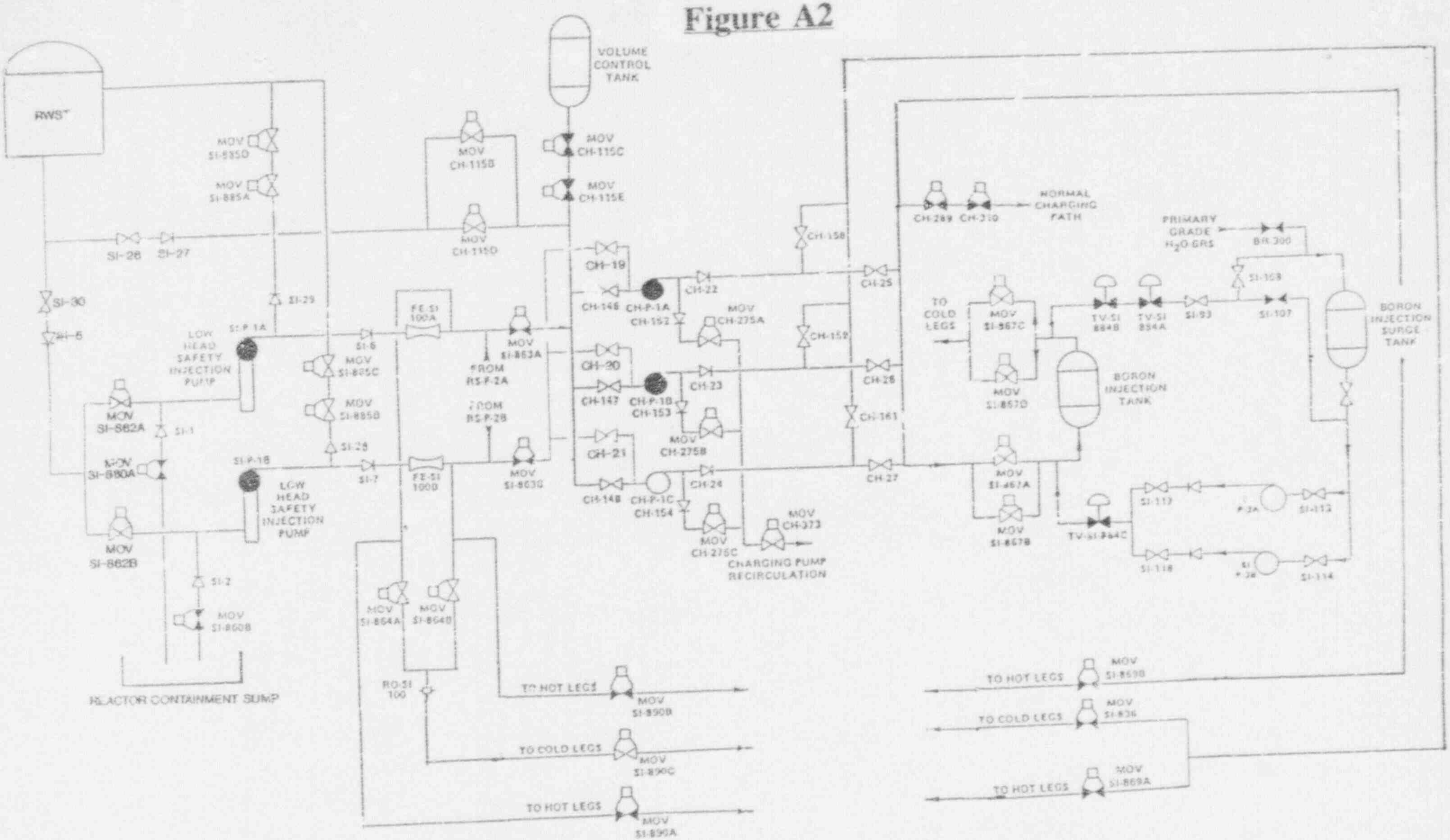
Attachment F contains a complete list of abbreviations and acronyms.

Attachment A
Figure A1



SAFETY INJECTION SYSTEM
NORMAL STANDBY MODE

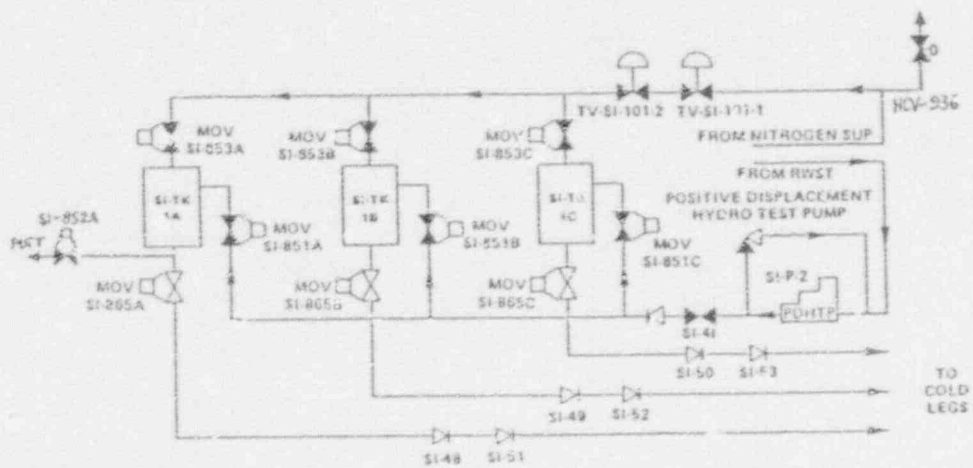
Attachment A
Figure A2



SAFETY INJECTION SYSTEM

INJECTION PHASE

Attachment A
Figure A3



LHSI Accumulators

ATTACHMENT A

SAFETY INJECTION SYSTEM SURVEILLANCE TESTS, BASES, AND REQUIREMENTS

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTIONS EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
HHSI Flow Paths available to the RCS					
HHSI BIT header full flow path capability available from the HHSI pumps to the RCS cold legs: Operational readiness of HHSI pump disch header isolation valves MOVs CH-275A,B,C; branch line isolation MOVs SI-867A,B,C,D and throttle valves SI-884A,B,C; and non-BIT header isolation MOV SI-836. Full flow capability of HHSI cold leg branch line check valves SI-23,24,25, 94,100,101, & 102 Leak tightness of non-BIT check valve SI-95 HHSI branch lines flows are properly balanced	IST Program Document design stroke times: SI-884A,B,C, ≤27 sec SI-867A,B ≤27 sec SI-867C,D ≤15 sec No specific reference provided Westinghouse Equip Spec No. G-676259: SI-836 design stroke time ≤ 10 sec maximum.* Westinghouse Equip Spec No.G-676241: Conduct check valve leakage testing iaw MSS SP-61 MSS SP-61, Para 6 (c): seat tests allow a maximum leak rate of 10 cc/hr per inch nominal valve size. Westinghouse Equip Spec G-677264: The leakage of self actuated check valves shall be ≤? cc/hr per inch nominal valve size.	Sec 6.3.2.1: The SI signal opens the BIT header isolation valves and starts the SI charging pumps. The BIT recirculation lines have redundant isolation valves which close on a SI signal. Sec 6.3.2.1: Valves of the SI System which are remotely operated and are normally in their ready positions, but do not receive a SI signal have their positions indicated on the control board. When one of these valves is not in the ready position for injection, it is shown on the board and an audible alarm alerts operators. Sec 6.3.2.2: The seating design is of parallel disk, flexible wedge, or equivalent. This allows release of the mechanical holding force at the first increment of travel and the MOV works only against the frictional component of hydraulic force and packing box friction.	Sec 4.0.5: Inservice inspection shall be conducted in accordance with Section XI of the ASME B&PV Code. 4.1.2.2: In operating modes 1,2,& 3, verify the flow path from the RWST via one HHSI charging pump 1) at least once per 7 days by cycling each testable MOV or auto valve at least one cycle of full travel. 2) At least once per 31 days by verifying that each valve (manual, power operated, sealed, or secured in position) is in the correct position. 3) At least once per 18 months during shutdown by cycling each power operated valve that is not testable during plant operation through at least one cycle of full travel. Table 4.4-3: Observed leakage rates shall be adjusted to the function maximum pressure iaw ASME Section XI, IWV-3423 Table 3.6-1: MOV 867C,D stroke limited to 15 sec. Table 3.3-5: ESF response time must be ≤27 sec.	OST 1.11.14 (R) SI System Full Flow Test. Verifies full flow capability of HHSI and LHSI to the reactor vessel during refueling. Acceptance Criteria: Full flow capability of check valves SI-10,11, 12,22,23,24,94,100,101,& 102. Stroke of MOVs SI-867C,D ≤13 sec; SI-836 ≤18 sec.* The difference between injection branch line flows must be ≤5 gpm with the strongest HHSI pump. OST 1.1.10 (W): IST for SI-867A,B stroke time ≤13 sec; SI-884A,B,C ≤11 sec; SI-836 ≤18 sec.* OST 1.47.3A,3B (R): ISTs for CH-275A,B,C; stroke time ≤16 sec. 1BVT 1.47.11 (R): IST leak test of check valve SI-95. OST 1.11.6 (M): ECCS flow path and valve position checks for CH-115B, SI-862A, 863A, 864A, 885A, 890A,C, 836, 869A, 8850, & 8867A,C	Test of 2/5/91: All valves met acceptable stroke times. Pumps and check valves achieved minimum full flow requirements. *IST maximum stroke time limits were established from initial baseline test data which was within the valve purchase specifications. The limit was calculated under the licensee's IST program criteria which based the maximum allowed stroke on these initial tests. The current maximums used for testing are iaw ASME 1983 allowances.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTIONS/ EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
Flow path available from the RWST to the HHSI pumps 1A, 1B, 1C: Operational readiness of HHSI pump suction header isolation MOVs CH-115D,115B; and CH-115C,E. Full flow capability of HHSI suction header check valve SI-27.	IST Program Document indicates CH-115C,E design stroke time must be ≤27 sec. No specific reference provided.	Sec 6.3.2.1: The suction of the SI charging pumps is diverted from their normal suction at the volume control tank to the RWST by the SI signal.	Sec 3.5.2: When T-avg ≥350°F, two seperate and independent ECCS subsystems shall be operable and shall consist [in part] of an operable flow path capable of taking suction from the RWST on a SI signal. Sec 4.1.2.2: In operating modes 1,2,& 3, verify the flow path from the RWST via one HHSI charging pump 1) at least once per 7 days by cycling each testable MOV or auto valve at least one cycle of full travel; 2) At least once per 31 days by verifying that each valve (manual, power operated, sealed, or secured in position) is in the correct position; & 3) At least once per 18 months during shutdown by cycling each power operated valve that is not testable during plant operation through at least one cycle of full travel. Table 3.3-5: ESF response time must be ≤27 sec. Sec 4.0.5: Inservice inspection shall be conducted in accordance with Section XI of the ASME B&PV Code.	OST 1.11.14 (R): SI-27 forward full flow capability iaw ASME Sec XI. OST 1.7.4, 5, 6 (Q): IST stroke tests of SI-27, if the RWST is supplying the HHSI charging pumps. OST 1.1.10 (CSD): IST for CH-115C,E; stroke times must be ≤13 sec.	

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTIONS/ EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
Availability of full flow path from the RWST to the suction of LHSI pumps 1A, 1B: Operational readiness of LHSI pump suction isolation MOVs SI-862A,B; Full flow capability of LHSI pump suction header check valve SI-5	Westinghouse Equip Spec No. G-676258: SI-862A,B specified stroke time = 120 sec maximum.	Sec 6.3.2.1: Valves of the SI System which are remotely operated and are normally in their ready positions, but do not receive a SI signal have their positions indicated on the control board. At any time during operation when one of these valves is not in the ready position for injection, it is shown visually on the board and an audible alarm alerts operators to the condition. Sec 6.3.3.5: 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 SI System components]	Sec 4.0.5: Inservice inspection shall be conducted in accordance with Section XI of the ASME B&PV Code. Sec 4.5.1.1.a.2: Verify that each accumulator isolation valve is open at least once per 12 hours.	OST 1.11.1 (Q): IST full stroke/flow test of SI-5 OST 1.11.14 (R): IST full stroke/flow test of SI-5 OST 1.47.3A & 3B (Q): IST for SI-862A,B; stroke time must be ≤36 sec. OM 1.50.4 (S/U) and OM 1.54.3: Verifies MOVs SI-865A,B,C are open	
Availability of flow path from the LHSI pumps to the RCS cold legs: Operational readiness of LHSI pumps 1A & 1B discharge header isolation MOVs SI-890C and SI-864A,B Full flow capability of LHSI pumps discharge check valves SI-6,7 Full flow capability of LHSI injection branch line check valves SI-10,11,12	Westinghouse Equip Spec No. G-676258: SI-864A,B specified stoke time = 120 sec* maximum	Sec 6.3.2.1: Valves of the SI System which are remotely operated and are normally in their ready positions, but do not receive a SI signal have their positions indicated on the control board. At any time during operation when one of these valves is not in the ready position for injection, it is shown visually on the board and an audible alarm alerts operators to the condition.	Sec 4.0.5: Inservice inspection shall be conducted in accordance with Section XI of the ASME B&PV Code.	OST 1.1.10 (CSD): IST for SI-890C; stroke time must be ≤20 sec. OST 1.11.14 (R): IST full stroke/flow test of LHSI pump discharge check valves SI-6,7 OST 1.47.3A,3B (Q): ISTs for SI-864A,B; stroke time must be ≤178 sec.* iaw ASME Sec XI. 1BVT 1.47.11 (R): IST leak test of SI-890A,B,C	*IST maximum stroke time limits were established from initial baseline test data which was within the valve purchase specifications. The limit was calculated under the licensee's IST program criteria which based the maximum allowed stroke on these initial tests. The current maximums used for testing are iaw ASME 1983 allowances.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTIONS/ EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE 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 MOVs SI-869A,B; and SI-890A,B Leak tightness of valves SI-890A,B,C	SI-890A,B design stroke times not available SI-869A,B design stroke times not available	Sec 6.3.2.1: Valves of the SI System which are remotely operated and are normally in their ready positions, but do not receive a SI signal have their positions indicated on the control board. At any time during operation when one of these valves is not in the ready position for injection, it is shown visually on the board and an audible alarm alerts operators to the condition.	Sec 4.0.5: Inservice inspection shall be conducted in accordance with Section XI of the ASME B&PV Code. Sec 4.5.2.a: At least once per 12 hours, verify valves SI-890A,B are closed and power to the valve operator control circuits are disconnected.	OST 1.1.10 (CSD): IST stroke test of *SI-869A,B and SI-890C 1BVT 1.47.11 (R): Leak test of valves SI-890A,B,C OM 1.54.3: Verifies MOVs SI-890A,B closed and SI-890C open	*Valves SI-890A,B are considered to be passive in the safety injection function and are not limited in stroke time since they remain closed during normal operations and do not open during SI.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTIONS/ EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
Accumulator Flow Paths to the RCS					
<u>Availability of full flow path from the accumulators to the RCS cold legs:</u> Full flow capability of accumulator primary boundary discharge check valves SI-48,49,50 and secondary boundary valves SI-51,52,53 Operational readiness of accumulator isolation MOVs SI-865A,B,C	<u>Westinghouse Equip Spec No. G-676258</u>: Full stroke rate specified for valves SI-865A,B,C is ≤49"/min.	<u>Sec 6.3.2.1</u>: The accumulator isolation valves receive the SI signal even though these valves are open. <u>Sec 6.3.2.2</u>: Mechanical operation of the swing-disk check valves by means of differential pressure is the only action required to open the injection path from the accumulators to the core via the cold legs. No external source of power or signal is needed to obtain fast acting, high flow capability. The valves were designed with a low pressure drop configuration. When the check valves are required to function, ≤25 psid will shear any particles which may prevent the valve from functioning. Accumulator isolation valves are designed to operate with full system differential pressure. <u>Sec 6.3.3.7</u>: The isolation valves are normally open with power to the operator locked out via banana type lockout jacks. The valves are closed when the RCS is depressurized or to test the check valves when the RCS is pressurized.	<u>Sec 4.0.5</u>: Inservice inspection shall be conducted in accordance with Section XI of the ASME B&PV Code. <u>4.5.1.1.a.2</u>: At least once per 12 hours, verify each accumulator isolation valve is open. <u>4.5.1.1.c</u>: At least once per 31 days when RCS pressure is >2000 psig, verify that power to the isolation valve circuit is disconnected. <u>4.5.1.1.d</u>: Verify at least once per 18 months that each isolation valve opens automatically when RCS pressure >2000 psig <u>and</u> upon receipt of an SI signal.	<u>18VT 1.11.3 (R)</u>: IST stroke/flow test of accumulator discharge check valves SI-48,49, 50,51,52,& 53. Acceptance criteria compares pressure vs. time to a calculated curve. Peak flow from each accumulator must be >41[illegible] gpm. Also provides remote position verification of valves SI-865A,B,C <u>OST 1.11.11 (R)</u>: Accumulator isolation valve auto open functional test. Verifies each accumulator isolation valve SI-865A,B,C opens when RCS pressure is >2000 psig. <u>OM 1.54.4 (S/U) and OM 1.54.3</u>: Verifies MOVs SI-865A,B,C are open	Valves SI-890A,B are considered to be passive for the SI function and are not limited in stroke time. No IST test existed to measure the stroke time for these valves. 6/12/91 test data satisfactory

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTIONS/ EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
SIS/RCS Boundary Protection					
Leak Tightness of RCS/HHSI/LHSI header cold leg primary boundary check valves SI-23,24,25	Westinghouse Equip Spec G-676241: Design leak rate for valves SI-23,24, 25 is 60 cc/hr at hydrostatic test pressure in accordance with MSS SP-61.	Sec 6.3.2.2: Exceptional tightness is specified for SI valves. The specified leakage across the valve disk required to meet the equipment specification and hydrotest are: ≤3 cc/hr/inch nominal pipe size at hydrotest pressure. 300 and 150 lb. USA Standard valves are required to be ≤10 cc/hr/inch nominal pipe size. The seat leakage test was conducted iaw the MSS SP-61, except that the acceptable leakage was 3 cc/hr per nominal pipe diameter.	Sec 3.4.6.2.d: Reactor coolant identified leakage shall not exceed 10 gpm. Sec 4.0.5: Inservice inspection shall be conducted in accordance with Section XI of the ASME B&PV Code. Sec 4.4.6.3.1: Leakage testing of check valves SI-23,24,& 25 shall be accomplished prior to entering Mode 2 after every time the plant is placed in cold S/D for refueling, and prior to returning the valve to service after maintenance, repair, or replacement. 4.4.6.3.2: Additional leakage testing of SI-23, 24,& 25 shall be accomplished prior to entering Mode 2 after each time the plant is placed in cold S/D for 72 hours if testing has not been accomplished in the preceding 9 months.	OST 1.11.16 (R): IST leak test of valves SI-10,11,12 23,24,25 Acceptance Criteria: leakage rates of ≤3 gpm at ≥150 psid test pressure and corrected to maximum function pressure are acceptable.	6/11/91 test data satisfactory SI-100,101,102 valves are not ASME Class A check valves and are not leak tested in the IST program.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTIONS/ EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
Leak Tightness of RCS/LHSI Accumulator discharge check valves SI-51,52,53 Leak Tightness of RCS/LHSI pump discharge header check valves SI-10,11,12	Westinghouse Equip Spec G-676261: Design leak rate for valves SI-10,11, 12 is 60** cc/hr at hydrostatic test pressure in accordance with MSS SP-61. Design leak rate for valves SI-51,52,53 is 120** cc/hr at hydrostatic test pressure in accordance with MSS SP-61.	Sec 6.3.2.2: Exceptional tightness is specified for SI valves. The specified leakage across the valve disk required to meet the equipment specification and hydrotest are: ≤3 cc/hr/inch nominal pipe size at hydrotest pressure. 300 and 150 lb. USA Standard valves are required to be ≤10 cc/hr/inch nominal pipe size. The seat leakage test was conducted iaw the MSS SP-61, except that the acceptable leakage was 3 cc/hr per nominal pipe diameter.* Sec 6.3.3.7: When the RCS is being pressurized during heatup, the check valves are tested for leakage after ≈100 psid is across the valve. When this test is completed, the discharge lines are opened.	Sec 4.4.6.3.1: Leakage testing of check valves SI-10,11,12,51,52,& 53 shall be accomplished prior to entering Mode 2 after every time the plant is placed in cold S/D for refueling, and prior to returning the valve to service after maintenance, repair, or replacement. 4.4.6.3.2: Additional leakage testing of SI-23, 24,& 25 shall be accomplished prior to entering Mode 2 after each time the plant is placed in cold S/D for 72 hours if testing has not been accomplished in the preceding 9 months.	OST 1.11.4A (R): IST leak test of accumulator check valves SI-51,52,& 53. Acceptance criteria are met if leakage rates are ≤3.0 gpm** at ≥150 psid. OST 1.11.16 (R): IST leak test of accumulator check valves SI-10,11,& 12. Acceptance criteria are met if leakage rates are ≤3.0 gpm** at ≥150 psid.	*UFSAR Section 6.3.2.2 contains inconsistent design leakage for these check valves. 2 cc/hr per inch nominal pipe size was also stated to be the amount required to meet equipment specifications and hydrotest requirements. **IST maximum leak rate limits were established from initial baseline test data which was within the valve purchase specifications. The limits were calculated under the licensee's IST program criteria which based the maximum allowed leakage on these initial tests. The current maximums used for testing are iaw ASME 1983 allowances. Test data for 6/11/91 were within the allowed limits.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTIONS/ EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
SI Pump Performance					
Performance capability of HHSI pumps CH-1A,1B,1C: HHSI pumps discharge head and flow rates	ND1MNE:5728 Minimum HHSI pump flow vs. RCS pressure: 308.2 gpm @ 0 psig 0 gpm @ 1446 psig DLW-89-848: HHSI pump runout head/flow = 1397 ft @ 550 gpm EM No.30806: HHSI minimum pump performance: 550 gpm @ 1111 ft TDH 0 gpm @ 5560 ft TDH Pacific Pump Dwg No. 305-847U96: Flow gpm / Max Head / Min Head 0 / 6200ft / 5800ft 150 / 6180ft / 5800ft 550 / 2000ft / 1400ft	Sec 6.3.2.2: Each pump was given a complete shop performance test iaw Hydraulic Institute Standards. The pumps were run at design flow and head, shutoff head, and three additional points to verify performance characteristics. Where NPSH was critical, this value was established at design flow by means of adjusting suction pressure. Table 6.3-7 Pump Parameters: HHSI Charging Pumps - design discharge head = 2725 psig (5800 ft) - design flow = 150 gpm - design runout = 550 gpm	4.1.2.4.1: At least 2 charging pumps shall be demonstrated operable by verifying on recirculation flow that each pump develops a discharge pressure of ≥2402 psig when tested pursuant to TS 4.0.5. 4.5.2.b.1): When tested pursuant to TS 4.0.5 verify the HHSI charging pumps develop the required discharge head of ≥2402 psig on recirc flow	OSTs 1.7.4, 1.7.5, and 1.7.6 (Q): Total pump flows obtained from summing RCP seal injection flow, fill flow and assumed flow through recirc line. Pump ΔP is calculated using indicated pump discharge pressure and calculated pump suction pressure. Acceptance criteria: pump must develop ≥2402 psig on recirc flow. Total pump head at test flow must be within ASME limits.	
Performance capability of LHSI pumps SI-1A,1B: LHSI pumps 1A, & 1B performance; discharge head and flow rates.	Westinghouse Pump Data Sheet and flow/head curve: Pump rating; 3000 gpm at 1770 rpm Disch Press = 108.2 psig Disch Head = 250 ft. ND1MNE:5728 LHSI pump performance: 0 gpm @ 104 psig 2125.5 gpm @ 0 psig Ingersoll-Rand Dwg. No. D-25-2APK86X3: Original LHSI pump performance characteristics: Flow / Head 0 / 415 ft min. 3000gpm / 280 ft min. 4500gpm / 115 ft min.	Sec 6.3.2.2: Each pump was given a complete shop performance test iaw Hydraulic Institute Standards. The pumps were run at design flow and head, shutoff head, and three additional points to verify performance characteristics. Where NPSH was critical, this value was established at design flow by means of adjusting suction pressure. Table 6.3-7: LHSI pumps - design discharge pressure = 300 psig (257 ft) - design flow = 3000 gpm - maximum flow = 4000 gpm	4.5.2.b.2): When tested pursuant to TS 4.0.5, verify the LHSI pumps develop the required discharge head of ≥159 psig on recirc flow.	OST 1.11.1 & 1.11.2 (Q): LHSI Pumps 1A & 1B IST Performance Test. Acceptance Criteria: average disch press ≥159 psig; pump ΔP = 125.5 to 130.6 psid; pump flow 219.6 to 238.3 gpm. Verifies opposite pump is not rotating backwards. OST 1.11.14 (R): SI System Full Flow Test. Pump flow measured at local indicators and in Control Room. Pump ΔP is calculated using indicated pump discharge pressure and calculated suction pressure. Acceptance criteria is met if pump head is ≥MOP curve at measured flow.	

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTIONS/ EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
Adequate NPSH available to the HHSI and LHSI pumps: (NPSHr=NPSH required) (NPSHa=NPSH available)	NED Memo 2BVM-5759: NPSHa is always ≥12.0 ft for LHSI, adequate for all modes of LHSI pump operation. Worst case NPSHa for LHSI = 12.1 ft. Ingersoll-Rand Dwg. No. D-25-2APK86Y3: LHSI pump NPSHr = 17 ft @ 3000 gpm = 23 ft @ 4500 gpm Pacific Pump Dwg. No. 3…-847096: HHSI pump NPSHr = 12 ft @ 150 gpm = 28 ft @ 550 gpm	Sec 6.3.2.1: Adequate NPSH for the LHSI pumps when utilizing the RWST suction path is available at any level in the RWST. Sec 6.3.3.5: During the injection phase, the SI charging pumps are not dependent upon any portion of other systems except the suction line from the RWST Sec 6.3.3.9: HHSI pumps at the initiation of recirculation SI flow: NPSHr = 22 ft. NPSHa = 30 ft. LHSI pumps at the initiation of recirculation SI flow: NPSHr = 10.6 ft. NPSHa = 12.4 ft.	Bases Sec 3/4.1.2. The required volume of water in the RWST for reactivity while operating is 424,000 gallons. The associated TS limit on the RWST is established at 441,000 gallons to account for reactivity considerations and NPSH requirements for the ECCS system.	OM 1.54.3: Records RWST level every shift. OST 1.7.8 (W): Verifies RWST level is 439,050 to 441,000 gallons and that low level annunciators are not lit. OST 1.11.14 (R): SI Full Flow Test; initial conditions require verification that RWST level is sufficient for HHSI pump NPSHr.	
Availability of the LHSI pump minflow recirc return line flow paths Adequacy of pump recirc flow Operational readiness of pump recirculation line isolation MOVs 885A,B,C,& D	Westinghouse Letter: DLW-4097: Minimum LHSI pump recirc flow = 225 gpm	Sec 6.3.2.1: Valves of the SI System which are remotely operated and are normally in their ready positions, but do not receive a SI signal have their positions indicated on the control board. At any time during operation when one of these valves is not in the ready position for injection, it is shown visually on the board and an audible alarm alerts operators to the condition.	4.5.2.b.2): When tested pursuant to TS 4.0.5, verify the LHSI pumps develop the required discharge head of ≥159 psig on recirc flow. No specific recirc flow values are specified by the TS	OST 1.47.3A,3B (Q): IST stroke test of SI-885A,B,C,D; stroke time must be ≤16 sec.	Pump recirc flow cannot be directly measured due to a lack of installed instrumentation. Pump temperature monitorning provides assurance of adequate recirc flow.
HHSI branch line flow rates Throttle position correct for cold leg branch line valves SI-97,98,99	Design specifications for branch line flow rates not available. Safety analysis assumes minimum total SI flows equally divided in the branch lines.	6.3.2.1: Manual throttle valves in the injection branch lines were properly adjusted by flow tests during initial start-up testing. The operating handles on these valves and the stems were removed.	TS does not address branch line flow balancing specifically beyond system operability requirements and periodic verification of flow path availability	OST 1.11.14 (R): Records individual and total branch line flows. Verifies that the flow differences do not exceed ±5 gpm with the strongest pump.	

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Accumulator nitrogen blanket pressure	Westinghouse Equip Spec No. 679065: Design Pressure = 700 psig Operating Pressure = 600 - 650 psig. Transient Pressure = 600 - 680 psig.	Sec 6.3.2.2: The margin between the minimum operating pressure and the design pressure provides a range of acceptable operating conditions within which the accumulator system meets the design core cooling objectives. Table 6.3-5: Normal operating pressure = 661 psig Minimum operating pressure = 605 psig Design pressure = 700 psig	4.5.1.a.1: Verify the nitrogen cover-pressure in each accumulator tank at least once per 12 hours.	OM 1.54.3: Verifies accumulator pressures agree within 32 psig, and that low level indicators are not illuminated each shift	

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTIONS/ EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
SI System Injection Volumes					
Total volume available in the RWST	No original equipment specification provided	Sec 6.4.2: Operational parameters of the RWST are provided in the TS Table 6.4-1: The RWST capacity is 441,000 gal.	3.1.2.8.b.1 and 4.1.2.8.a.2: Verify the water level in the RWST is at 439,500 - 441,000 gallons at least once per 7 days. Bases Sec 3/4.1.2: The required volume of water in the RWST for reactivity while operating is 424,000 gallons. The associated TS limit on the RWST is established at 441,000 gallons to account for reactivity considerations and NPSH requirements for the ECCS system.	OM 1.54.3: Records RWST water level each shift. OST 1.7.8 (W): Verifies RWST level is 439,050 to 441,000 gallons and that low level annunciators are not lit.	
Total volume available in each Accumulator	Westinghouse Equip Spec No. 679065: 1450 Ft^3 capacity tank	Table 6.3-5: Water volume at operating conditions = 7664 to 7816 gallons. Sec 6.4.3.2: Accumulator volume is continuously monitored during station operation. Flow from the tanks can be monitored at any time using test lines.	4.5.1.a.1: Verify the contained borated water volume in each accumulator tank at least once per 12 hours.	OM 1.54.3: Verifies the accumulator water levels are within 5% of each other and that the low level indicators are not illuminated each shift.	
BIT minimum volume available	No original equipment specification provided	Table 6.3-6: Total volume = 900 gallons.	4.5.4.1.1.a: Verify the water level in the BIT surge tank at least once per 7 days.	OM 1.54.3: Records the level in the BIT surge tank each shift	

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTIONS/ EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
SIS Overpressure Protection					
Overpressure protection of LHSI pump discharge headers injection piping: Setpoint and relief capacity of valves SI-845A,B,C	Westinghouse Equip Spec No. G-676257: SI-845A,B,C relief pressure = 220 psig.	Table 6.3-8, ECCS Relief Valve Data: LHSI pump discharge relief valve set pressure = 235 psig.	Sec 4.0.5: Inservice inspection of ASME Code components shall be performed in accordance with Section XI, IWV-3510 of the ASME B&PV Code.	1BVT 1.60.5 (R): LHSI header relief valves setpoint test. Sets valves at 235 ±7 psig.	
Leak tightness of relief valves SI-845A,B,C; SI-858A, B,C; and SI-857	Westinghouse Equip Spec No. G-676257, para.4.3.6: Relief Valves shall be exceptionally tight at 10% below the set pressure prior to opening. Exceptional tightness for water is ≤10 cc/hr.	Table 6.3-5: The relief valves have soft seats and are designed and tested to ensure zero leakage at the normal operating pressure.	Sec 3.4.6.2.d: Reactor coolant identified leakage shall not exceed 10 gpm.	1BVT 1.60.5 (R): Leak test of valves SI-845A,B,C; SI-858A,B, C; and SI-857. Acceptance criteria is met if leakage is ≤1 cc/10 min.	
Accumulator over pressure protection Setpoint and relief capacity of valves SI-858A,B,C	Equipment specification sheets for valves SI-858A,B,C not available	Sec 6.3.2.2: The relief valves are sized to pass N_2 in excess of the gas fill line delivery rate. They also pass water in excess of the expected inleak rate. Table 6.3-5: Relief set point = 700 psig. The valves have soft seats and are designed and tested to ensure zero leakage at normal operating pressure. Table 6.3-8, ECCS Relief Valve Data: Accumulator relief valve set pressure = 700 psig.	Sec 4.0.5: Inservice inspection of ASME Code components shall be performed in accordance with Section XI of the ASME B&PV Code.	1BVT 1.60.5 (R): Adjusts relief valves SI-858A,B,C 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 = 700 ±21 psig.	5/5/91; 4/22/91/; and 4/19/91 test data satisfactory.
BIT over pressure protection Setpoint and relief capacity of valve SI-857	Westinghouse Equip Spec No. G-676257: SI-857 set pressure = 2735 psig.	Table 6.3-8, ECCS Relief Valve Data: Boron Injection Tank relief valve set pressure = 2735 psig.	Sec 4.0.5: Inservice inspection of ASME Code components shall be performed in accordance with Section XI of the ASME B&PV Code.	1BVT 1.60.5 (R): Boric acid injection header relief valve setpoint test. Adjusts valves to the BIT design pressure of 2735 ±82 psig.	

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTIONS/ EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
SIS Availability					
SIS testability System actuates properly in response to an SI actuation signal.	No original design basis specifications for SI System response provided. Current safety/accident analyses require that ESF response time be ≤27 sec. and that designed system response occurs with a single active failure assumed.	Sec 6.3.3.3: The starting sequence of the HHSI & LHSI pumps, and related emergency power is designed so that delivery of full rated flow is reached in ≤25 sec. after process parameters reach the setpoints for the SI signal. 6.3.4.1: All components of the ECCS system are inspected periodically to demonstrate system operability. Each active component of the ECCS may be individually actuated at any time during operation of the unit to demonstrate operability. The operability of at least 1 HHSI pump is demonstrated by continuously charging while at power. Testing on the other two pumps can be performed while at power by using the minimum flow recirc line. Tests of the LHSI pumps employs the minimum flow recirc test line which returns to the RWST.	4.5.2.f.1: At least once during shutdown, cycle each power operated valve in the flow path not tested during plant operations through at least one complete cycle of full travel. 4.5.2.f.2: At least every 18 months during shutdown, verify each automatic valve in the flow path actuates to its correct position on an SI signal. 4.5.2.f.3: At least once every 18 months during shutdown, verify that the centrifugal charging pumps and LHSI pumps start automatically upon receipt of an SI signal.	OST 1.36.3,4 (R): EDG 1,2 Automatic Tests; simulates a loss of offsite power in conjunction with a SI signal. Acceptance criteria require that the diesels start on the auto signal, energize the emergency buses with permanent loads, energizes the auto connected loads through the load sequencer. The load sequence timer must operate with each load within ±10% of its required time. The test activates all active SI System components which receive an SI signal and verifies the appropriate circuit breaker and component responses.	Tests performed 1/16/91 and 6/6/91 satisfactorily.

Attachment B

SLCR SYSTEM DESCRIPTION

Figure B provides a diagram of the SCLR System.

The SLCRS contains two 50,000 cfm exhaust fans VS-F-4A&B and two 36,000 cfm capacity roughing-charcoal-HEPA main filter banks. One fan is normally in service with the filter banks bypassed through VS-D-4-1A&B. In this configuration, those areas normally aligned to the system are being maintained at greater than 0.125" W.G. negative pressure.

In response to an actuation signal, the filter bank bypass dampers close and the filter bank inlet dampers VS-D-4-2A&B open. This allows potentially contaminated air collected from areas served to be exhausted through the in service filter bank (one bank is normally isolated) for iodine removal prior to discharge from the SLCRS vent on top of the containment. The 15,000 cfm difference between filter bank and fan capacity is provided by outside air damper VS-D-4-33. In addition, on a containment isolation phase B, the charging pump cubicles ventilation normal exhaust dampers VD-D-3A&B close and the emergency exhaust to SLCRS dampers VS-D-4-4A&B open to collect leakage from this area. SLCRS actuation signals are containment isolation phase A, high radiation in containment contiguous areas, spent fuel storage area, waste gas storage area, and containment (during refueling). The auxiliary building is normally exhausted through its own ventilation system. The auxiliary building radiation monitor signal closes normal exhaust dampers VS-D-7-1&3 close and opens emergency dampers VS-D-7-2A&4A to align the auxiliary building shielded areas to the SLCRS, as well as actuating SLCRS alignment through a filter bank.

In the event of a loss of offsite power coincident with an accident, the safeguards area air conditioner will loose power. When temperatures in the pump areas reach 110 °F, the individual pump cubicle dampers and outside air dampers open to maintain area temperatures below 120°F. These dampers are VS-D-12A&B, 13A&B, 15A&B, 16A&B, and 17A&B.

During refueling operations, the containment purge supply and exhaust valves VS-D-5-3A&B and 5A&B will be open. The containment high radiation signal will shut these as well as aligning SLCRS flow through a filter bank.

System flow rates are balanced to assure the required negative pressure, equipment cooling capability, and filter bank flow restrictions are met in the post accident lineup.

MATRIX CHARTS

The following matrix charts provide a graphic representation of the identified safety functions of the Supplementary Leak Collection and Release System. The entries contained in each column are not exact quotes from the referenced documents, but are reduced 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:

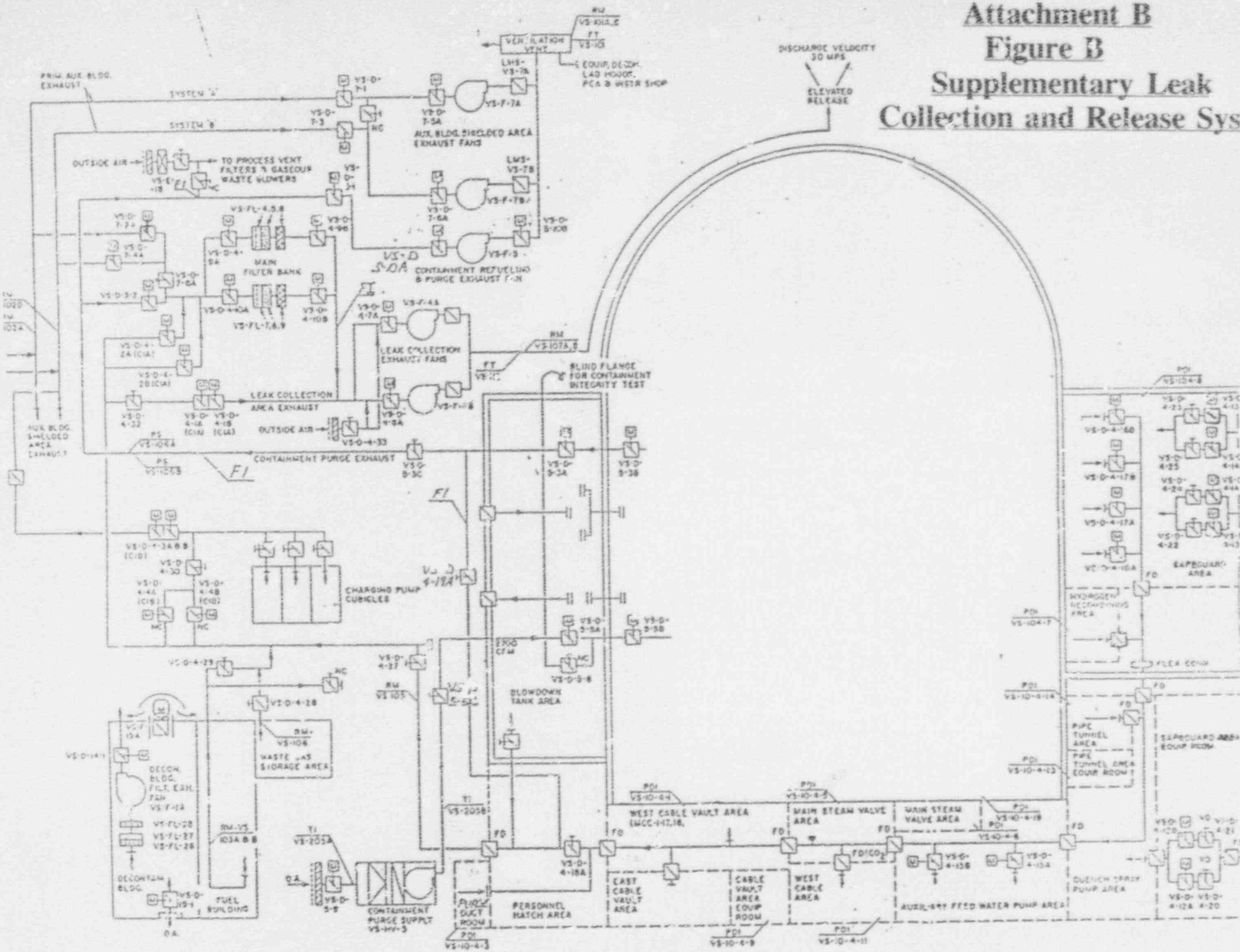
1BVT = Beaver Valley Test (Unit 1)
3BVT = Beaver Valley Test (common to Units 1 & 2)
OST = Operations Surveillance Test
PC = Periodic Calibration
COL = Checkoff List

Attachment F contains a complete list of abbreviations and acronyms.

Attachment B

Figure B

Supplementary Leak Collection and Release System



Attachment B

SUPPLEMENTARY LEAK COLLEC[illegible]ON AND RELEASE SYSTEM SURVEILLANCE TESTS, BASES, AND REQUIREMENT.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTIONS EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
SLCRS Filter Bank (roughing-HEPA-charcoal) During post-accident operation, filters potentially contaminated exhaust air for radioactive iodine removal.	DBD/VTM: -Filter bank rated airflow = 36,000 cfm. -Prefilter should be changed at .8" d/p, but may operate with 4" d/p in an emergency. -HEPA filters should be changed at 3" d/p, may operate at 8" d/p in an emergency. -Charcoal filters clean d/p 2.3", VTM states "resistance across carbon filters has very little relation to its ability to function." -The function of charcoal filters is to filter SLCRS exhaust for iodine removal to maintain offsite doses within 10CFR100 limits following postulated accidents.	UFSAR 6.6 & 14.2.1.2: Charcoal filters are to remove iodine from exhaust air; composite iodine efficiency assumed to be 85% for a fuel handling accident. HEPA filters rated efficiency = 99.97%.	TS 4.7.8.1.a.1: Verify flow through filter train once per 31 days. TS 4.7.8.1.b: Once per 12 months or 720 hours of operation -Verify carbon filters remove >99% of refrigerant test gas when tested IAW ANSI N510-1975 and flowrate 36,00 cfm ±10%. -Verify HEPA filters remove 99% of DOP when tested iaw ANSI N510-1975. -Verify carbon filter iodine removal efficiency >90% by laboratory analysis. -Verify system flowrate = 36,000 cfm ±10%. TS 4.7.8.1.c: Once per 18 months -Verify combined HEPA/Charcoal filter pressure drop <6" W.G. at specified flowrate. -Verify airflow distribution to each filter cell ±20% of average. -Verify flow diverts to filter train on Containment Isolation - Phase A signal. DOP=Dioctylphthalate Particles	OST 1.16.1,2: verifies flow through filter train for 15 minutes once per 31 days. OST 1.16.6,7: "SLCRS Filter Efficiency Test." Used in conjunction with 3BVT 11.60.8 "In Place Filter Monitoring" for in place filter testing IAW ANSI N510-1975. Acceptance criteria are: Charcoal filter efficiency >99% for hydrocarbon refrigerant test gas, >90% for radioactive methyl iodine removal; HEPA filter efficiency >99% for DOP removal. 1BVT 1.16.01,03: "SLCRS Filter Bank Flow Test" measures total filter bank flow via methods of a generic air flow measurements procedure; also verifies filter d/p is within TS limit. 1BVT 1.16.4: "Main Filter Bank Air Flow Distribution Test" verifies individual cells flow ±20% of average. OST 1.1.3,5: "Containment Isolation Trip Test CIA" Verifies component operation in response to a CIA signal	There is no flow through the filter banks during normal operation. Results of last performance of OST 1.16.1 & 1.16.2, OST 1.1.3 & 1.1.5, and 1BVT 1.16.01 through 1.16.7 included the appropriate data sheets from general procedures and/or laboratory sample reports. Results of these procedures are all within the acceptance criteria. OST 1.16.6 & 1.16.7 specified testing which verified the bypass dampers were included in the flow path. The facility determined that earlier testing had overlooked these dampers; this problem is corrected in the performance copies reviewed. All TS sections were covered by these procedures.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTIONS EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
SLCRS Motor Operated Dampers-actuation by ESF signal	DBD: Filter Bank bypass dampers (VS-D-4-1A,B) close and filter bank inlet dampers (VS-D-4-2A,B) open in response to CIA signal; charring pump cubicle normal exhaust dampers (VS-D-4-3A,B) close, emergency exhaust dampers (VS-D-4-4A,B) open in response to a CIB signal.	These dampers are not discussed in detail in the UFSAR	TS 4.7.8.1.c.3 requires testing of flow diversion on a CIA once per 18 months; no TS requirement for testing of damper actuation in response to a CIB was identified.	Testing of CIA actuation is described under SLCRS filter banks. CIB damper actuation testing is accomplished as part of OST 1.1.5,6 "Containment Isolation Trip Test, CIB Train A,B." The test verifies the dampers move to their required post-accident positions.	Reviewed last performance copy of OST 1.1.5,6; proper operation of charging pump cubicle dampers was checked.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTIONS EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
SLCRS Motor Operated Dampers-actuation by radiation monitors	DBD/OM-16: All dampers that reposition for a CIA also reposition in response to Hi-Hi alarm signals from the following radiation monitors: RM-VS-105: areas contiguous to the containment monitor RM-VS-106: waste gas storage area monitor RM-VS-103A & B: fuel building monitors RM-VS-102A & B: auxiliary building shielded areas exhaust monitors RM-VS-104A & B: containment purge monitors The following additional dampers are repositioned by RM-VS-102 A & B: -aux building exhaust dampers 1VS-D-7-1,3 close, ventilation exhaust to main filter bank dampers 1VS-D-7-2A,4A open. The following additional dampers are closed by RM-VS-104 A & B: -containment purge supply and exhaust dampers 1VSD-3A,3B,5A,5B	UFSAR Table 5.3-1: Containment purge supply and exhaust isolation valves closure time is 8 seconds. Other dampers are not discussed in detail.	TS 4.3.3.1: monthly functional test of radiation monitoring channels 104A&B, 103A&B, in applicable modes. TS 4.9.13.3.1: once per 18 months verify exhaust diverts through SLCRS filter bank on a Hi-Hi radiation signal.	OST 1.43.1: :"TS Required Area and Process Monitors Functional Test" monthly verification that SLCRS dampers and Containment Purge dampers operate on radiation monitor signals. OST 1.43.2: "Area and Process Monitors Functional Test" quarterly verification of SLCRS damper operation in response to non-Technical Specification radiation monitor signals. 1BVT 01.16.02: "Fuel Building Ventilation Test" is an 18 month surveillance which verifies area negative pressure in addition to damper operation by RM-VS-103A&B.	Last performance of OST 1.43.1, 1.43.2, and 1BVT 01.16.01 indicated results satisfactory. Containment purge valve operation not verified since these valves are normally closed above Mode 5. Verified shut by walkdown.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTIONS EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
Containment Isolation Valves The containment purge supply and exhaust valves are included in the TS listing of containment isolation valves	DBD: These valves are not specifically addressed in the SLCRS DBD.	UFSAR Table 5.3-1: specifies stroke times (8 and 11 seconds).	TS 4.6.3.1.2.c: once per 18 months verify that containment purge exhaust valves actuate to the closed position on an actuation signal, maximum stroke time is 8 seconds for 3 of the valves, 11 seconds for the fourth. TS 4.6.1.2.d: containment penetrations are leak rate tested at least once per 24 months; combined leakage for all penetrations ≤.60 of La, where La = .1% by weight of containment air per 24 hours at 40 psig. (La = leakage allowable)	OST 1.43.1 "TS Required Area and Process Monitors Channel Functional Test": verifies valves stroke in response to radiation monitor signal. OST 1.10 "Cold Shutdown Valves": measures valve stroke times OST 1.44C.1 "Containment Purge and Exhaust Isolation Test": verifies valve stroke times within TS limits prior to core alterations. 1BVT 1.47.5 "Type C Leak Test": Tests penetration leakrate, not individual valve leakrate; no criteria for individual valves.	Last performance copy of each surveillance test verified purge dampers results satisfied test acceptance criteria.
SLCRS Motor Operated dampers - pump cubicle and outside air damper actuation by area high temperature to maintain area temperature within environmental qualification temperature of 120°F.	DBD, SSFE, ENGINEERING CALCULATIONS: Pump cubicle or room exhaust dampers open at 110°F; outside air dampers open when cubicle/area exhaust dampers are fully open. outside air inlet dampers: - VS-D-4-12A,B - VS-D-4-13A,B - VS-D-4-14A,B room/area exhaust dampers: - VS-D-4-15A,B - VS-D-4-16A,B - VS-D-4-17A,B	No Technical Specification requirements concerning these dampers were identified.	The UFSAR does not discuss these dampers in any specific detail.	1BVT 02.16.08 "Safeguards Pump Cubicles Ventilation Test": This test uses a heat gun and bottled freon to verify damper motion and alarms in response to area thermostats. The test verifies only that damper or alarm actuation occurs; actual setpoint temperatures are checked via a contact pyrometer, but these are not test acceptance criteria.	Last performed 4/17/91. Results satisfactory. Calibration of damper actuating thermostats is now being performed in response to a facility SSFE recommendation; calibration was done for the last performance.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTIONS EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
SLCRS Exhaust Fans Under post accident conditions, the in-service fan draws approximately 36,000 cfm through the filters and exhausts to a vent on top of the containment.	DBD: Capacity =50,000 SCFM; 150 Horsepower motor at 1180 rpm	UFSAR 6.6: "The supplementary leak collection and release system consists of two 100% capacity leak collection exhaust fans with a design capacity of 50,000 cfm each. The capacity of each fan is in excess of the estimated air inleakage to the containment contiguous areas, fuel building and waste gas storage areas."	T.S. 3/4.7.8 SLCRS: No specific fan capacity testing is required. A required system flowrate of 36,000 ±10% cfm through the charcoal filters is verified at least once per 12 months	1BVT 1.16.1.3 "SLCRS Filter Bank Flow Test": Used in conjunction with generic air flow measurement methods procedure to verify total filter bank flow = 36,000 cfm ±10%.	Last performed 9/16/91. Results satisfactory.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTIONS EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
SLCRS system Flow Balancing Positioning of flow balancing dampers to control flow distribution and total flow.	Design Calculations: -Adequate flow volume to maintain areas served at -.125 inches water gauge negative pressure -Adequate flow volume to maintain adequate equipment cooling during a DBA/loss of offsite power; maintain room temperatures ≤120°F. Current adequacy calculations (not original design) provide the following flow numbers: charging pumps: 2800 cfm for A&B pumps, 2900 cfm for C pump recirc spray pumps: 1548 cfm low head SI pumps: 1279 cfm aux feed/quench spray pumps: 3096 cfm	UFSAR 6.6: The SLCRS is designed to maintain .125 inches W.G. negative pressure in most areas contiguous to the containment, in containment during refueling, in the waste gas storage area, and in the fuel building. The post accident equipment cooling function was not addressed.	T.S. 4.9.13.b: The fuel building ventilation system shall be demonstrated operable at least once per 18 months by: verifying that the ventilation system maintains the spent fuel storage area at a negative pressure of ≥1/8 inches W.G. relative to the outside atmosphere during system operation.	1BVT 02.16.05 "SLCRS Safeguards Balance Test": Balances flow and verifies negative pressure in safeguards area with system in post accident lineup. Acceptance criteria are: - .125 inch W.G. negative pressure - 1548 cfm from recirc spray pump cubicles - 1279 cfm from low head SI pump cubicles - 3096 cfm from aux feed/quench spray pumps area - <17,500 cfm total from safeguards area - filter bank flow 36,000 cfm ±10%; d/p ≤6" W.G. across charcoal & HEPA - 5654 cfm total from combined recirc spray and SI pump cubicles if individual flow is not measured 1BVT 1.16.6, "REFUELING VENTILATION BALANCING": - Verifies .125 inches negative pressure in fuel building and containment during refueling, balances containment ventilation flow at 7500 ±10% cfm. No periodic procedure currently existed to verify charging pump cubicle flow.	Last record performance of each surveillance indicated the safeguards area balance total recirc spray/low head SI flow was left at 5453 cfm, (slightly low). Individual pumps were not measured. Other results were within acceptance criteria. The magnehelic d/p gauges specified by the procedure have not been calibrated since installation. A portable d/p instrument was used to verify gauge readings during this performance. Although no surveillance existed for the charging pump cubicles, a Temporary Operating Procedure was performed in response to an SSFE observation. The as-found flows were unacceptably low due to a failed damper. The as-left condition exceeded the most recently calculated minimum flows. At the time of this inspection, a recalculation of SLCRS required flows and development of a new periodic flow balancing procedure was in progress as corrective action for this deficiency.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTIONS EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
Charcoal Filter High Temperature Detectors, solenoid operated deluge valves. Valves must be normally closed to prevent a bypass path around the filter banks	System actuates on high temperature in charcoal filter beds to prevent release of filtered material.	UFSAR Section 9.10: main filter bank charcoal cells are served by an automatically and manually actuated sprinkler system.	Fire suppression systems are not addressed in Technical Specifications (deleted by ammendment 136).	SLCRS Normal System Arrangement - valves are normally closed. (The operability of fire detection and suppression system was not evaluated during this inspection).	These particular solenoid valves in the SLCRS were verified to be normally closed to prevent filter bank bypass in accordance with the Normal System Arrangement as recommended by a facility Safety System Functional Evaluation.

Attachment C

AUXILIARY FEEDWATER SYSTEM

System Description:

Figure C provides a diagram of the Auxiliary Feedwater System.

The AFWS uses two motor-driven auxiliary feedwater pumps (1FW-P-3A and 3B) and one turbine-driven auxiliary feedwater pump (1FW-P-2) to ensure a means of injecting AFW remains available during a design basis accident with a loss-of-offsite power. A dedicated source of AFW is provided by the primary plant demineralized water storage tank (PPDWST), with an alternate water supply from the safety-grade river water system. The suction of the AFWPs are normally aligned to the PPDWST through individual supply lines.

The discharge of each AFWP is capable of being routed through two independent discharge headers. Each of the MDAFWPs is aligned to a different discharge header. In turn, each discharge header can provide AFW flow to any one of the three SGs using the main FW lines downstream of the FW system isolation valves. This allows the main FW lines to be isolated from the containment and still be able to inject AFW flow into the SGs.

AFW flow is controlled using the six motor operated valves (MOV-1FW-151A through F) located in each of the discharge lines to all three SGs. The AFWs requires the operator to maintain SG water level manually by throttling the required MOV (151A through F), or securing AFWPs, after SG water level has been recovered. Operator actions can be accomplished from the control room or, if needed, from the remote shutdown panel.

The system was designed to have a continuous recirculation flow from each pump back to the PPDWST. This flow provides pump and turbine bearing lubricating oil cooling. Also, for testing or long term pump operation with the discharge valves shut, a larger recirculation line has been provided for each pump. The flow through the long term recirculation line is controlled using flow control valves (FCV-1FW-103A, B, and 102) and restricting orifices. To protect the pump during pump starts, the flow control valves open and remain open until pump suction flow has increased sufficiently (above about 135 gpm for the MDAFWPs and about 230 gpm for the TDAFWP) for continuous pump operation.

Power is supplied to the MDAFWPs from the emergency busses, with each MDAFWP powered from different EDGs during a loss-of-offsite power. Steam to the TDAFWP is available from all three SGs through separate lines provided to a common header and isolation valve (MOV-1MS-105). The isolation valve is normally open and provides steam to two parallel, redundant air operated trip valves (TV-1MS-105A and B) that are normally closed. When a TDAFWP start signal is received, the air is vented off the air operated valve (AOV) when the solenoid operated valve (SOV) de-energizes and opens. This opens TV-1MS-105A(B), allowing steam to flow to the TDAFWP turbine.

Instrumentation and controls are provided to the control room operators to monitor and control AFWP flow rates to each SG, MOV-1FW-151A through F, and TV-1MS-105A and -105B in both the control room and the remote shutdown panel. Additional instrumentation is provided to measure pump suction and discharge pressures and pump suction flow for testing. The pump suction flow instrumentation (FIS-1FW-152 and 151A(B)) are also used to control the flow control valves in the long term recirculation lines.

MATRIX CHARTS

The following matrix charts provide a graphic representation of the identified safety functions of the Supplementary Leak Collection and Release System. The entries contained in each column are not exact quotes from the referenced documents, but are reduced 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:

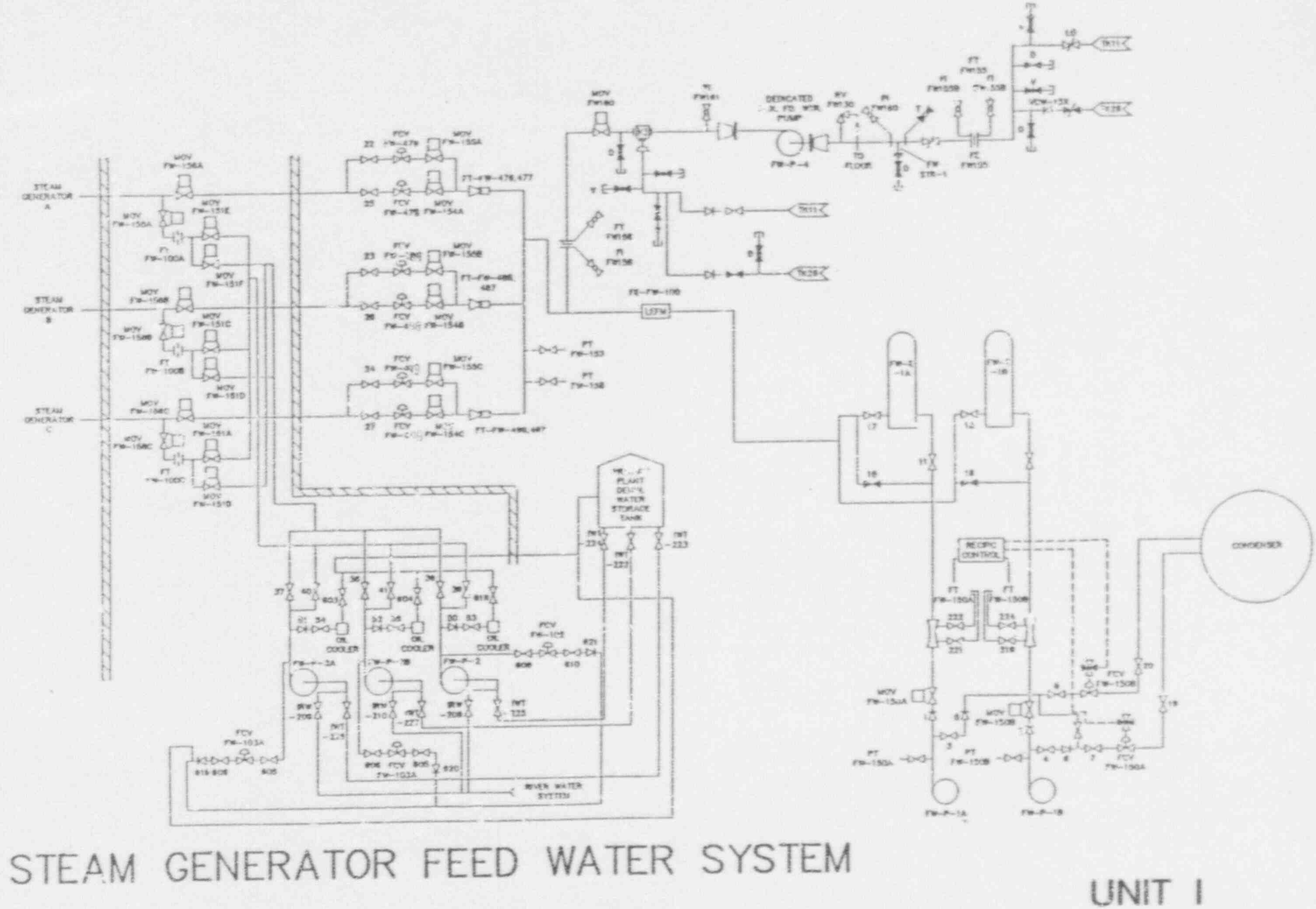
1BVT = Beaver Valley Test (Unit 1)
3BVT = Beaver Valley Test (common to Units 1 & 2)
OST = Operations Surveillance Test

(R) = Performed each refueling
(Q) = Performed quarterly
(M) = Performed monthly

Attachment F contains a complete list of abbreviations and acronyms.

Attachment C

Figure C



ATTACHMENT C

AUXILIARY FEEDWATER SYSTEM SURVEILLANCE TESTS, BASES, AND REQUIREMENTS

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTIONS/ EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
SYSTEM DESIGN SAFETY FUNCTIONS					
AFWS - emergency source of FW to SGs backup to normal FWS.	• AFWS - min 350 gpm total flow to 2 SGs w/in 1 min. for: (1) loss of normal FW (2) LOOP w/Rx trip (loss of normal FW) (3) secondary side rupture (4) C/D after SG tube rupture • Main FW line break - AFWS feed rate of 350 gpm and the capacity of 1 MDAFWP • 350 gpm to SG adequate to protect core and ensure an orderly C/D. Westinghouse calculation DLW-91-009 found 315 gpm from MDAFWPs adequate • AFWS can maintain 350 gpm after accident for: (1) 2 hrs at hot S/D (2) additional C/D to lower hot leg temp to 350°F where RHR can operate • AFWS op press > 2nd lowest MSSV setpoint plus set press tolerance of 1096 psi/2532 ft	AFWS - source of FW to SGs. ensures safe S/D for: (1) main turbine trip w/ loss of normal power (2) loss of normal FW (3) LOOP AFWS minimum 350 gpm to SGs. • AFWPs start w/in 1 min w/loss of all A/C w/loss of normal FW. • Major rupture of a main FW pipe. AFW flow rate 350 gpm and the capacity of 1 MDAFWP • When MS pressure not adequate to operate TDAFWP, RHR need reduced where RHR system can be used • AFWS operating head = 2690 ft (1167 psid) • AFWS assures FW will be available so no substantial overpress of RCS shall occur and RCS level shall be sufficient to cover the Rx at all times	3.7.1.2 - 3 SG AFWP and flow paths shall be operable with: (a) 2 AFWPs, each capable of being powered from separate emergency busses (b) 1 AFWP capable of being powered from operable stm supply system 4.7.1.b.1 & 2 - double verify non-locked valve positions 4.7.1.2.c - After extended outage verify AFW flow from WT-TK-10 to SGs with AFWS in normal alignment 3/4.7.1.2 - Bases • Operability of AFWPs ensures the RCS can be cooled down to <350°F from NOP/NOT with loss of power. • MDAFWPs can deliver 350 gpm at 1133 psig to SGs. TDAFWP can deliver 700 gpm at 1133 psig to the SG. This capacity ensures adequate FW flow is available to remove decay heat and reduce RCS temp to <350°F where RHR system may be placed into operation.	(Individual component test requirements are described in the following charts)	DLC has revised the minimum acceptable operating capacity of the AFWS from 350 gpm to 315 gpm for the MDAFWPs and to 609 gpm from 700 gpm for the TDAFWP. Westinghouse has analyzed these flows as adequate for the AFWS to fulfill its design safety functions.

SAFETY FUNCTION	DESIGN BASIS REQUIRMENTS	UFSAR DESCRIPTION/ EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
WATER SUPPLIES					
PPDWST (1WT-TK-10)	Dedicated source of condensate quality water to the suction of each AFWPs. Max capacity = 152,000 gallons Provides sufficient water for the unit to be maintained in a hot standby condition for at least 9 hours without makeup to the tank from the safety-related river water system Provided with freeze protection heaters - tank temp. maintained between 40°F to 120°F PPDWST Volume required to allow 2-hour hold at hot standby, followed by a cooldown to 350°F = 109,100 gallons (DLC Analysis 8700-DMC-2221) PPDWST volume required to maintain hot standby for 9 hours - 111,520 gallons (DLC Analysis 8700-DMC-2219) at a maximum water temperature of 120°F Useable volume of PPDWST = 129,425 gallons	Provides direct source of water to the suction of the AFWPS Tank capacity = 140,000 gallons Water in tank between 35°F and 120°F - 35°F used for thermal shock, 120°F used when considering AFWs water enthalpy	3/4.7.1.3 PPDWST shall be operable with a minimum contained volume of 140,000 gallons The PPDWST shall be demonstrated operable at least once per 12 hours by verifying the water level 3/4.7.1.3 Bases The operability of the PPDWST with the minimum water volume ensures that sufficient water is available for cooldown of the RCS to <350°F in the event of a total loss of offsite power. The minimum water volume is sufficient to maintain the RCS at hot standby for 9 hours with steam discharge to atmosphere	Each shift the operators record the PPDWST level in their TS log sheets	

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTION EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
WATER SUPPLIES					
Alternate Water Supplies to AFWS	A header of river water systems can provide water to suction of the AFWPS Isolated from AFWS by manual valves (1RW-206, 207, 208, 209 and 210) all normally shut with 1RW-206 locked shut requires operator action at AFWP location to lineup A river water header Motor driven river water (9,000 gpm each at 155 ft TDH) or engine-driven fire pump (2500 gpm at 289 ft TDH) provide a source for the 'A' river water header	The AFWPs can also be supplied from the river water pumps or the engine driven fire pump via one of the river water system headers	4.7.1.2.b.4 Verify operability of each River Water Auxiliary Supply valve by cycling each manual River Water to AFWS valve through one complete cycle.	OST 1.24.10 (M) Acceptance Criteria: (1) Each RW supply valve to the AFWS cycled thru 1 complete cycle of travel	1/21/92 Performance (1) 1RW-206, 207, 208, 209, & 210 cycled (2) double verified: 1RW-206 locked shut 1RW-207 shut 1RW-208 shut 1RW-209 shut 1RW-210 shut

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTION EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
PUMPS					
Limiting Pump Performance Requirements MDAFWPs - (1FW-P-3A and 3B)	AFWS can mitigate both LOCA and non-LOCA events with MDAFWP min op flow >315 gpm to the SG (Westinghouse Analysis DLW-91-009) Pump (specs - BVS 112) (1) op temp = 32-120°F (2) TDH = 2696 ft (3) required NPSH = 17 ft (4) avail NPSH = 25.9 ft Each MDAFWP delivers water to a seperate AFWS header Pumps start on the following signals: (1) lo-lo level in 2 out of 3 SGs (2) auto trip of both main FW pumps (3) SI signal (4) failure of TDAFWP (5) manual start Started from control room or shutdown panel Auto starts must be completed within one minute of the initiating event The minimum capacity of the MDAFWPs and TDAFWP have been decreased to 315 gpm and 609 gpm respectively. Westinghouse has analyzed the reduced flows as acceptable.	AFWS ensures FW supply of >340 gpm upon loss of power since each MDAFWP capacity = 350 gpm and TDAFWP = 700 gpm - main FW line break AFWS delivers 350 gpm plus the MDAFWP capacity, 350 gpm at 2696 ft TDH Pumps start signals: (1) lo-lo level in 2/3 SGs (2) both MFWPs stopped & either control switch for MFWP (1FW-P1B /1FW-P-1A) in close and after close position (3) SI signal (4) TDAFWP low discharge pressure (5) manual start (6) loss of FW in 2 of 3 FW loops via ATWS mitigating system actuation circuitry MDAFWPs started from control room or SDP Auto starts within one minute for blackout conditions and loss of normal feedwater	4.7.1.2 - Surveillance Requirements: IST (1) verify that on recirc flow MDAFWPs develop a disch press >1133 psig (2) verify that on recirc flow TDAFWP develops a disch press >1155 psig w/ secondary stm press >600 psig After extended outage, verify AFWS flow from WT-TK-10 to SG with AFWS in normal alignment Each 18 months during shutdown: verify each pump auto starts on test signal 3.3.2.1, Table 3.3-5 MDAFWP Response time all signals = 60 sec. 3/4.7.1.2 Bases MDAFWPs each capable of a total FW flow of 350 gpm at a press of 1133 psig to the entrance of the SGs 4.0.5 Test ASME pumps and valves shall be performed iaw Section XI ASME B&PV code 4.3.2.11, Table 4.3-2, Each ESF actuation system channel shall be demonstrated operable by performance of the channel check, channel calibration and channel functional test during the modes and the frequencies shown in Table 4.3-2	OST 1.24.2 (Q) Accept Criteria (1) >1155 psig on recirc (2) >1270 psid on recirc (3) w/in Sec XI pump limit (4) starts from CR/SDP OST 1.24.8 (R) and before startup after >30 day outage: Accept Criteria (1) MDAFWPs develop d/p w/in 0.98 (0.97) to 1.02 of performance curve data (2) ≥ 350 gpm to SGs OST 1.24.5 (R). Accept Criteria (1) disch press >1155 psig w/in 60 sec of SI signal (2) auto start on SI sig (3) receive start signal on 2 of 3 SG lo-lo level signals OST 1.24.6 (R) Accept Criteria (1) auto start w/trip of main feed pump (2) SG flow >350 gpm 60 s	2/2/91 performance data satisfactory 12/4/91 performance data satisfactory 11/25/91 performance data satisfactory for pump 1FW-P-3A 11/4/91 performance data satisfactory for pump 1FW-P-3B 6/11/91 performance data satisfactory 4/13/91 performance data satisfactory The MDAFWPs no longer start on a sustained low dischrage pressure of the TDAFWP. The licensee has modified the system to remove this function (DLC Design Concept document 8700-DC-1423-0 provides the engineering analysis for the modification). The next update to the UFSAR will document this change.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTION EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
PUMPS					
TDAFWP (1FW-P-2)	TDAFWP principal pump of AFWS - MDAFWPs backups TDAFWP required to start w/in 1 min of event resulting in start signal Pump (BVS-112) (1) temp 32 to 120°F (2) TDH = 2696 ft (3) efficiency 74% (4) 6 stage centrifugal (5) BHp(nor/max)= 675/730 (6) req. NPSH = 19 ft (7) avail NPSH = 25.9 ft (8) speed 4200 rpm (9) flow - 700 gpm to SG TDAFWP starts on: (1) lo-lo SG level-1 SG (2) undervolt on 2 of 3 RCP busses (3) manual start	Turbine Drive: (1) norm stm = 1100 psig (2) alt stm = 600 psig (3) pump capacity adequate above 125 psig stm press (4) exhaust to atmosphere (5) stm from each SG (6) stm lines under MS pressure (7) single inlet, single stage unit Pump: (1) 700 gpm @ 2696 ft TDH (10.3.5.2.2) (2) primary system pump (10.3.5.2.2) TDAFWP starts on: (1) lo-lo lvl in any SG (2) undervoltage on any 2 RCP busses (3) manual actuation (4) loss of FW in any 2 out of 3 FW loops via AMSAC	3.3.2.1, Table 3.3-5 ESF activation system response times: (1) SG water level lo-lo: TDAFWP = 60 sec (2) undervoltage RCP: TDAFWP = 60 sec 3/4.7.1.2 Bases TDAFWP capable of a total FW flow of 700 gpm at a press of 1133 psig to the entrance of the SGs.	OST 1.24.9 (R) and S/U after >30 outage Accept Criteria: (1) disch press ≥1155 w/secondary stm press >600 w/in 60 sec of 2 out 3 RCP bus undervoltage signal. (2) w/in ASME Sec XI pump limits and >MOP curve (3) vibration w/in ASME limits OST 1.24.4 (Q) Accept Criteria: (1) disch press ≥1155 on recirc w/secondary steam press >600 psig. (2) w/in ASME Sec XI pump limits OST 1.24.5 (R) Accept Criteria: (1) TDAFWP receives start signal (trip valves open) on receiving a 2/3 RCPs bus undervoltage signal (2) TDAFWP receives start signal (trip valves open) on receiving a SG lo-lo OST 1.24.13 (R) Accept Criteria: (1) overspeed trip occurs between 4780 and 4880 rpm	11/28/91 performance data satisfactory 1/21/92 performance data satisfactory 5/10/91 Performance Data Satisfactory 6/28/91 Performance Data Satisfactory

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTION/ EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
CHECK VALVES					
TDAFWP Steam Supply Check Valves (1MS18,19,20)	• in lines from each SG • 3 in. check vlv • Mfg spec leak rate = 30 cc/hr water or 0.3 scfh air (RVS-207, MSS SP-61)	• check valve in line from each SG • 3 in size (Fig 10.3-1)	4.0.5 - ASME components shall be tested iaw Section XI • 1MS-18,19,20 • Partial stroke, fwd dir; full stroke, fwd dir; full stroke, rev dir leak test • Partial stroke, fwd dir, performed quarterly • Full stroke, fwd dir performed at cold S/D • Full stroke, rev dir leak test each refueling.	OST 1.24.9 (R and after S/D >30 days) Acceptance Criteria: (1) (1MS-18,19,20) exer fwd dir - op verified stm flow adequate to ensure total ≥700 gpm to the SGs (full stroke, fwd dir) OST 1.24.4 (Q) Accept Criteria (1) TDAFWP ≥1150 psig on recirc flow w/secondry steam press >600 psig (2) TDAFWP w/in ASME pump limits (3) 2 of 3 check valves (1MS-18,19,20) operate per ASME IWV-3520; operation verified if steam flow adequate to meet 1st 2 acceptance criteria (partial stroke/fwd dir) BVT 1.60.7 ASME Acceptance Criteria: 1MS-18,19,20 seat leakage ≤1010 scfd (ASME limit)	11/28/91 performance data satisfactory 1/21/92 Performance Data Satisfactory 6/23/91 Performance: 1MS-18 = 922.1 scfd 1MS-19 = 900.0 scfd 1MS-20 = 261.0 scfd

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTION/ EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
CHECK VALVES					
AFWP Discharge Check Valves (1FW-33, 34, & 35)	Each pump has a separate disch check valve • 1FW-33: 6 in. (1) mfg leak rate = 60 cc/hr (2) from TDAFWP • 1FW-34/35: 4 in. (1) mfg leak rate = 40 cc/hr water or 0.4 scfh air (BVS-209 MSS SP-61) (2) for MDAFWPs	ach pump has a separate disch check vlv • TDAFWP - 6 in. size • MDAFWP - 4 in. size (Fig 10.3-5)	4.0.5: IST testing; • 1FW-33,34,35 • Full stroke, fwd dir; rev dir performed in cold S/D conditions	OST 1.24.9 (R and after S/D >30 days) Acceptance Criteria: 1FW-35 exercise fwd flow per ASME Sec XI (full stroke fwd) OST 1.24.8 (R and after S/D >30 days) Acceptance Criteria: (1) 1FW-34/35 operable per ASME-verify valves open/seat (full stroke, fwd dir, rev dir) (2) 1FW-33 operable per ASME - valve seats properly	11/28/91 Perform nce Data: flow to a SGs = 730 gpm; passes hru 1FW-35 11/4/91 Performance Data: (1) 1FW-P-3B running - flow to SGs >350 gpm (375 gpm) - 1FW-35 passes full flow (full stroke, fwd) 11/25/91 Performance Data: (2) 1FW-P-3A running - flow to SGs >350 gpm (365 gpm) - 1FW-34 passes full pump flow (full stroke fwd)
AFWS A & B Header Check Valves FW-622, 623, 624, 625, 626, & 627)	• Each AFWS header - separate check valve for each SG • Mfg leak rate = 30 cc/hr water or 0.3 scfh air (BVS-207, MSS SP-61)	• Each header - separate check valve for each SG • 3 in size (Fig 10.3-5)	• 1FW-622, 623, 624, 625, 626, 627 •full stroke, fwd dir; full stroke, rev dir • Perform in cold S/D conditions	OST 1.24.8 (R) and after S/D >30 days Acceptance Criteria: (1) 1FW-622, 623, 624, 625, 626, 627 exer open/seat properly as required by ASME Sec XI	11/4/91 Performance Data: B header test only (1) 1FW-623,625,627 sat full stroke fwd; (2) 1FW-622,624,626 rev dir seat test satisfactory

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTION EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
CHECK VALVES					
AFWS Inlet to Main FW Line Check Valves (1FW-42,43, & 44)	• in each supply line to each main feed line • 3 in Crane check valves • Mfg leak rate = 30 cc/hr water or 0.3 scfh air (BVS-207, MSS SP-61)	• check valve in each supply line to each main feed line • 3-in size (Fig 10.3-5)	• 1FW-42,43,44 • Full stroke, fwd dir, reverse dir • Full stroke, fwd dir done at cold shutdown frequency	OST 1.24.8 (R) and after S/D >30 days Acceptance Criteria: (1) 1FW-42,43,44 exercised open as required by ASME Sec XI OST 1.24.11 (R) Acceptance Criteria: (1) rev flow leakage calculated to be ≤5 gpm for 1FW-42,43,44 (cold S/D w/ SG level ≥85% wide range - leakage collected at low press side drain of flow transmitters	11/4/91 Performance Data: 1FW 43, 43, 44 passed full AFW flow to the SGs 6/13/91 Performance Data. 1FW-42 = 1.14 gpm; 1FW-43 = 0.1 gpm; 1FW-44 = 0 gpm

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTION/ EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
MOTOR OPERATED VALVES					
<u>AFW Throttle Valves 1FW-151A - F</u>	• SG 1A from 151 E & F • SG 1B from 151 C & D • SG 1C from 151 A & B • all normally open • receive backup open signal - stays in 30 seconds • SDP controls avail • design leak rate = 0.023 gpm (BVS-653)	• normally open • automatic operation • SDP controls available	<u>4.7.1.2.b.1&2</u> Verify every 31 days to be in proper position <u>4.7.1.2.d</u> Every 18 months during S/D (1) cycle pwr op (exclude auto) vlv in flow path not testable during ops thru 1 cycle full travel (2) verify each auto vlv actuates to correct position on test sig <u>4.6.3.1.1.a</u> (contain isol) Every 92 days (1) cycle thru 1 cycle full travel <u>4.6.3.1.2</u> Cold S/D or Refueling every 18 months (1) cycle each vlv thru 1 cycle of full travel and measure isolation time. <u>Table 3.6-1</u> Stroke times • isolation times = N/A <u>4.0.5</u> measure stroke time open iaw ASME Sec XI	<u>OST 1.24.8/1.24.9 (R)*</u> • Acceptance Criteria: (1) dbl verify position* <u>OST 1.24.10 (M)</u> Acceptance Criteria: (1) non-locked vlvs dbl verify position <u>OST 1.24.5/1.24.9 (R)</u> Acceptance Criteria: (1) rec'v auto open sig - travel in open dir (2) all auto vlvs to correct position on test signal <u>OST 1.24.1 (Q)</u> Acceptance Criteria (1) cycle thru 1 cycle (2) w/in ASME stroke open time limit (3) open stroke times not increased by: >25% if >10 sec stroke >50% if <10 sec stroke (4) annual stroke open from SDP	11/5/91 performance data: (1) 151 A,C,E open 11/27/91 performance data: (1) 151 B,D,F open 1/21/92 performance data (1) 151A thru F open 6/10/91 performance data: (1) close 151 B,D,F (2) test signal - 151 B, D, F open w/signal 6/12/91 performance data: (1) close 151 A,C,E (2) test signal - 151 A, C, E open w/signal 12/18/91 data (seconds) •151A = 26.68 (+0.7%) •151B = 29.6 (+0.6%) •151C = 28.23 (+3.25%) •151D = 29.63 (+0.3%) •151E = 27.2 (+1.3%) •151F = 29.69 (+0.7%) All times sat 2/12/91 data from SDP •151A = 26.66 (+0.[illegible]%) •151B = 29.69 (+0.24%) •151C = 27.93 (+0.54%) •151D = 29.73 (-0.34%) •151E = 28.33 (+0.35%) •151F = 29.91 (-1.38%) All times sat TS lists the MOVs as containment isolation valves, but isolation times are specified as not applicable. The valve stroke data obtained during testing has been for opening times to satisfy ASME Section XI requirements.

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTION EVALUATIONS/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
MOVs & AOVs					
TDAFWP Stm Supply Vlvs TV-1MS-105A/B	• parallel/redundant stm supply trip valves • 3 in, 600lb class solenoid actuated, AOVs • open when solenoid de-energized vents air • control switch in CR and SDP • stroke times (calc) open = 4.5 sec* close = 4.75 sec* (12/6/71 letter from Masoneilan to DLC) • normally closed	Not discussed	4.7.1.2.d.2 Verify each auto valve actuates to the correct position on a test signal 4.0.5: measure stroke time open iaw ASME Sec XI	OST 1.24.9 (R) Acceptance Criteria: (1) TV-1MS-105A/B go to open position on test signal OST 1.24.4 (Q) Acceptance Criteria: (1) Exercise TV-1MS-105A/B to position req'd (open) using switch in control room (2) TV-1MS-105A/B open stroke times w/in ASME limits; not >25% increase from last test (3) TV-1MS-105A/B stroked from the SDP annually	11/28/91 Performance Data: (1) Train A test signal - TV-1MS-105A goes open sat (2) Train B test signal - TV-1MS-105B goes open sat 1/21/92 Performance Data: (1) TV-1MS-105A cycled from control room; (2) TV-1MS-105B cycled from control room; (3) TV-1MS-105A cycled from SDP; (4) TV-1MS-105B cycled from SDP; (5) 105A open time = 21.97*sec (+3.5%); 105B open time = 22.53*sec (+0.36%) *ASME open time max = 35 seconds for both valves. IST maximum stroke time limits were calculated from initial baseline test data which was within the valve purchase specifications. The current maximums used for testing are iaw ASME 1983 allowances.
MS to AFWP turbine Isolation Vlv MOV-1MS-105	• 3 in, 600lb class gate valve (BVS-374) • normally open • stroke times (BVS-374) open = 30 sec close = 30 sec • mfg seat leakage = 30 cc/hr	Not discussed	4.6.3.1.1.a.1 - (containment isolation) Every 92 days cycle thru 1 cycle full travel Table 3.6-1 isolation times = N/A 4.0.5 - measure stroke/time open	OST 1.47.3A (Q) Acceptance Criteria: (1) w/in ASME open stroke limits (42 seconds) (2) stroke times not increased by >25% over previous tests (3) cycle valve through 1 complete cycle	12/3/91 Performance Data: (1) MOV-1MS-105 stroke open time = 28.16 sec (+0.11%); (2) 1 cycle completed

SAFETY FUNCTION	DESIGN BASIS REQUIREMENTS	UFSAR DESCRIPTION/ EVALUATION/GUIDANCE	TECHNICAL SPECIFICATIONS	SURVEILLANCE AND PLANT PROCEDURES	NOTES AND COMMENTS
RELIEF VALVES					
TDAFWP Disch Relief 1RV-FW-155	• recommend setpoint=1430 • installed as overpress protection if TDAFWP overspeed occurs	Not discussed	4.0.5: set pressure test required iaw ASME Sec XI	1BVT 1.60.5 Acceptance Criteria: Setpoint = 1455 ±43 psig	Data from the corrective maintenance procedure done 5/21/91; setpoint tested 3 consecutive times to verify repeatability and accuracy. • As found data: (1) 1290, 1300, 1300 psig • As-left data: (1) 1450, 1450, 1450 psig; (2) no seat leakage

ATTACHMENT D

Persons Contacted

Duquesne Light Company:

* * L. Arch, Principal Engineer
* * T. Basich, Senior Engineer
* * G. Cacciani, Senior Engineer
* * J. Forney, Principal Engineer
* K. Frederick, Mechanical Engineer
* F. Gardener, Mechanical Engineer
* * K. Grada, QSU Manager
* * R. Hansen, Director, General Engineering
* * G. Kammerdeiner, Director, Materials Engineering
* P. Kozlowski, Mechanical Engineer
* * F. Lipchick, Senior Licensing Supervisor
* R. Martin, Director, Nuclear and Mechanical Engineering
* * C. Makowka, System Engineer
* * D. McLain, Manager, Technical Services
* * T. Noonan, General Manager, Nuclear Operations
* * F. Oberlitner, Supervisory EQ Engineer
* K. Ostrowski, BVPS Operations Manager, Unit 1
* M. Pettigrew, Nuclear Operation Service Unit Engineer
* * B. Sepelak, Licensing Engineer
* J. Severryn, Mechanical Engineer,
* * J. Sieber, Vice President, Nuclear Group
* * D. Spoerry, General Manager, Nuclear Operations Services
* * G. Thomas, General Manager, Corporate Nuclear Services Unit
* * N. Tonet, Manager, Nuclear Safety
* J. West, Nuclear Operation Service Unit Engineer
* B. Williams, Nuclear Operation Service Unit IST Coordinator
* * K. Woessner, SSFE Project Manager
* * R. Zabowski, System Engineering Administrator
* * B. Zini, Supervisory General Engineer

United States Nuclear Regulatory Commission:

* * J. Beall, Senior Resident Inspector, Beaver Valley
* * L. Bettenhausen, Chief, Operations Branch, DRS

* Attended the exit meeting on 2/7/92

Attachment E

Documents Reviewed

Design Basis Documents:

Operating Manual Chapter 16 "Supplementary Leak Collection and Release System"

UFSAR Section 6.3, "Emergency Core Cooling System"
UFSAR Section 6.6, "Supplementary Leak Collection and Release System"
UFSAR Section 10, "Steam and Power Conversion System"

DBD No 16 "Supplementary Leak Collection and Release System"
DBD No 24B, "Design Basis Document for Beaver Valley Power Station - Unit No.1, Auxiliary Feedwater System," Rev 0

Vendor Technical Manual - "Primary Ventilation Filters"
Vendor Technical Manual - "Centrifugal Fans"
Vendor Technical Manual - Ingersoll-Rand Instructions - class HMTA & HMTB horizontally split multi-stage pumps with ball bearings

Fuel Handling Accident Evaluation BVPS Unit No. 1

Beaver Valley Specification (BVS)-206, "Carbon Steel Valves - Socket Weld Ends 2 Inch and Smaller," 2/4/72

BVS-207, "Cast Carbon Steel Valves 2-1/2 Inch and Larger," 2/4/72

BVS-208, "Forged Stainless Steel Valves - Socket Weld Ends 2 Inch and Smaller" 10/28/91

BVS-209, "Stainless Steel Valves 2-1/2 Inch and Larger," 4/6/78

BVS-374, "Carbon Steel Valves - Motor Operated," 4/19/73

BVS-194, "The Air Operated Control Valve for BV-1," 12/21/71

BVS-653, "Motor Operated Control Valves," 7/22/80

BVS-112, "Steam Generator Auxiliary Feed Pumps for BVPS - Unit 1," 1/16/70

BVS-151, "River Water Pumps," 3/18/70

Certificate of Compliance containing pump performance curves for 1FW-P-3A and 3B, 7/27/71

Certificate of Compliance containing pump performance curves for 1FW-P-2, 4/26/71

Westinghouse Equipement Specification G-676241, "Manual "T" and "Y" Glove, Manual Gate, and Self-Actuated Check Valves," Rev 1

Westinghouse Equipment Specification G-676257, "Auxiliary Relief Valves," Rev 1

Westinghouse Equipment Specification G-676258, "Motor Operated Valves," Rev 2

Westinghouse Equipment Specification G-677264, "2 inch and Below Manual "T" and "Y" Globe; and Self-Actuated Check Valves."

Westinghouse Equipment Specification 679065, "Equipment Data Sheet for 1450 ft^3 Accumulator," Rev 5

Manufacturers Standardization Society (MSS) Standard Practice SP-61, "Hydrostatic Testing of Steel Valves," 1961 edition

DCP-270, Installation of a Unit 2 charging pump in Unit 1
DCP-278, Installation of 42 qualified solenoid valves in accordance with NRC Bulletin 79-01
DCP-324, LHSI pump discharge relief valve setpoint change from 220 to 235 psig
DCP-355, Removal of charging pump minflow orifice throttle valves
DCP-423, Replacement of 3" discs on Type C58 Velan check valves
DCP-442, Replacement of 6" discs on Type C58 Velan check valves
DCP-469, Replacement of old design Velan check valves with new design
DCP-832, Installation of charging pump cubicle flooding protection

Engineering Calculations and Analyses:

8700-DMS-2688 "Low Ventilation Air Flow Rates in the BVPS Unit 1 LHSI and Recirculation Spray Pump Rooms"

8700-DMC-2500 "SLCRS Flow Requirements for the Unit 1 Charging Pump Cubicles (DBA Alignment)"

8700-DMC-2283 "Supplementary Leak Collection and Release System Adequacy"

11700-BS-SG-V-1 "Safeguards Area Ventilation"

11700-BS-SG-V-2 "Ventilation Requirements Safeguards Area"

11700-BS-LC-V-1 "Leak Collection System - Flow Rates"

11700-BS-AB-V-1 "Heat Gain Calculations - Auxiliary Building Ventilation"

13387.18-B-77 "Analysis of Safeguards Area and Pipe Tunnel Heat Gain"

13387.18-B-78 "A[illegible]s of Auxiliary Building Heat Gain"

13387.34-M-53, "Auxiliary Feedwater Flow with Isolated Steam Generator"

8700.24.46 (8700-DMC-2402), "Auxiliary Feedwater System Design Basis"

Design Analysis No. 8700-DMC-2231, "Auxiliary Feed Pump Response Times"

Design Analysis No. 8700-DMC-2221, "PPDWST Volume Required for Cooldown"

Design Analysis No. 87-DMC-2219, "Water Volume (PPDWST) Required for 9 Hours at Hot Standby"

<u>Administrative Procedures:</u>

Beaver Valley Unit 1 Technical Specification Procedure Matrix
BVPS Inservice Testing Program for Pumps and Valves
Site Administrative Procedures Manual, Chapter 41, "Clearance Procedure," Rev 4

<u>Nuclear Group Administrative Manual Procdures</u>:

1.2.3, Corrective Action Response
1.2.11, Plant Labeling and Tagging Program
1.5.4, Trending of Plant Parameters
1.7.3, Technical Specification Interpretation
1.8.2, Inservice Testing (IST)
6.4, Control of Vendor Documentation
8.1, Work Activity Surveillance Program
8.2, Inservice Test Program
8.12, Control/Coordination of Surveillance, Calibration, and Other Periodic Tasks
8.18, 10 CFR 50.59 Evaluations
8.19, Control and Use of Measuring and Test Equipment
9.2, Master Equipment List

<u>Nuclear Engineering Administrative Manual Procedures</u>:

1.6.5, Evaluation, Tracking, and Dispostion of Correspondence
2.7, Engineering Specifications
2.11, Handling of Vendor Technical Information
2.13, Technical Evaluation Reports
7.1, Corrective Action
8.1, Work Activity Surveillance Program

Technical Services Department Administrative Procedures

TSAP 1.5.3, "Administrative Guidelines for Performing Tests," Rev 1
TSAP 1.5.5, "Control of Test Records," Rev 0
TSAP 3.10, "IST Administrative Procedure," Rev 0

Surveillance and Engineering Test Procedures:

OST 1.1.10, "Cold Shutdown Valve Exercise Test," Rev 3
OST 1.1.3,4, "Containment Isolation Trip Test CIA Train A, Train B," Rev 2
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OST 1.24.10, "Auxiliary Feedwater System Monthly Verification," Rev 0
OST 1.24.11, "Auxiliary Feedwater Check Valve Exercise Verification," Rev 1
OST 1.24.13, "Overspeed Trip Test of Turbine Driven AFW Pump (1FW-P-2)," Rev 0

OST 1.24.14A, "Main Feed Containment Isolation Valve (MOV-1FW-156A) Exercise Verification," Rev 0

OST 1.36.3, "Diesel Generator No. 1 Automatic Test," Rev 2

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OST 1.47.3A,3B "Three Month Containment Isolation and ASME Section XI Test," Rev 4

1BVT 01.01.02, "Engineered Safety Features Time Response Test," Rev 11

1BVT 01.11.03, "SI Accumulator Discharge Check Valve Full Stroke Test," Rev 2

1BVT 01.16.01,3, "SLCRS Filter Bank Flow Test," Rev 14,13

1BVT 01.16.02, "Fuel Building Ventilation Operation Tests," Rev 8

1BVT 01.16.04, "Main Filter Bank Air Flow Distribution Test," Rev 7

1BVT 01.16.05, "Refueling Ventilation Balance," Rev 10

1BVT 01.16.06,07, "Supplementary Leak Collection and Release System Filter Efficiency Test," Rev 6,5

1BVT 01.47.05, "Type C Leak Test," Rev 5

1BVT 01.47.11, "SI/CH Valve Integrity Test"

1BVT 01.60.05, "IST Safety and Relief Valve Tracking," Rev 7

1BVT 01.60.07, "ASME XI Check Valve Reverse Flow Test," Rev 2

1BVT 02.16.05, "SLCRS Safeguards Balance Test," Rev 2

1BVT 02.16.08, "Safeguards Pump Cubicles Ventilation Test," Rev 1

3BVT 11.60.8, "In Place Filter Monitoring," Rev 1

3BVT 11.60.11, "Air Flow Measurement Methods," Rev 0

1MSP 24.35, "F-FW100A Aux Feedwater Flow Channel Calibration," Rev 1

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OM 1.50.4, "Instructions To Heatup Primary Plant From Cold Shutdown"

OM 1.54.3, "Reactor Operator Log"

Maintenance Procedures:

4.25, "Plant Instrument Calibration Program"

4.27, "Control and Calibration of Measuring and Test Equipment"

Drawings:

8700-RM-411-1, "Valve Operator No. Diagram - Safety Injection System," Rev 4

8700-RM-424-1 and 8700-RM-424-2, "Valve Operator No. Diagram - Feedwater System," Rev 1

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EM No. 100187, "Auxiliary Feedwater Pump MOP Curves"

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DLW-91-009; from Westinghouse to DLC, 1/17/91. BVPS Unit 1 Reduced AFWP Capacity Safety Evaluation Checklist

Attachment F

Table of Abbreviations and Acronyms

AC -	Alternating Current
AFW -	Auxiliary Feedwater
AFWP	Auxiliary Feedwater Pump
AFWS -	Auxiliary Feedwater System
AMSAC -	ATWS Mitigating System Actuation Circuitry
ANSI -	American National Standards Institute
AOV -	Air Operated Valve
AP -	Administrative Procedure
ASME -	American Society of Mechanical Engineers
ASTM -	American Society for Testing and Materials
ATWS -	Anticipated Transient Without Scram
BIT -	Boron Injection Tank
B&PV -	Boiler and Pressure Vessel (Code)
BTU -	British Thermal Unit
BVPS -	Beaver Valley Power Station
BVS -	Beaver Valley Specification
BVT -	Beaver Valley Test
C -	Centigrade
CB -	Containment Building
cc -	cubic centimeters
C/D -	Cooldown
cfm -	Cubic Feet per Minute
CFR -	Code of Federal Regulations
CIA -	Containment Isolation, Phase A
CIB -	Containment Isolation, Phase B
CIV -	Containment Isolation Valve
COL -	Checkoff List
CR -	Control Room
DBD -	Design Basis Document
DC -	Direct Current
DCL -	Duquesne Light Company
[illegible]	direction
[illegible]W -	Westinghouse designator for Beaver Valley Unit 1
DOP -	Dioctylphthalate Particles
d/p -	differential pressure
E-Spec -	Equipment Specification
ECCS -	Emergency Core Cooling System
EDG -	Emergency Diesel Generator
EQ -	Equipment Qualification
ESF -	Engineered Safety Feature
F -	Fahrenheit
FCV -	Flow Control Valve

FI -	Flow Indicator
FPM -	Feet Per Minute
FSAR -	Final Safety Analysis Report
FW -	Feedwater
fwd -	forward
GDC -	General Design Criterion
GL -	Generic Letter
gpm -	gallons per minute
HEPA -	High Efficiency Particulate Absolute
HHSI -	High Head Safety Injection
HP -	Horsepower
HX -	Heat Exchanger
iaw -	in accordance with
I&C -	Instrumentation and Control
ISI -	Inservice Inspection
IST -	Inservice Test
IWP -	ASME Section XI Chapter on Pump Tests
IWV -	ASME Section XI Chapter on Valve Tests
KW -	Kilowatts
La -	Leakage allowable
LBLOCA -	Large Break Loss of Coolant Accident
LCO -	Limiting Condition for Operation
LCV -	Level Control Valve
LHSI -	Low Head Safety Injection
LI -	Level Indicator
LOOP -	Loss of offsite power
m -	meter
m^3 -	cubic meters
mfg. -	manufacturer
MDAFWP -	Motor Driven Auxiliary Feedwater Pump
MOP -	Minimum Operating Point
MOV -	Motor Operated Valve
MS -	Main Steam
MSS -	Manufacturers Standardization Society
MSLB -	Main Steam Line Break
MW -	Megawatts
MW_t -	Megawatts Thermal
MWR -	Maintenance Work Request
N_2 -	Nitrogen Gas
NED -	Nuclear Engineering Department
NOP -	Normal Operating Pressure
NOT -	Normal Operating Temperature
NPSH -	Net Positive Suction Head
NPSHa -	Net Positive Suction Head available
NPSHr -	Net Positive Suction Head required
NRC -	Nuclear Regulatory Commission

OI -	Open Item
OL -	Operating License
OM -	Operating Manual
OST -	Operations Surveillance Test
PCV -	Pressure Control Valve
PI -	Pressure Indicator
PPDWST -	Primary Plant Demineralized Water Storage Tank
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
RC -	Reactor Coolant
RCP -	Reactor Coolant Pump
RCS -	Reactor Coolant System
Reg. -	Regulatory
rev -	reverse
Rev. -	Revision
RHR -	Residual Heat Removal
RM -	Radiation Monitor
rpm -	revolutions per minute
RTD -	Resistance Temperature Detector
RW -	River Water
RWST -	Refueling Water Storage Tank
Rx -	Nuclear Reactor
SBLOCA -	Small Break Loss of Coolant Accident
scf -	standard cubic feet
scfd -	standard cubic feet per day
scfh -	standard cubic feet per hour
scfm -	standard cubic feet per minute
S/D -	Shutdown
SECL -	Safety Evaluation Checklist
SG -	Steam Generator
SI -	Safety Injection
SLCRS -	Supplementary Leak Collection and Release System
SOP	Standard Operating Procedure
SOV -	Solenoid Operated Valve
SW -	Service Water
T-ave -	Average reactor coolant temperature
TCV -	Temperature Control Valve
TD -	Turbine Driven
TDAFWP -	Turbine Driven Auxiliary Feedwater Pump
TDH -	Total Developed Head

TE -	Temperature Element
TS -	Technical Specifications
TV -	Throttle Valve
UFSAR -	Updated Final Safety Analysis Report
USAS -	United States of America Standard
V -	Volts
VTM -	Vendor Technical Manual
VS -	Ventilation System
W.G. -	Water Gauge (pressure)
w/ -	with
≈ -	Approximately equal to
> -	greater than
< -	less than
≥ -	greater than or equal to
≤ -	less than or equal to
Δ -	delta (change in)