CYGNA ENERGY SERVICES
A Division of General Physics Corporation

SERVICE WATER SYSTEM OPERATIONAL PERFORMANCE INSPECTION (SWSOPI)

FOR

GRAND GULF NUCLEAR STATION

REPORT NO. EOI-471

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ATTACHMENTS

EXECUTIVE SUMMARY

General Physics Corporation, through its Cygna Energy Services Engineering Division, conducted a Service Water System Operational Performance Inspection (SWSOPI) at the Grand Gulf Nuclear Station, from October 24, 1994 to November 18, 1994. The Safety Grade Service Water System at Grand Gulf (a BWR 6) is the Standby Service Water System (SSW). This system is supported by the Plant Service Water (PSW) System, which is used during normal plant operation. The SSW System operates during normal plant cooldowns and upon receipt of a loss of power, Loss of Coolant Accident (LOCA), or other safeguards signals.

The inspection was conducted by a six member inspection team comprised of five reviewers from General Physics and one from Cleveland Electric Illuminating Company, which is a member of the BWR 6 Owner's Group.

The inspection methodology utilized for this effort was a full scale SWSOPI using NRC Temporary Instruction TI 2515/118 titled, "Service Water System Operational Performance Inspection (SWSOPI)" and USNRC Inspection Procedure 93801, "Safety System Functional Inspection (SSFI)," as a guideline. The inspection requirements and objectives were incorporated into Cygna's SWSOPI Technical Review Plan (TRP). The inspection was then conducted in accordance with the TRP.

The objective of the SWSOPI was to assess the operational readiness of the SSW System, with emphasis on Grand Gulf's actions in response to Generic Letter 89-13 "Service Water System Problems Affecting Safety-Related Equipment."

Grand Gulf was found to have implemented the 5 Actions of Generic Letter 89-13. However, there was one exception. This was the need to periodically reassess the large bore SSW System piping, specifically at the large bore backing ring butt weld joints, to determine the condition of the weld joints. A major chemical cleaning of the system was conducted over 5 years ago to address the affects of Microbiological Induced Corrosion (MIC) in the system. Subsequent to the chemical cleaning, the system was treated with biocides and sodium hypochlorite on a weekly basis. While a good program is in place to assess small bore piping and a sidestream test loop with sample coupons is in place to assess for effects of the chemical treatment, there was no program in place to assess the large bore piping and associated weld joints. Generic Letter 89-13 action item I requires an inspection program be in place to assess the effects of MIC on the system.

Other observations identified during the SWSOPI were associated with instrumentation and calibrations, calculations, maintenance and operations. These observations are discussed in detail in the body of the report.

Several programmatic strengths were found to exist at Grand Gulf. These consisted of the Chemical Treatment Program, the Heat Exchanger Heat Transfer Testing Program, Maintenance Programs, and the Small Bore Pipe Examination and Replacement program.

1.0 INTRODUCTION

A SWSOPI was conducted at the Grand Gulf Nuclear Station (GGNS) by General Physics Corporation through its Cygna Energy Services Engineering Division. The inspection was conducted between October 24, 1994 and November 18, 1994.

The inspection methodology utilized for this effort was a full scale SWSOPI using NRC Temporary Instruction TI 2515/118 titled, "Service Water System Operational Performance Inspection (SWSOPI)" and USNRC Inspection Procedure 93801, "Safety System Functional Inspection (SSFI)", as a guideline. The inspection requirements and objectives have been incorporated into Cygna's SWSOPI TRP. The inspection was then conducted in accordance with the TRP.

Assessment Objectives

The objectives of the USNRC SWSOPI Procedure are to:

1. Assess the licensee's planned or completed actions in response to Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment".

2. Verify the Service Water System is capable of fulfilling its thermal and hydraulic performance requirements and is operated consistent with its design basis.

3. Assess the operational controls, maintenance, surveillance, and other testing and personnel training to ensure the Service Water System is operated and maintained so as to perform its safety related functions.

The scope of Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment", requires the licensees to perform the following tasks:

1. Implement and maintain an ongoing program of surveillance and control techniques to significantly reduce the incidence of flow blockage problems as a result of biofouling in open-cycle service water systems.

2. Conduct a test program to verify the heat exchanger capability of all safety-related heat exchangers cooled by service water. The total test program should consist of an initial test program and a periodic test program. Both the initial test program and the

periodic retest program should include heat exchangers connected to or cooled by one or more open-cycle systems.

3. Ensure, by establishing a routine inspection and maintenance program for open-cycle service water system piping and components, that corrosion, erosion, protective coating failure, silting, and biofouling cannot degrade the performance of the safety-related systems supplied by service water.

4. Confirm that the service water system will perform its intended function in accordance with the licensing basis for the plant.

5. Confirm that maintenance practices, normal and emergency operating procedures, and training that involve the service water system are adequate to ensure that safety-related equipment cooled by the service water system will function as intended and that operators of this equipment will perform effectively. This confirmation should include reviews of practices, procedures, and training modules.

The objective of an SSFI is to assess the operational readiness of a system by determining whether:

1. The system is capable of performing the safety functions required by the design basis.

2. Testing is adequate to demonstrate that the system would perform all of the safety functions required.

3. System maintenance (with emphasis on pumps and valves) is adequate to ensure system operability under postulated accident conditions.

4. Operator and maintenance technician training is adequate to ensure proper operation and maintenance of the system.

5. Human factors considerations relating to the selected system (e.g., accessibility and labeling of valves) and the supporting systems for those systems are adequate to ensure proper system operation under normal and accident conditions.

2.0 GENERAL SYSTEM DESCRIPTION

The SSW System consists of two independent trains, each comprised of a basin and associated mechanical draft cooling tower, with SSW System pumps and piping delivering water to the RHR Heat Exchanger, RHR Pump Seal Cooler, RHR Pump Room Cooler, Diesel Generator, ESF Switchgear Coolers, Control Room A/C, RCIC Room Cooler, LPCS Room Cooler, the Drywell Purge Compressor Coolers, Instrument Air Compressors, Fuel Pool Cooling and Cleanup Pump Room Cooler, and the Fuel Pool Heat Exchanger. The SSW System is the ultimate heat sink for removal of reactor decay heat.

A third SSW train is provided, consisting of the HPCS Service Water Pump and associated piping delivering water to the HPCS diesel generator, and the HPCS Pump Room Cooler. The third train's pump is considered to be Division 3 and is located in the same pumphouse/basin as the Division 1 SSW Pump.

Each Cooling Tower Basin has four cooling tower sections. Two sections are for the Unit 1 cooling tower fans and two sections were for the Unit 2 cooling tower fans. The fans for the Unit 2 sections have not been installed. The HPCS Service Water System Division 3 return water is routed to the Unit 2 side in Basin A, which is now a natural draft cooling tower.

The two SSW trains are divided into 2 Divisions (Division 1 and 2). The heated water returning from the various plant components is routed to each train's mechanical draft cooling tower.

There are approximately 6,630,000 gallons of usable water in each basin. Makeup water to the basins is provided by the PSW System. The two basins are interconnected by a siphon pipeline, which will enable transfer of approximately 3,000,000 gallons of water to the other basin in the event of an accident with loss of offsite power and failure of a diesel or SSW pump. This combined capacity provides sufficient water to support LOCA requirements for a 30 day period without the need for make-up water.

The SSW system is used for normal cooldowns following shutdown and is automatically actuated on a safeguards signal, loss of power, or RCIC start. The PSW system is normally operated to provide equipment cooling. The PSW system serves several components also served by the SSW system (ESF Room Coolers, Control Room A/C) and other components capable of being supplied by SSW (Drywell Chiller Condensers, CCW Heat Exchanger). The TBCW system normally serves the Service Air and Instrument Air Compressor Coolers. When an accident signal is received, the ESF Room

Coolers and Control Room A/C are automatically transferred to the SSW system. The Service Air and Instrument Air Compressors, Drywell Chillers and CCW Heat Exchanger are also automatically transferred from their normal cooling water supplies to SSW on loss of power provided no LOCA signal exists.

The system piping is designed in accordance with the ASME Boiler and Pressure Vessel Code Section III Class ND. The piping material is carbon steel. The system is treated with chemicals to minimize the effects of MIC.

The SSW and HPCS SW Pumps take suction from their associated basin. A screen is provided in the basin to prevent debris from reaching the pump suction area. The make-up water to the basins from the PSW System comes from radial wells located adjacent to the Mississippi River. The system is provided with a blowdown capability to discharge water to the discharge canal.

Control valves at the pump discharge and in the return line are closed when the system is shut down. The valves open when the pumps receive a start signal. The return lines to the spray headers, located in the cooling towers, contain drain holes to drain the spray headers to provide freeze protection for the piping.

A fill tank is provided to keep the system full of water to minimize water hammer effects. The fill tank receives make-up water from the PSW system.

3.0 STANDBY SERVICE WATER SYSTEM REVIEW

3.1 Overall SSW System Corrosion

The SSW system at GGNS has experienced significant corrosion and MIC. The corrosion has affected the cooling tower basins, cooling tower return header piping, large and small bore piping to the various system components, and the components themselves. Programs have been implemented to address the various aspects and determine the locations of corrosion and fouling. The corrosion problems and the programs to resolve the problems are addressed in other sections of this report.

3.2 SSW Heat Removal Capacity

The Grand Gulf SSW System is defined as an open loop system by Generic Letter 89-13, however, it closely approximates the design of a closed loop system. Service Water is circulated from the SSW Basins to the components, and then returned to the basin via the Cooling Towers. However, some of the water leaves the system in the cooling tower via

evaporation mechanisms and through tower drift. There are approximately 6,630,000 gallons of usable water in each basin. The basins are sized to provide sufficient cooling without additional makeup for at least 30 days of operation following an accident. The design of the basin capacity is based on the worst combination of weather conditions such as dew point, dry bulb temperatures, wet bulb temperatures, and basin water temperature.

NPE Calculation MC-Q1P41-86034, Rev. 0, dated 5/5/86, was reviewed. The calculation determined the Ultimate Heat Sink performance requirements during the first refueling outage (RF01) postulating a LOCA in Unit 1, with no fuel in the storage pool due to operation during the first fuel cycle, and Unit 2 not in operation. The calculation determined the water losses due to evaporation and tower drift, and calculated whether sufficient water was available in the basin for the 30 day period following a hypothetical LOCA in Mode 5. The calculation concluded that sufficient water was available in the basin for the 30 day post LOCA period.

Calculation MC-Q1P41-86102, Rev. 0, dated 10/9/86, was reviewed. The calculation determined the Ultimate Heat Sink performance requirements for a 30 day period postulating a LOCA in Unit 1 30 days after shutdown from the start of RF01, no fuel in the storage pool due to operation during the first fuel cycle, and Unit 2 not in operation. The calculation calculated the water losses due to evaporation and tower drift and determined whether sufficient water was available in the basin for the 30 day period following a LOCA. The calculation used the same methodology as calculation MC-Q1P41-86034, Rev. 0. The calculation determined that sufficient water was available during the postulated accident to meet the requirements.

Per UFSAR Section 9.2, the available water volume between two basins for a single active failure is 10.59×10^6 gallons. This provides a margin of 2.804×10^6 gallons of water.

Calculation MC-Q1P41-86007, Rev. 0, dated 4/30/86 was reviewed. The design basis calculation determined the Ultimate Heat Sink performance requirements postulating a LOCA in Unit 1, and Unit 2 not in operation. The calculation determined the water losses due to evaporation and tower drift, and determined whether sufficient water was available in the basin for the 30 day period following a LOCA. The calculation concluded that sufficient water was available in the basin for the 30 day post LOCA period. The calculation used the same methodology as calculations MC-Q1P41-86034 and MC-Q1P41-86102 and included the additional heat loads from HPCS operation to bound the maximum heat load combinations.

All three calculations appear to use a conservative approach to determine the water losses. Calculation MC-Q1P41-86007 identifies a water loss of 7,784,971 gallons. With the water from the other basin available, a margin of 2,503,044 gallons is identified. A very significant margin exists. The general methodology, approach, and results of the calculations were found to be acceptable.

3.3 HPCS SSW Flow Analysis

Calculation MC-Q1P41-90138, Rev. 0, was a computer calculation of the HPCS SSW loop pressure drop. It was used to determine the effects of new orifice plates in the lines to obtain proper flows to the HPCS Room Cooler and to the Diesel Generator Jacket Water Coolers. The calculation was a sub calculation for the system. A base calculation, MC-Q1P41-90119, Rev. 0, was previously done for the loop. Both calculations were reviewed. The methodologies and results were found to be acceptable.

The computer analysis also verified the installation of flow orifices to obtain proper flow balancing between the HPCS Diesel Generators and the HPCS room cooler. The flow orifice installation corrected a flow balancing deficiency which was not identified in the original startup testing.

3.4 Instrumentation/Electrical

The SSW System instrumentation/electrical design attributes were reviewed, along with the associated programmatic aspects relating to these disciplines. Specific areas of inspection were directed towards determining the system's design basis from the documents available, reviewing the design process for the SSW System, and assessing the operational readiness of the system to perform its safety related functions. The results of this review are as follows:

3.4.1 System Design Basis

SSW basin level is a Technical Specification related parameter, since it represents the fluid capacity of the ultimate heat sink at GGNS. Technical Specifications Section 3.7.1.3 lists the basin level as ≥87" or greater than elevation 130'-3". SSW basin level indication is provided on a recorder in the Control Room. Additionally, a low SSW basin level alarm is provided. The design basis for the Technical Specification surveillance procedure (06-OP-1000-D-0001) action setpoint and alarm setpoint was requested to determine whether there was sufficient margin between the Technical Specification value and the setpoints.

In response to this request, GGNS responded that there were no specific uncertainty calculations done to support either the instrumentation used for Technical Specification surveillance procedure (06-OP-1000-D-0001) action setpoint or the alarm setpoint. GGNS responded that calculations for setpoints are performed only for safety-related instrument loops with active safety functions and for Regulatory Guide 1.97, Category 1 & 2 loops.

For setpoints without active safety functions, such as the SSW basin level, GGNS relies on conservatively derived operating procedures to assure that Technical Specifications Limits are not reached. In the case of the SSW Basin Level, Alarm Response Instruction 04-1-02-1H13-P870, Panel No: 1H13-P870 requires:

1. Checking the indicator in the control room for the water level.
2. Checking the water level at the basin.
3. Restoration of the water level if the alarm condition exists.

The alarm occurs at 93" requiring explicit operator action 6 inches above the Technical Specification Limit. The normal operating level in the basin is 101". GGNS stated that there was no credible path to fail to generate an LCO with basin level below 87". GGNS's position is that sufficient margin and conservatism exists, concerning setpoint uncertainties, in the system design such that margin can be demonstrated.

3.4.2 Calibration

The calibration procedures were reviewed to ensure head corrections were accounted for in calibration data, "as-left" and "as-found" tolerances were stated and what the basis was for their determination, and whether calibration frequencies were adequate and consistent with the drift term used in the setpoint uncertainty calculations.

No current, official, documented design basis could be located for calibration tolerances. It appears the tolerances were developed by the A/E using algebraic techniques and very conservative drift terms.

For the as-left tolerance, the design basis appears to be derived from the manufacturer's specified reference accuracy, which is consistent with other plants.

Some calibration frequencies had been exceeded for safety-related transmitters which were required to be calibrated every 18 months ±25%. QDR 93-0043 was previously generated by GGNS in 1993 to address this concern.

In regards to calibration of instruments for ASME Section XI testing, two observations were made regarding Article IWP, "Methods of Measurement". The first was with the Code requirement of paragraph IWP-4110, "Quality", which requires instruments used during in-service testing measure flowrate to ±2% of full scale. An observation was issued requesting the uncertainty calculation for FI-R009. The response stated that there was no calculation. A response to an Engineering Assistance Request stated that M&TE should be used where the installed instrumentation did not meet the ASME 2% requirement. GGNS stated that per the 1980 Code, these calculations are not required and only the instrument accuracy is of concern and not total loop accuracy; hence, no calculation is required. The GGNS position is that all instrumentation used for ASME Section XI testing, fully meets the 2% requirement.

The second observation concerning the ASME XI program, "Methods of Measurement", involves paragraph IWP-4140 which requires instruments used for IST to "be calibrated either prior to..... or on a regular basis, as established by the owner". Presently, some of these instruments are calibrated on a five year calibration frequency. GGNS personnel provided plant data which supported the five year calibration frequency used.

3.4.3 Instrument Installation

Many of the sensing line tubing slopes for instruments in the SSW System are negative, which creates a potential for air entrapment. The GGNS position was that air in the sensing lines has been a problem and that instructions for venting high point vents are contained in established procedures. The instrument sensing lines are vented on an as needed basis, whenever erratic instrument response is observed or when nuisance alarms are received in the control room. These instruments do not perform any safety-related control functions, have vents which are readily accessible, and are not located in a harsh environment.

3.4.4 Electrical Maintenance

During a system walkdown, it was observed that equipment grounding lugs for various pieces of equipment were painted. This gives rise to the possibility that paint seeps behind the lug and acts to insulate the lug from the equipment. GGNS responded that the painting of grounding lugs was not their policy, and that the painting coordinator would be notified so that a recurrence of this practice would be prevented. GGNS was actually more pro-active to the issue by cleaning behind the lugs and removing the paint on the lugs leaving a bright metal finish, resulting in a good metal to metal connection.

3.4.5 Separation

Per the UFSAR, black cables and yellow cables cannot be run in the same raceway. Per a system walkdown, 3 black cables were routed out of MCC15B51 through Division 1 raceway 1MATNX05. The cables in question were walked down by NPE and Maintenance personnel. The walkdown determined that the cables were Unit 2 temporary power feeds, which have been disconnected and abandoned in place. No design records could be located for these cables. Since the cables are no longer functional, no separation issue presently exists.

3.5 Single Failure Review

A design review was previously conducted by Duke Engineering Services (DES). The Duke report was reviewed to ensure the follow up actions for the items identified in the DES report were completed. The significant items in the report relative to single failure were satisfactorily completed as follows:

1. LER 86-29 Revision 10 Section G.3 states, in part, "Per FSAR 9.2.1.2, redundant automatic isolation valves are provided to separate all nonessential cooling water systems from the SSW system. However, the design review revealed a failure to provide suitable redundancy such that failure of an MCC (rather than complete failure of a division of ESF power) could create a path for diversion of SSW flow such that a gradual reduction in the 30-day UHS inventory could occur." Section 'a' then discussed the PSW/SSW interface for the Control Room air conditioning system, where there is a problem with both divisions. Division 1 valves cited were P41-F125, F066A and F064A powered from MCC 15B61. Division 2 valves were F074B and F189 powered from MCC 16B61.

Resolution: Design modification 87/4017 was implemented, and present MCC power feeds are as follows,

F125	15B11-C2	F074B	16B61-B2
F066A	15B61-B3	F189	16B11-D2
F064A	15B21-G4		

2. Appendix A to the 4/24/87 DES report included the following observation: "LOCA during basin blowdown operation: The two basin blowdown valves for each loop are powered from the same MCC. Thus, if a LOCA were to occur during the time that the SSW is operating in a blowdown mode and the common MCC is lost due to a single failure, there would be some loss of UHS inventory until the pumps were tripped or the valves were manually closed. Blowdown flow is limited by restricting orifices which would provide time for operator action before the 30 day UHS inventory would be affected."

Resolution: LER 86-29 Rev. 10 Section G.3.b states that an operator will be stationed at the valves whenever a blowdown is in progress (Implemented in procedure 04-1-01-P41-1).

3. Appendix A to the 4/24/87 DES report included the observation: "LOCA while instrument air compressors are supplied cooling from SSW: This is not an expected system alignment during normal power operation; however, if normal cooling were lost, consideration may be given to aligning SSW for replacement cooling. This would be a problem since safety/non-safety piping isolation provisions are not single mode failure proof (i.e., valves F155B-B and F155A-B share a relay in their automatic closure circuit and power to the valves is supplied from the same MCC).

Resolution: LER 86-29 Revision 10 Section G.3.c discussed the supply to the 'B' instrument air compressors, concluding that this scenario was outside the design basis.

4. There are different rationales used for the LOCA scenario described in item 1 compared to the Fire Protection Analysis. FPP-1, Appendix A states, in part, "Valves P41F064A, F066A&B, F066A&B, F074A&B, F081A, F125, F155B, F189 and F121A&B are not included on the "Safe Shutdown Equipment List" (FPP-1, Appendix A-Data 1 & 2). Fire scenarios can be postulated in which failure of these valves due to fire can breach the SSW System pressure boundary resulting in a gradual loss of SSW basin inventory, thereby affecting the ultimate heat sink inventory requirements delineated in NRC Regulatory Guide 1.27. The relevant consideration is that cold shutdown can be achieved within 72 hours, and maintained thereafter. Under the conditions postulated for fire scenarios (i.e., no LOCA or seismic event), and conservatively assuming that no action is taken to terminate the leakage interface, replenishment capability for the SSW basin would still be available. System flow rates are not substantially affected by the gradual loss of SSW basin inventory, and are sufficient to accommodate required safe shutdown loads. Therefore, safe shutdown capability would not be compromised, and no further fire protection measures are required."

In reviewing the power supplies for these valves, however, it was noted that P41F121A&B (RHR HX SSW Inboard Vent Valves) could affect the plant in a LOCA scenario similar to item 1. All valves on the list except these two valves have isolation relays that protect the H22 circuitry in the event of a Control Room fire. F121A&B do not, nor do they have a small fuse in the Control Room indication circuit that would prevent the main control circuit fuse from blowing from a short. After further review, it was determined this circuit never entered the control room three hour fire barrier and was no longer an issue.

3.6 Freeze Protection

Procedure 04-1-03-A30-1, Rev. 6, "Cold Weather Protection" specifies actions to ensure that the space heaters are energized for the cooling tower fan motors, as cold weather approaches.

Procedure 04-1-01-P41-1, Rev. 42, "SSW System" does not specify any precautions for operation of the cooling tower fans at/or below freezing temperatures. Procedure Attachment IIIA includes a breaker alignment for the space heaters for each of the fan motors. Included in this table are tower fan space heaters which are actually the tower fan motor (C003A) space heaters.

The configuration of the SSW cooling tower fans and blades leaves them exposed to the elements. No information could be found in the vendor manual which addressed the ability of the fans to remain in balance during icing conditions.

The heavy duty grating above the fans has a minimum dimension of 1" between the bearing bars. This configuration is also susceptible to ice build-up under adverse weather conditions.

4.0 MECHANICAL COMPONENTS REVIEW

4.1 HPCS SSW and SSW Pumps

The SSW and HPCS SSW pumps are located in the Basin Pumphouses. They are approximately 50 foot long vertical pumps. The pumps are rated at 12,000 gpm at 270 ft. for the SSW pumps and 1,300 gpm at 173 ft. for the HPCS SSW pump. The pumps were evaluated for submergence, NPSH, and runout protection. The Gould pump curve in Bechtel Calculation 2.2.65-Q was reviewed, and the NPSH and submergence aspects of the design were found to be acceptable.

4.2 SSW Piping

The piping used in the SSW system is unlined carbon steel pipe. The system is fabricated using socket weld joints for small bore piping and backing ring butt weld joints for large bore piping. The water in the SSW system is aggressive with regards to corrosion. The water in the system is from radial wells located adjacent to the Mississippi River. This water is high in iron, manganese, phosphate, organic carbons, etc. The water is not demineralized and was not treated with sodium hypochlorite during the initial operating period.

MIC has been found in the SSW piping at GGNS. When MIC was found, assessments were made and plans were developed to

remove the MIC. The A Train piping was chemically cleaned in RF02. The B Train piping was chemically cleaned in RF03.

Leaks developed in the piping as a result of MIC. Initially, the leaks occurred at small bore connections and the leaks were repaired. Engineering developed a program, GGNS MS-46 "Standard for Monitoring Internal Erosion/Corrosion in Moderate Energy Piping Systems" dated 4/24/94 Rev. 1, for inspection of unique locations in SSW for wall thinning. Criteria were provided so that piping was replaced when wall thickness was found to be below that specified in MS-46. MS-46 requires inspection for piping 4 inch in diameter and smaller. Additionally, MS-46 includes other inspection requirements. These are associated with the E/C program and with operations sensitive non-safety related piping.

The small bore lines have been inspected in accordance with QAI 9.29, "Radiographic Examination for Microbiological Induced Corrosion". The inspection of small bore piping is administratively controlled by QAP 9.90, "Administration of Microbiological Induced Corrosion (MIC) Tracking in Standby Service Water Systems". MNCRs are generated when piping is found to be unacceptable. The overall program for pipe wall thinning per MS-46, QAP 9.90, and QAI 9.29 was found to be acceptable and is considered to be a strength at the GGNS.

A similar program for inspection of the large bore piping greater than 4" in diameter was not found during the inspection. In the response (AECM-90/0007) to the NRC Generic Letter 89-13, SERI stated in the attachment, for Action III item 7, that for Erosion Monitoring and Control, the SSW system was reviewed for possible inclusion in the erosion/corrosion monitoring program which was established for NRC Bulletin 87-01, "Thinning of Pipe Walls in Nuclear Power Plants". The GL 89-13 response indicated that the SSW system did not meet the criteria of the E/C program. As such, large bore piping greater than 4" diameter has not been re-inspected/re-evaluated since the chemical cleaning. Since these large bore lines were fabricated with backing rings, the weld joint created crevices which typically support MIC growth.

At this time, there have been no through wall leaks at the large bore welds. Since a chemical treatment program is in effect, some of the MIC activity has been mitigated. However, it is not known whether the MIC activity has been mitigated within the large bore weld joint crevices. Corrosion within SSW pipelines has been a significant problem at most nuclear plants. Considerable funds have been required at many plants to correct the piping corrosion problems. Generic Letter 89-13, Action Item III, requests licensees to establish a routine inspection and maintenance

program for open-cycle service water system piping and components that corrosion, erosion, protective coating failure, silting, and biofouling cannot degrade the performance of the safety-related systems supplied by service water.

Additionally, if there is MIC activity below the backing rings, then either additional or different chemical treatment may be required to mitigate the MIC effects.

As a result of the above, the condition of the large bore piping lines could not be evaluated to Generic Letter 89-13 requirements. There is no visual or volumetric inspection program in place for the large bore piping similar to that for the small bore piping.

One of the results of the MIC pipe inspection program was that locations 101 and 102 were found to be experiencing erosion. EER 88/6029 was issued to determine which tracking program should be used to track the condition. NPE reviewed the EER and concluded that these piping locations should be in the E/C program. This type of communication is judged to be a good example of the awareness of the problems in the system and good awareness of the programs in place to address the varying problems.

The Cooling Tower return header piping also has experienced corrosion. This piping is subject to constant wetting and drying. The original external coating has worn away, and as a result, both the piping OD and associated pipe supports experienced significant corrosion. Design Change Packages were developed to replace the pipe supports and the cooling tower piping. Piping fabrication is currently in process for a SSW basin. The replacement piping will be carbon steel, and will be hot dip galvanized for corrosion protection. Modification 94/004 is in process for this work.

Engineering Report GGNS-94-0026 was developed to assess the corrosion experienced in the return headers. It identified the corrosion mechanisms, and contained several alternative recommendations for resolving the problems.

Attachment 1 includes a history of the SSW piping Corrosion Problems at GGNS. This listing is not a complete listing of documents, but is a listing of the documents reviewed during the inspection.

The SSW piping was designed, fabricated, and installed in accordance with the ASME Section III Boiler and Pressure Vessel Code, Class ND. A keep fill system is provided to keep the pipe lines full of water to minimize water hammer conditions during pump starts. The return line to the

cooling tower has a valve which is closed when the system is shutdown. Another valve at the pump discharge is also closed when the system is shutdown. The piping downstream of the return line control valve has drain holes which enable the cooling tower spray headers to drain which prevents freezing of the water in the exposed lines. The piping design, water hammer mitigation design, and the keep fill system were found to be acceptable.

Since the pump discharge valve is closed when the system shuts down, it must open when the pump is started. With the closed discharge valve, the pump discharge piping is subject to pump shutoff pressures. The SSW pumps were modified to increase the Total Developed Head of the pump. When the higher head pumps were installed, a pressure relief valve was provided upstream of the recirculation line control valve to provide overpressure protection. The relief valve typically opens on a pump start. When sufficient flow is developed, the pump developed head is reduced below the relief valve setpoint and the relief valve closes.

As noted in Section 6.3 below, the relief valve was found to open at a pressure less than the desired setpoint. This occurred on several occasions. Problems associated with valve assembly were found and corrected. The actuation of the relief valve during each pump start is a challenge to the system. Significant energy is dissipated during the relief valve actuation. The pressure drop across the relief valve is considerable during the pump starts (shutoff pressures - 400 ft). Cavitation and flashing are probably occurring within the piping downstream of the valve due to the high pressure drop, and operation is very noisy. As the system MOVs open and system design flows are finally reached, the system pressures reduce and the valve closes. The relief valves have operated satisfactorily since corrections to the assembly were made.

The SSW piping was reviewed to determine if water hammer was an issue. It was determined under certain operating conditions, such as with the SSW System aligned to the fuel pool heat exchanger and the SSW pump subsequently experienced a trip on a diesel generator load shed signal, the piping servicing the heat exchanger could drain. Should the SSW pump restart automatically on a diesel generator load sequence signal, vapor cavity collapse with attendant pressure surges may result and could potentially damage the system piping and components. GGNS had previously performed a PRA in engineering report GGNS-93-0005, Rev. 0, on this scenario, which concluded the core damage frequency for GGNS SSW water hammer is considered a potential to be approximately 60% higher than the GGNS IPE estimate of 1.72 x 10^{-6}/reactor year. GGNS states that if the report postulated more reasonable assumptions, the core damage

frequency percentage would be approximately 19% higher than the GGNS IPE total, which falls within acceptable guidelines of NUMARC/NEI 91-04, Table 7-4.

4.3 Heat Exchanger Evaluations

The RHR Heat Exchangers, Diesel Heat Exchangers, and Room Coolers are performance tested. Calculation MC-Q1P41-90186 "Determination of the Thermal Performance of Standby Service Water System Heat Exchangers (Loops A & C)", Rev. 0 assessed the condition of the heat exchangers.

A computer program developed by Holtec was used for evaluation of the heat exchanger performance. A separate report dated 11/16/94 for development of the computer software "STER Shell and Tube Heat Exchanger Rating Program - RHR 11/16/94" was reviewed. The program was found to be acceptable.

Thermal Performance Test Results in WO 119246 dated 4/26/94 were reviewed and found acceptable.

The computer codes used determine the actual fouling factors in the heat exchangers. The as-found values are then used to predict performance at postulated design flows and temperatures. The initial testing and evaluations utilized temperature values which were not as accurate as required for a thermal performance calculation, due to the thermometers initially installed not having the required accuracy. Even so, since the fouling factors are so large for the water/water heat exchangers, the calculation results showed that the heat exchangers met design conditions.

Subsequent testing was then conducted with M&TE equipment and the data obtained were significantly improved. To assess the computer code accuracy, a sample case was run on the computer to try to match the vendor's heat exchanger data sheets. Both the HPCS diesel and RHR Heat Exchanger data sheets matched the computer runs.

The testing performed on the room coolers was found not to be as accurate as the water/water heat exchangers. Holtec's AIRCOOL program is utilized for air/water heat exchangers. It is difficult to obtain accurate measurements for air flow rates, wet bulb and dry bulb temperatures in the air stream. Efforts have been made to improve the test measurements for these components. M&TE equipment has been used for the temperature measurements. One factor which favors GGNS regarding room cooler performance, is the fact that the room coolers are oversized, and this has been beneficial when taking into account the instrument errors that exist during the testing for thermal performance.

The performance testing and evaluation program at GGNS were judged to be acceptable and a strength in the overall GL 89-13 program.

4.4 Cooling Tower

Generic Letter 89-13 requires testing and inspection of heat exchangers. One additional action that could be performed to satisfy the intent of Generic Letter 89-13, although not explicitly required by 89-13, is a thorough inspection of the cooling towers. The cooling tower is a "heat exchanger". Currently, maintenance procedure 07-S-14-56, "Western Gear Speed Reducer", Rev. 11, is used for inspection of the cooling tower. This procedure does not sufficiently address requirements for a cooling tower inspection. GGNS stated that Chapter 13 of the Cooling Tower Manual, "Inspection of Cooling Towers" from the Cooling Tower Institute (CTI) has an inspection procedure, which provides thorough criteria for cooling tower inspections. This is especially true of the fill inspections. The performance of the cooling tower is significantly affected by the condition of the fill. An inspection of the cooling tower to the CTI procedure would meet the intent of GL 89-13 for inspections of heat exchangers

4.5 HPCS Motor Failure Review

A review of the HPCS SSW pump motor failure was performed utilizing the associated documentation. The documentation reviewed, LER 93-03, IR 93-03-09, MNCR 0046-93, QDR 0067-93, and QDR 0095-93, showed that the failure was due to shorted motor windings. It was also noted that MNCR-0046-93 will remain open until the root cause determination associated with the motor failure has been completed. Additionally, it was noted that LER 93-03, Rev. 1, incorporated the results of GE's failure analysis, even though GE had not formally issued their report. Also, the GE Motor Rework Report, dated 9/27/93, was not precise as to the actual root cause, which could be either a manufacturing defect (inadequate insulation) or a design deficiency which allowed the windings to move too freely.

After completing a review of all applicable documentation and the response to MNCR 0046-93, the following was noted. No steps are identified to prevent recurrence of this condition. The MNCR disposition uses general motor failure data to justify "no action" on a premature failure, which as stated earlier, could be due to a design deficiency or a particular type motor. Further the redisposition states that GGNS does not perform vendor recommended motor inspections, except for those required for Equipment Qualification, and that the inspections would be too

expensive and would have to be performed off-site. Also, the statements that weekly starts have no effect on the situation may be contradictory of the GE failure report.

GGNS responded to the above as follows:

In regards to motor failure being attributed to a design deficiency, an NPRDS search was performed to determine if motors of the same model and manufacturer (GE) had seen the same type of failure throughout the industry, but the search yielded no findings. A search was then performed to look for failures of General Electric motors present in Service Water Systems. The search identified 73 records and revealed that the most common mode of failure for motors in the size range of the HPCS SSW motor was bearing degradation. Failures relating to shorted windings and degraded insulation appeared to be due to age of motor and its operating environment. Based on the operational history of motor at GGNS, and the results of the NPRDS search, it appears that the design of the HPCS SSW motor is sufficient to provide dependable operation.

GGNS has preventive maintenance tasks in place to perform all of the GE recommended maintenance activities on the HPCS SSW motor except for the following: "visual inspection of stator windings for cleanliness, varnish degradation, and coil movement" and "cleaning and varnish treatment of stator windings, if required". It was stated that this is because the "clean" environment that the motor operates in prevents the dirt accumulation and winding degradation that would be seen on motors that operate in "harsh" environments. Additionally, GGNS only performs these type of tasks on the 5 ECCS motors and Radial Well pump motors as required (due to their "harsh" operating environment). However, visual inspections of the HPCS SSW motor stator windings will be performed when bearing replacement is required. At this time, if varnish degradation or excessive coil movement is discovered, appropriate corrective actions will be taken to correct the problem.

The weekly starts of the HPCS SSW motor are required to perform chemical treatment of the SSW C piping and to prevent the onset of Microbiological Induced Corrosion (MIC). Therefore, this practice will be continued. However, the maintenance activities and inspections currently in place are sufficient to provide effective preventive maintenance on the HPCS SSW motor and to ensure its dependable operation.

5.0 SERVICE WATER SYSTEM MODIFICATION REVIEW

5.1 Separation of the HPCS Service Water Loop from the Division 1 return line

Modification Package 90/0551 was reviewed. This modification separated the return line from the HPCS diesel from the main SSW return line from the RHR heat exchanger. The separation was to achieve better heat rejection in the cooling tower, if the main SSW pump was not available. The total flow from both the SSW pump and the HPCS SSW pump was greater than 13,000 gpm. If the SSW pump were not available, the approximate 800 gpm flow from the HPCS diesel would be insufficient to develop a spray over the tower fill. Therefore, the separated line would have its own spray nozzles sized for the desired flow, and discharge in the former Unit 2 side of the cooling tower basin.

The modification also installed new restricting orifices to correct flow imbalances between the HPCS Diesel and the HPCS Room Cooler.

As identified in Section 3.3, the computer flow analysis used to support this modification was acceptable.

After the modifications were made to the header piping in the cooling tower, a test was conducted to determine whether the modification improved performance. Engineering Report GGNS-90-0200 assesses the performance of the SSW Cooling Tower with natural draft circulation. The test was run in accordance with the Cooling Tower Institute (CTI) Acceptance Test Code for Water-Cooling Towers. The report and supporting data were also reviewed.

A constant heat load was assumed for the test. A review of the test data showed the temperature differentials of the water to and from the diesel, actually varied by about 5% during the test period, which is significant since this represents the majority of the flow.

The performance test showed the tower removed the heat from the diesel and room cooler. Since a performance test was not originally performed on the main tower, this test provides a basis that the modeling is correct for the cooling tower.

5.2 Installation of Instrumentation for Heat Exchanger Performance Testing

Modification package for DCP 90/0109 was reviewed. The DCP was reviewed by tracking Annubar flow element 1P41-FE-N126C through the modification process. Per the DCP Rev. 0, this flow element did not have a seismic configuration for all

operating design conditions. Therefore, prior to placing this system into operation, the seismic operability issue would have to be addressed. A Change Notice to the package later revised the seismic configuration for all operating desigr conditions.

5.3 Future Changes

Since erosion and corrosion significantly impact the SSW System, Administrative Procedure No. 903, "Review of Design Documents Which Potentially Impact Piping Integrity Programs", was developed. The procedure requires a review of design documents to ensure adequate consideration is given to mitigate pipe wall loss due to Erosion/Corrosion (E/C) and MIC, during the performance of design changes. This is judged to be a positive action to minimize corrosion problems when future modifications are made.

6.0 SERVICE WATER SYSTEM SURVEILLANCE AND TESTING

A review of Surveillance, Calibration, and Performance and System Engineering procedures associated with the SSW System was performed. This portion of the review was performed to ensure the SSW System surveillance procedures and associated test results satisfy Technical Specifications requirements. This review was coordinated with the review of both the mechanical systems and I&C design reviewers, to ensure design assumptions on system performance were satisfactorily demonstrated by the test methodologies. The SSW System design and licensing basis were also reviewed to verify that test acceptance criteria were consistent with the design basis to ensure the SSW System testing adequately demonstrated that the SSW System will operate as designed. Selected plant modifications were reviewed to ensure that surveillance and testing had been properly performed after the implementation of the modification. A review was also performed to verify installed SSW System components are tested/calibrated to ensure the components will perform in accordance with their design bases. During the course of this review, minor discrepancies were noted in a few of the procedures, with Procedure Change Feedback forms generated and filed.

6.1 Technical Specification Surveillance Testing

The Grand Gulf Technical Specifications have several requirements for the SSW system. The following surveillance procedures were reviewed to verify Technical Specification requirements were being met:

06-OP-1P41-M-0001	"HPCS Service Water Operability Check"
06-OP-1P41-M-0004	"SSW Loop A Operability Check

06-OP-1P41-M-0005	"SSW Loop B Operability Check"
06-OP-1P75-R-0003	"Standby Diesel Generator 11: 18 Month Funct. Test"
06-OP-1C61-M-0001	"Remote Shutdown Panel And Accident Monitoring Instrumentation Surveillance Check"
06-IC-1C61-R-0004	"Standby Service Water System Flow (RSM)"
06-OP-1C61-R-0002	"Remote Shutdown Panel Control Check"
06-OP-1000-D-0001	"Daily Operating Logs"

The identified procedures were found to satisfy the Technical Specifications requirements for SSW System valve lineups and operability, and were also found to be in agreement with the plant's design and licensing basis, as identified in the UFSAR. Additionally, the Surveillance Procedures were compared to Plant Licensing Procedure 09-S-05-7, "GGNS Technical Specifications/Surveillance Program Master Cross-Index", to ensure that the identified procedures and Technical Specifications were consistent and in agreement. Past surveillance results were reviewed and no problems were observed.

The ASME Section XI/Technical Specification requirements, as identified in Section 4.0.5 of the Technical Specifications, have been reviewed in detail with the results detailed in Section 6.3 of this inspection report.

6.2 Preoperational Test Review

Preoperational test results were not reviewed due to modifications to the system since the initial preoperational testing was performed. However, a review of the existing Performance and System Engineering Procedures, Surveillance Procedures, and the associated test results, indicated the SSW System capabilities and limitations were appropriately demonstrated. It was also noted that appropriate precautions and limitations are established to avoid unacceptable system or component operating conditions.

6.3 Inservice Inspection and Testing

The GGNS, Unit 1 Pump and Valve Inservice Testing Program, Specification SERI-M-189.1, was reviewed as the baseline document to determine compliance with the ASME Section XI Code. Additionally, the Specification was reviewed using Generic Letter 89-04, "Guidance On Developing Acceptable Inservice Testing Programs." The Specification was found to provide an acceptable basis for Relief Requests and the alternate testing frequencies for P41F113, SSW Fill Tank Outlet Valve, and for check valve QSP41F174 (RR P41-1). This Specification was then compared to the following

surveillance procedures and their associated test results, to ensure all requirements are identified and components are satisfactorily tested:

06-OP-1P41-Q-0004,	"Standby Service Water Loop A Valve And Pump Operability Test"
06-OP-1P41-Q-0005,	"Standby Service Water Loop B Valve And Pump Operability Test"
06-OP-1P41-Q-0006,	"HPCS Service Water Valve And Pump Operability Test"
06-ME-1000-R-0003,	"Safety And Relief Valve Functional Test"
06-OP-1P42-C-0002,	"Component Cooling Water Valve Operability Test"

An observation was noted associated with the testing and repair of SSW C001A S/R Valve 1P41F299A. During a time frame between October and November of 1990, this valve was removed, tested, and reinstalled for required ASME XI Inservice Testing (WO#:011101). However, the valve was subsequently removed two (2) more times within the previously identified time frame due to the valve not seating properly (WO#:027866) and due to substantial seat leakage during normal system operation (WO#:028971). As a result of these Work Orders, two (2) Material Nonconformance Reports (MNCR-0235-90 and MNCR-0269-90) were issued to request an evaluation of the probable cause for the as-found condition of the relief valve and to obtain both a disposition and justification for the disposition. The valve was reworked and then modified as a result of these two (2) MNCRs. The valve has been satisfactorily tested several times since the above conditions were rectified with no problems observed.

A review of Administrative Procedures 01-S-06-44, "Operability Determination" and 01-S-06-5, "Incident Reports/Reportable Events", was performed to determine that scenarios, such as described above, are appropriately addressed and evaluated to ensure compliance with 10CFR50.72 and 10CFR50.73. There were no concerns noted with these procedures, and they were found to be in agreement with the requirements identified in both 10CFR50.72 and 10CFR50.73.

Additionally, a review of Performance and System Engineering Instructions 17-S-05-P41-H, "System Hydrostatic Test SSW System (P41)" and 17-S-05-P41, "System Pressure Test Standby Service Water System (P41)", and their associated test results, was performed to verify valve lineups, isolations, test boundaries, and agreement with the applicable P&IDs. Also, these instructions and results were reviewed to ensure that the requirements, as identified in the Technical Specifications, UFSAR, and ASME Section XI Code, have been adequately satisfied. These instructions are required to be

performed in support of the ASME Section XI Ten Year Inservice Inspection (ISI) program. There were no areas of concern observed with these procedures or test results.

Special Process Instruction 07-S-74-P41-1, "LLRT Valve Alignment For Standby Service Water Penetrations", was reviewed to ensure agreement with both the UFSAR and the P&ID. The procedure is performed utilizing Surveillance Procedure 06-ME-1M61-V-0001, "Local Leak Rate Test." The procedure and methods utilized for testing of the SSW containment isolation valves were both reviewed and found to be acceptable.

Minor Change Package MCP 92/1059, "Replacement of SMB-000-5/H2BC Actuator Assemblies on Motor Operated Valves Q1P41F001A, Q1P41F001B, Q1P41F005A, and Q1P41F005B With SMB-00-10/H3BC Actuator Assemblies", was reviewed to ensure satisfactory post modification testing was performed. The actuators and the associated valves were found to be satisfactorily tested. Also, Specification M.189.1, was reviewed and was found to have been updated to reflect the new data associated with these valves.

6.4 Heat Exchanger Performance Testing Review

Performance and System Engineering Procedures 17-S-06-22, "SSW "A" Performance" and 17-S-06-24, "SSW "C" Performance" and their associated test results were reviewed for both flow balancing and thermal performance. The procedures were compared against the SSW System Design Criteria Document to ensure the flow values identified in the procedure are consistent with those identified in the design criteria. There were minor inconsistencies observed between the documents. These inconsistencies did not have any impact on the performance test results or impact the safety function of any of the heat exchangers.

Thermal performance testing performed utilizing the previously identified procedures were found to be satisfactory. There is a trending program in place for heat exchanger performance which ensures design margins and operating limits associated with the heat exchangers are not exceeded (Refer to Section 4.3).

6.5 Instrumentation Calibration Procedure Review

The instrumentation associated with the SSW System was reviewed to ensure calibration procedures, with appropriate calibration frequencies, were in place to monitor the operability of the SSW System.

7.0 BIOFOULING CONTROL AND TESTING

The SSW system experienced MIC problems in the mid 1980s. The problems were particularly significant at small bore piping connections, especially the vent and drain connections. Several through wall leaks occurred at the socket weld locations. The problems of MIC were evaluated and a chemical cleaning program was recommended. The piping system was chemically cleaned with tannin and citric acid. After the system was cleaned, it was treated with various biocides. After several years, the use of sodium hypochlorite was initiated to further minimize the impact of MIC.

At this time, the system is treated on a weekly basis with biocides and sodium hypochlorite. The system is operated for 24 hours each week. At the end of the operating period, the sodium hypochlorite is injected, with an injection line arranged to supply the chemical near the pump suction bell. This is maintained for sufficient time to ensure the sodium hypochlorite reaches all parts of the system. The system is then shut down, and the sodium hypochlorite is "bottled up" within the piping system.

The system is examined periodically to determine the condition of the small bore pipe connections. QAP 9.90 was initiated to identify all the possible locations where MIC may be present. The locations are radiographed and a wall thickness determination is made to decide on a course of action.

Over the initial operating period, these connections failed somewhat frequently. Since the initiation of the chemical cleaning, chemical treatment with biocides and sodium hypochlorite, the failure rate of these connections has decreased.

8.0 MAINTENANCE

8.1 89-13 Inspections

Action III of Generic Letter 89-13 recommended that a routine inspection and maintenance program be established to ensure that corrosion, erosion, protective coating failure, silting and biofouling do not degrade the performance of the safety related systems supplied by the service water system. Action V further recommended that maintenance practices be adequate to ensure safety related equipment cooled by the service water system function as intended.

In the January 29, 1990 response to GL 89-13, GGNS committed to perform the following, as related to system periodic maintenance:

a) Chemical cleaning of ESF room coolers and piping using existing procedures and the cleaning of heat exchangers and system piping using special maintenance instructions when evaluation of heat exchanger performance indicates an adverse trend in flow capacity. (Action III, Response 3)

b) Flushing of ESF switchgear room coolers and control room A.C. condensors, which have common SSW/PSW piping, periodically when evaluation of heat exchanger flow indicates an adverse trend in flow capacity. (Action III, Response 4)

c) Develop a program for establishing and accomplishing required maintenance of permanent plant equipment. The program includes the performance of repetitive and corrective maintenance on safety related equipment supplied by service water. (Action V, Response 1)

d) Prepare lesson plans used to train maintenance personnel on valve and pump maintenance procedures, breaker and control circuit maintenance procedures, and instrumentation and electronic fundamentals. (Action V, Response 2, Review Item 2)

The implementation of the above GL 89-13 commitments were specifically incorporated into the applicable review areas.

The Maintenance Technical Review Plan was used to guide the reviewer in the performance of this assessment, and aided in the review of all maintenance areas, in addition to those specified, in response to GL 89-13, above.

The chemical cleaning of the ESF room coolers has occurred. This portion of the system is especially susceptible to fouling since it is usually operated on the PSW system. Grand Gulf is aware of the problems with this equipment and includes flushing of the lines when adverse trends indicate cleaning is required.

Additionally, a number of walkdown/Inspections were conducted in the SSW Buildings, related valve rooms, and in areas in which SSW heat exchangers were located. The material condition of the areas and equipment was exemplary. No SSW material deficiencies were identified. Deficiencies were identified relating to: 1) emergency lighting, and 2) an unidentified 240 volt cable with connections external to the Unit 2 MCC and connected in an apparent temporary fashion.

An observation was issued identifying the above conditions. The plant responded by issuing Trouble Ticket TT 2279 and the deficiencies were corrected.

Relief valve PSV F065 was found with a manufacturer's label stamped PSV-1 instead the of the tag identification shown on the P&ID. Operations/Plant staff, after being notified of this condition, took prompt action to tag the valve.

8.2 Maintenance Procedures

A procedural review was performed with the following observation noted:

General Maintenance Instruction, 07-S-14-286, "HPCS - SSW Pump Overhaul", was reviewed against the Vendor Manual 460000405, Gould Pumps Type 1 Manual HPCS Service Water Pump. The last revision of the procedure is Rev. 1, dated 9/11/86. The procedure was found to be out-of-date and does not reflect the current configuration of the HPCS Standby Service Water Pump. Sections 7.3 and 7.9 include many steps which refer to stuffing box assembly and disassembly, including the diagram in figure 1. The current pump configuration includes a mechanical seal, not a stuffing box.

Additionally, the procedure was referenced during the performance of work orders: M65071, M65072, and M70694. Work order 65071, completed 9/23/86, describes the work to rework the spare HPCS SSW pump, and references Section 7.9 of the procedure. Work Order M65072 removes the installed HPCS SSW pump and reinstalls the spare pump. Section 7.9 of the above procedure is again referenced and the mechanical seal is included on the parts list.

The GGNS response to the observation identified that the procedure would be updated.

8.3 Vendor Manuals

Vendor Manuals were reviewed and verified against the SSW components. Issues were identified which indicate deficiencies in the control of vendor information. References for the review included: 1) 01-S-05-4, Control of Vendor Technical Manuals; and 2) INPO Good Practice DE - 102, Control of Vendor Manuals.

1. No record of vendor manual review and approval by NPE is included with the manuals.

GGNS noted that the manuals were reviewed and approved by Bechtel prior to turnover. The original Bechtel filing contains Bechtel's review and approval.

2. No list of effective pages exists.

GGNS responded that some manuals have effective page lists and others do not. At the time of approval by either Bechtel or NPE, no requirements were delineated to add the effective page list.

3. Pages are not numbered in such a manner that demonstrates that all pages are included in the manual.

GGNS responded that the number of sheets in a manual or in a section will be quantified. This effort will be included as part of the task resolving QDR 94-018.

4. No list of applicable pages exists.

GGNS responded that no effort has been performed to note which portions of a manual may or may not be applicable to a component. The manuals are generally in a state as received from the vendor. It is assumed that a person using a manual has enough understanding to be able to apply the applicable portions of a manual.

5. The revisions are not entered in the vendor manuals in a manner that delineates those pages that have been revised (Previously documented on a QDR).

GGNS responded that revisions to vendor manuals are presently delineated on the record of revision sheet with adequate information to identify revised pages, sections, etc. This effort started this year to resolve QDR 94-0018.

6. Vendor drawings have not been separated from the VMs.

GGNS responded that all vendor manuals are annotated with a warning label to check document control personnel for the latest revision of a drawing contained within a manual. Drawings that are not identified as not being in the drawing control system and are required to support design activities are reviewed and approved by NPE and entered into the drawing control system.

VM No.460000403 **Ceramic Cooling Tower Company Standby Service Water Cooling Towers**

The record of revisions was evaluated. The following observations were identified:

o VMA92-0143 replaced VMA92-109 which initially revised the parts list for part numbers 730, 731, 732, and 733. VMA 94-0163 again revised those part numbers. VMA 94-0163, however, appears to have used the original page as the basis for the VMA, and no notes exist to reflect

the deletion of VMA-92-0143 in the record of revision.

GGNS responded that the latest addenda VMA 94-0163 does reflect the correct information for the affected page. They stated that the possible omission, resulting in the observation, is not identifying that VMA 94-0163 replaced the previous VMA in its entirety. The information is available by searching on the VMAs, but was not delineated in the record of revision.

- VMA 94-0208 refers to a change to Table 3 of Appendix B. Appendix B is referenced in both the record of revision and the VMA. The changes have actually been made (appropriately) to the Instruction Manual, Cooling Tower Speed Reducers, in Appendix A of the VM. The reference to Appendix B may be to a different document, but the VMA is confusing due to the absence of page numbers and list of effective and/or revised pages.

GGNS responded that the observation was valid. Both the VMA and the record of revision sheet reflect the change was applicable to Appendix B. The document being changed is actually in Appendix A. The change was made correctly in the manual regardless of the incorrect instruction.

- The record of revisions refers to "See cooling letter from George Tengrowski, 12/12/80". Within the letter and it's attachments, pages 10, 15, and 18 of 23 of the CCTC Installation Procedure have been revised as Revision 1. Those pages are identified as Revision 0 in the controlled copy of the manual. Revisions have not been completely entered in the controlled copy of the manual. The revised pages include changes to the installation instructions of the gear reducers, the motor, and drive-shaft alignment.

GGNS responded that the errata sheet that provides revision 1 sheets, dated 9/12/79, reflects pages 10, 15, 16, 17, 18 & 19. The errata sheet that provides revision 2 sheets, dated 12/12/80 reflects pates 16, 17 & 19. The reissued manual, dated 10/20/94, has the correct pages.

VM No. 460000405 Gould Pumps Type 1 Manual, HPCS Service Water Pump

The record of revisions was evaluated. The following observations were identified:

- GINs 91-02399 and 91-02225 are included in the record of revision as including documents to be incorporated into the manual. GIN 91/02225 does not include sufficient information to identify those pages impacted by the changes.

GGNS responded that current updating requirements would not permit a sheet to be added or modified without the sheet being identified with the change authority.

<u>VM No. 460002723</u> **<u>Gould Type 1 Manual, (applicable to the Standby Service Water Pumps A & B)</u>**

Changes have been made to both the: 1) applicability page, (P.O. & S.O. #) and the 2) Table of Contents with no identification of control/change numbers.

GGNS responded that the changes were made by Bechtel prior to the manuals being turned over to and controlled by Entergy and that current methods of changing manuals does not permit this to happen.

8.4 Maintenance Planning

Planning, scheduling, and coordination of maintenance on SSW components appears adequate. Weekly and monthly schedules and the SSW system maintenance backlog were reviewed. Maintenance planning and scheduling following the occurrence of an unscheduled outage was evaluated and appears adequate. Maintenance planning, scheduling, and maintenance coordination and performance during a SSW divisional outage was observed, evaluated, and determined to be adequate.

A number of SSW system/component MNCRs and their related root cause analyses were reviewed. MNCR 0030-94 was written on 3/5/94, when SSW "B" Pump was taken out of service due to high vibration. The pump was removed/disassembled for trouble shooting, and multiple nonconformances were noted. Nine (9) steps of disposition instructions, primarily relating to design and maintenance activities, are identified and are in various stages of completion.

Regarding MNCR 0030-94, the Licensing Commitment Closure Sheet for LCTS Item #16838 states, "Preventive Maintenance Procedure 07-S-14-287 Rev. 2, has incorporated total lift readings for the pump assembly and pump alone". This sheet is dated 6/30/94. No Rev. 2 exists at this time for the subject procedure, since the MNCR is not closed out.

MNCR 0036-94 includes design changes in the impeller-bowl axial clearance and a change to the securing mechanism for the wear rings to use set screws. The Vendor Manual Addendum (VMA) and the drawing change were developed and approved in March 1994, but have not yet been posted against the documents. This is because the existing update procedure requires that the VMA be posted after MNCR closeout and the MNCR is not closed out.

A number of Corrective and Preventive Maintenance Work Orders were reviewed. The CM and PM programs appear to be effectively implemented for SSW components. The Reliability Centered Maintenance (RCM) Program, Predictive Maintenance Program, and the actions being implemented to establish compliance with the Maintenance Rule were also evaluated, as applied to the SSW system.

9.0 OPERATIONS

Operation of the system was observed, licensed and non-licensed operators were interviewed, and the operating procedures for the SSW System were reviewed to evaluate the GGNS plant operations relative to the SSW System. The information obtained from these inspection activities were used to determine the adequacy of operations procedures and the valve lineup program for the system along with an assessment of the station conduct of operations. Additionally, the adequacy of operator training for the SSW System was evaluated as part of this area of the inspection. The Operations area was found to be acceptable, with some observations noted in the following Sections.

9.1 Operations Procedures

The system operating procedures were reviewed for useability, clarity, and determination that sufficient guidance was provided to ensure satisfactory system operation isn't simply a result of experienced operators. Also, a review of certain off-normal, and emergency operating procedures was completed. Included in the operating procedures review were the following:

SOI-04-1-01-P41-1, "System Operating Instruction, Standby Service Water System" (including TCN 84, dated 6-16-94).

SOI-05-1-02-V-11, "Off-Normal Event Procedure, Loss of Plant Service Water."

04-1-02-1H13-P870, "Alarm Response Instruction, Panel No: 1H13-P870" (SSW applicable ARIs).

04-S-02-SH13-P854, ARIs for PSW Header Pressure Lo and Lo-Lo, Rev. 10 and 11 respectively.

There were no concerns noted with the above procedures, however, the observations identified below were addressed and discussed during the course of this inspection. Control room operators were asked about any problems they experienced or concerns they might have in operating the SSW System. Operators expressed some concern about ensuring the Loop C return valve to the cooling tower, Q1P41-F011C, would

be closed following a HPCS pump jog. The pump jog is required to confirm pump breaker operability following maintenance, which necessitated racking out the HPCS pump power supply breaker. If during the HPCS pump jog, the pump is run for less than 10 seconds, the Loop C SSW pump does not automatically start due to a 10 second time delay in its start logic. Since the stroking of F011C occurs immediately from the initiation signal and no annunciation occurs, the operators must remember that following the HPCS pump jog, F011C must be closed to place Loop C SSW back into the standby condition.

Upon discussing the situation with various Operations staff, GGNS issued a change request to include a precaution in the HPCS System Operating Instruction alerting the operators to this situation when jogging the HPCS pump.

Additionally, LER 86-029-10 Item E.3.f of the Supplemental Corrective Actions discusses an ISEG initiated SSW System Performance Assessment which identified a potential for a water hammer event if a LOP, LOCA, or LOP/LOCA were to occur while the SSW was in operation with the Drywell Purge Compressors or FPCC heat exchanger isolation valves open. This issue was closed out by taking credit for certain procedural changes discussed in AECM-87/0095 and AECM-88/0045. In essence, these documents stated GGNS had established administrative controls to limit the amount of time the SSW system is aligned to the drywell purge compressors or the FPCC heat exchangers for testing. No reference to limiting this condition in any of the operating procedures for the SSW System could be found. However, it was found that the station did reevaluate the issue when it began operating the SSW Loops more frequently for chemical treatment runs. Station personnel initiated a procedure change request to add AECM-87/0095 and AECM-88/0045 to the Requirements Cross-Reference List in the SSW System Operating Instructions and the SSW chemical addition procedures for each Loop.

9.2 Valve Lineup Program

No discrepancies were noted in the valve lineup program for the SSW System. However, in reviewing the procedure for breaker lineup checks for cold weather operation, it was noted that one of the Loop A valve motor heater breakers, which was aligned properly per the system operating procedure, was missing from the cold weather lineup sheet. After discussions with Operations personnel, a procedure change request was initiated by the GGNS staff to include this motor heater breaker.

9.3 Conduct of Operations

The SSW System operation was observed on several occasions. The weekly chemical addition operation of the loops and the performance of the quarterly SSW Loop B Valve and Pump Operability Test, 06-OP-1P41-Q-0005, were observed. The ability to locally operate SSW equipment was examined by system walkdowns with operations personnel. Local indication was evaluated to determine if it could be used to support normal and abnormal operating procedures. The SSW procedure manipulations required for shutdown from outside the control room were walked down. The ability to operate the system locally was also evaluated in terms of environmental conditions, such as expected room temperature, emergency lighting, and steam, assumed under accident conditions.

Good communications, command, and control when observing system operations were noted. Crew briefings in the control room were held prior to beginning the part of the quarterly pump and valve operability testing that was observed. No performance errors during the observed operations of the SSW System were noted. Control room operators were interviewed to identify any problems or concerns they might have with operation of the SSW system. The problems or concerns identified during the interviews are addressed in the appropriate Sections of this evaluation.

9.4 Operator Training

Training was evaluated to determine the adequacy of operator knowledge of such items as the operation of the system, its role in accident mitigation, technical specification surveillance requirements, and determination of system operability. Specifically, the evaluation consisted of reviewing operator training materials for adequacy and accuracy. The training materials were reviewed against other plant documentation such as the operating procedures, the system P&IDs, and Design Change Packages. Since no operator training was being conducted on the SSW System which could be observed during the inspection period, additional information on the adequacy of training was obtained by probing the operator's knowledge of the system operation during interviews.

The following training materials were evaluated:

OP-LO-SYS-LP-Y47-03,	Licensed Operator Lesson Plan, Standby Service Water Ventilation System.
OP-LO-SYS-LP-P41-05,	Licensed Operator Lesson Plan, Standby Service Water System.

OP-LO-SYS-LP-P41-01,	Non-Licensed Operator Lesson Plan, Standby Service Water System.
OP-LOR-IE-LP-008-00,	Licensed Operator Requalification Training, Industrial Experience, SSW "C" Alternative Cooling.
SD-P41,	System Description, Standby Service Water System.

Seven Initial Licensed Operator Training Simulator Scenario Lesson Plans associated with SSW:

OP-LO-SIM-EP-LP-004-01
OP-LO-SIM-ONEP-LP-020-01
OP-LO-SIM-IF-LP-004-00
OP-LO-SIM-EP-LP-038-01
OP-LO-SIM-EP-LP-034-01
OP-LO-SIM-EP-LP-032-01
OP-LO-SIM-EP-LP-005-02

Three Operator Qualification Cards and two Job Performance Measures:

OP-LO-QC-001-13
OP-AON-QC-001-02
OP-NOB-QC-001-04
OP-LOR-JPM-CRO-P41-001-01
OP-LOR-JPM-CRO-C61-005-01

The Licensed Operator Requalification Program was reviewed for evidence of training on SSW System modifications. A recent modification which eliminated the ability to transfer water from SSW Basin A to Basin B had been presented in a recent requalification module. However, the only documented training on DCP 90/0551, which separated the SSW Loop C return line from the Division 1 return line, consisted of lesson plan OP-LOR-IE-LP-008-00. This lesson plan provided training on contingency plans for the long-term cooling of SSW Basin A and the proposed resolution of MNCR 90-0016 dealing with the HPCS return header modifications. The training was performed prior to the modification. The final form of the modification was not reviewed to determine whether any other changes needed to be incorporated.

With the exception of a few minor setpoint inconsistencies regarding the differential flow alarm setpoint values, the lesson plans for the Licensed Operator System training were found to be adequate in scope and depth, as well as accurately reflecting the as-built SSW System and its operation. The training staff is in the process of eliminating an older version program system lesson plans to use only the licensed operator lesson plans. The new lesson plan will contain all of the information necessary for all

other training programs, as well as the licensed operator. Objectives for each separate training program will define the subset of material within the licensed operator lesson plan to be used.

The SSW lesson plan for non-licensed operator training had a number of technical inaccuracies, some of which, were reflected in interviews with operators. For example, several operators interviewed indicated they understood the piping for SSW Loop C return to be connected to the cooling towers with Div. I, Loop A flow, as the system was originally designed. Drawings of the system in System Description SD-P41 and the Non-Licensed Operator Lesson Plan still show Loop C connected to Div. I return piping to the cooling towers, instead of a separate flow path, as modified by DCP 90/0551. An interim revision for the lesson plan had been issued covering the changes in system configuration for DCP 90/0551. However, the last revision of the lesson plan did not correct the lesson plan text or drawings to incorporate the change. After discussion with Training personnel, another change request was initiated to correct the lesson plan.

In the Attachment to AECM-90/0007 (W. Cottle letter to USNRC Region II Administrator, dated 1/29/90), Response to NRC Generic Letter 89-13 Service Water System Problems Affecting Safety-related Equipment, response to 89-13, Action V, Training, Item II.E.2, states that "SERI reviewed the training materials used to train operators and maintenance personnel. This encompassed a detailed review of the SSW system description, which is used by plant personnel as a reference for system operation."

The most recent revision for SD-P41 was issued on 5/11/90. Two paragraphs in the SSW System Description describe establishing primary coolant flow through the RHR Heat Exchanger prior to initiating SSW flow in order to prevent SSW inleakage into the primary coolant, thus avoiding a chloride contamination problem. The RHR system operating procedure, SOI 04-01-E12-1, used for aligning RHR for shutdown cooling was reviewed. It has the SSW flow established to the RHR heat exchangers prior to establishing primary coolant flow from the reactor, contrary to the discussion in the SSW System Description. After discussion with Training personnel, a Training material revision request form was generated to correct the discrepancies in SD-P41.

10.0 SYSTEM WALKDOWN

Several in-depth walkdowns of the SSW Pumphouses, SSW Valve Room, Diesel Generator Buildings, and the Control Room Ventilation components were conducted. Maintenance and

Surveillance activities were also witnessed on various occasions. Attributes observed included housekeeping, material condition, component installations, emergency lighting, transient material, procedure adherence, drawing conformance, and general conduct of testing. The results of these activities are contained in the appropriate sections of this report.

11.0 PERSONS CONTACTED

The following persons were contacted during the course of the SWSOPI:

C. A. Abbott - QP
A. D. Barfield - NPE
T. E. Barnett - NPE
H. D. Berryhill - NPE
J. G. Booth - Operations
R. J. Boring - RCM
D. G. Bost - NPE
C. A. Bottemiller - Licensing
B. D. Bryant, Training
J. L. Burton - NPE
G. C. Coker - Chemistry
C. E. Cresap, Training
M. A. Cross - QP
S. A. Davis, Training
M. A. Dietrich - Training
R. K. Dubey - NPE
C. M. Dugger, Operations
O. L. Grice - QP
C. C. Hayes - QP
T. H. Holcombe, Operations
R. D. Ingram - System Engineering
R. R. Jackson - NS & RA
B. G. Jones - QP
L. A. Keiser - Systems Engineering
A. Khanifar - NPE
J. M. Kinsey - Chemical Engineer
G. B. Lantz - NPE
C. Laird, Operations
J. K. Magee, Operations
S. L. Martin - NPE
K. P. Martin - Systems Engineer
P. T. Martin - Planning & Scheduling
A. J. Malone - ISI/IST Coordinator
C. H. McCaa - QP
W. R. McCain - NPE
N. F. McGowan, Operations
L. B. Moulder - Maintenance
D. L. Pace - Plant Manager
R. L. Patterson - NS & RA
L. A. Patterson - P & SE

J. E. Reaves - QP
C. L. Schultz - Scheduling
G. S. See - Systems Engineer
W. M. Shelly - Plant Staff
D. L. Smith, Operations
L. M. Speyerer - System Engineering
T. H. Thurman - Systems Engineer
B. E. Warren - NPE
J. P. Watkins, Operations
J. A. Webb - Maintenance Training
T. L. Williamson - Chemistry Superintendent
J. D. Wilson - NPE

ATTACHMENT 1

SSW EROSION/CORROSION HISTORY

SSW EROSION/CORROSION DOCUMENT HISTORY

DATE	DOCUMENT	ACTIONS
6/17/86	Memo on PMI-86/04017, resolution of the SSW Basin/System Corrosion Concern	1. Action Plan for corrosion problem is provided. 2. Bechtel report Preliminary Report on SSW System Treatment for Corrosion Control provided. 3. Plant review requested. 4. Water analyses requested.
8/7/86	PMI 86/06176 resolution of the SSW Basin/System Corrosion Concern - NPE	1. NPE SSW Basin Corrosion Resolution Program is provided. 2. Hypochlorite treatment is recommended, cleaning compounds in evaluation, 3. Component Inspections during operations are withdrawn. 4. Cleaning/coating process recommended. 5. Small Bore Replacement/Inspection program is recommended. 6. RF01 RHR, DG inspection agreed upon. 7. Post RF01 activities: Review water quality testing results Review cleaning results Follow up on corrosion coupon rack installation
11/19/86	MNCR 0676-85 disposition	1. Summary of component repairs/evaluations is provided. 2. New chemical treatment program is identified.
1/6/88	SERI response on violations 50-416/87-39-01. (No Safety Evaluation on the effects of chemical cleaning)	1. Assessment of effects on weld material provided.
3/5/88	PMI 88/01233 Revised Safety Evaluation	1. Revised evaluation, for effects of chemical cleaning on weld, is provided.
10/21/88	IPC 88/5150 Chemical Cleaning Task Force meeting agenda	1. Review of items for the chemical cleaning
6/26/87	PMI 87/04184 Recommendations for Chemical Cleaning of Condensers and SSW System during RF02.	1. Recommendation to clean both the Condensers and SSW system.
8/24/87	PMI 87/05651 Engineering concurrence on inspection program.	1. Div 2 DG, RHR C Room Cooler, and FPC Room Cooler to be inspected.

2/26/88	PMI 88/01205 ESF Switchgear Chemical Cleaning assessment.	1. Engineering Report 88-0006 provided.
11/18/88	Project Scoping Report for DCP 86/0092 - SSW Chemical Injection Subsystem	1. Project Scoping Report Submitted.
3/20/89	Engineering Report SERI-89/0004 Chemical Cleaning of SSW - Loop B	1. Assessment of effects of the Chemical Cleaning is provided.
11/9/93	Plant Operations Manual 01-S-08-16 Administrative Procedure Chemical Treatment Program	1. Provides procedure for Chemical Treatment, which includes the SSW system.
2/22/94	Plant Operations Manual 08-S-03-10 Administrative Procedure Chemistry Sampling Program	1. Provides procedure for Chemical Sampling, which includes the SSW system.
4/24/94	Standard GGNS MS-46 Rev. 1 issued, Standard for Monitoring Internal Erosion/Corrosion in Moderate Energy Piping Systems.	1.Program for inspection of Plant Service Water and Standby Service Water systems for Ercsion/Corrosion conditions. 14 SSW locations are identified to be inspected.
10/13/91	QAP 9.90 Administrative of Microbiological Induced Corrosion (MIC) Tracking in Standby Service Water Systems	1. The program implements the MIC tracking and assessing of small bore piping.
2/28/94	QAI 9.29 Radiographic Examination for Microbiological Induced Corrosion (MIC)Rev. 2	1. Provides methods for radiographic examination of piping for detection of wall thinning due to MIC in 4 inch and under piping.
8/8/94	Engineering Report GGNS-94-0026 Evaluation of Corrosion on SSW Spray Header Piping	1. Provides an evaluation of the corroded piping in the SSW Cooling Tower Spray Header Piping and provides alternatives to resolve the problem.
4/29/94	Rev. 1 for Specification MS-46 Standard for Monitoring Internal Erosion/Corrosion in Moderate Energy Piping Relater Components (safety Related)	1. Identifies Locations in SSW to be inspected for effects of corrosion. 2. Provides acceptance criteria for pipe wall thickness when piping is found to be less than nominal minimum pipe wall thickness.

Attachment 2

to

GNRO-95/00019

Resume for Cleveland Electric Team Member

LEWIS B. BIDDLECOMB

Experience

1985 to Present: Perry Nuclear Power Plant - see attached sheet.

1981 to 1984: GE Operations Manager at Hanford-2 Nuclear Power Plant. Provide technical direction and procedure review on GE scope-of-supply equipment. Coordinate resolution of startup/operations-discovered problems with GE projects office. Provide administrative supervision to other GE site test personnel. Certified by GE to Level III under ANSI 45.2.6.

1978 to 1981: Combined GE Lead Test Engineer and utility NSSS Lead Test Engineer at Perry Nuclear Power Plant. GE duties identical to Hanford-2 duties. In addition to the usual NSSS Lead functions, I provided technical assistance to utility management personnel for program and policy formulation.

1974 to 1978: GE Startup Testing & Operations Engineer at Brunswick-1 & 2, Hatch-2 and Shoreham. GE SRO certification - was GE Shift Superintendent on Brunswick-2 startup. Experience with all NSSS mechanical systems and some BOP. Writing, review, and performance experience on all types of procedures. Trained one RO class through complete certification course.

1972 to 1974: Westinghouse Nuclear Plant Engineer at S1W Naval Prototype. Qualified Engineering-Officer-Of-the-Watch (EEOW) and Plant Operations Crew Supervisor (POCS). Responsibilities divided equally between operations and training, with some maintenance supervision and physics testing.

1970 to 1972: Mathematics teacher and wrestling coach - Junior High.

Summer 1969: Student Aide at Argonne National Laboratory Idaho Facilities. Worked on increasing allowable exposure to fuel pins at EBR-II.

Education

College - BS Metallurgical Engineering	University of Idaho
Graduate - 16 credits Secondary Education	University of Idaho

Military Record

1957 to 1968: US Navy (all applicable to power plant engineering) for 11 years. Served on 5 submarines (2 conventional, 3 nuclear). IC1(SS) Interior Communications Technician. Reactor Operator, Nuclear Electrician, and Submarine qualified. Shipyard and new construction duty about 2 years. Various professional schools.

LEWIS B. BIDDLECOME

Perry Highlights (1985 - Present)

Subsection Supervisor: Compliance, NRC commitment tracking, NRC & INPO bulletin reviews, NPRDS activities, and periodic tests.

Independent Safety Engineering Group (ISEG) Chairman (NUREG-0737)

Finishing Plan Chairman: Ad hoc committee to determine all actions required to finish construction and testing sufficiently to satisfy fuel load license and other commitment requirements and to ensure all deferrals were properly evaluated.

Nuclear Safety Review Committee (NSRC) Operations & Maintenance Subcommittee Member (corporate safety review group)

Management Procedure Review Team Chairman: Supervised a 5-month review of all preoperational tests and selected acceptance tests to satisfy NRC concerns on preop program weaknesses. Ensured all FSAR and docketed test commitments were satisfied and properly documented.

Fuel Load Achievement Group Member: Ad hoc committee (chaired at the GM level) to provide special project procedures to certify all plant systems and operating procedures were fully ready to support the fuel load, 5% power and full power milestones.

Power Ascension Program Director: In charge of all Reg. Guide 1.68 startup testing from pre fuel load through commercial operations.

Post Fuel Load Planning Task Force Member: Ad hoc committee (chaired at the GM level) to ensure all maintenance and design change packages were properly prioritized to support fuel load and power ascension needs.

Work Review Committee Member: Standing committee (an outgrowth of the Post Fuel Load Planning Task Force, but at a lower level) to ensure all maintenance and design change packages are properly prioritized to meet all current project goals and to set forced and planned outage scope.

NSRC Engineering Subcommittee Member (corporate safety review group)

NSRC Member and NSRC Engineering Subcommittee Chairman

Design Assurance & Reliability Engineering Unit Lead: Coordinate project response to all external operating experience reports (NRC, INPO, vendor, etc). Supervise project Commitment Tracking System, NPRDS, Reliability Information Tracking System, assorted failure analysis activities, and design assurance studies. Provide technical assistance to Maintenance Section regarding Reliability Centered Maintenance.

ISEG Member