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GL 89-13

PROGRAM DOCUMENT

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1.0 PURPOSE

The purpose of the Generic Letter (GL) 89-13 Program is to document ongoing actions taken by Point Beach Nuclear Plant (PBNP) to meet commitments to the U.S. Nuclear Regulatory Commission in response to GL 89-13. Implementation of this program provides the plant and the public a reasonable assurance that the service water system will function to perform the designated design and licensing basis functions during the remaining life of the plant.

Specifically, this document identifies the NRC recommendations made in the generic letter, the Point Beach plant activities and/or commitments regarding those recommendations, and the current state of compliance with the commitments. Additionally, this document provides guidelines and responsibilities regarding program implementation for ongoing activities which are required for continued GL 89-13 programmatic success (i.e. testing, cleaning, documentation filing, etc.).

2.0 BACKGROUND

On July 19, 1989, the Nuclear Regulatory Commission issued, "Service Water System Problems Affecting Safety-Related Equipment (Generic Letter 89-13)" to all holders of operating licenses or construction permits for nuclear power plants. Generic Letter (GL) 89-13 was issued to address reoccurring problems identified in open-cycle service water systems at various nuclear generating facilities. Problems identified by the NRC in service water systems included fouling due to biofouling agents, silting, mud, and corrosion products, degradation caused by corrosion and erosion, personnel and procedural errors, and design deficiencies.

GL 89-13 asked that licensees ensure the requirements of the General Design Criteria (GDC) in 10 CFR Part 50 Appendix A be met. Specifically the letter asked that licensees and permit owners ensure that the requirements of 10 CFR Part 50 Appendix A GDC Criterion 44, 45, and 46 and the requirements of 10 CFR Part 50, Appendix B, Section XI "Test Control" are met. This action required that licensees and applicants "supply information about their respective service water systems to assure the NRC of such compliance".

PBNP is not licensed to 10 CFR Part 50 Appendix A. As stated in the Final Safety Analysis Report (FSAR) Section 1.3, "Appendix A of 10 CFR Part 50 contains a different set of GDCs which were published in 1971 (After Point Beach construction permits were issued). Note that the GDCs found in 10 CFR Part 50 Appendix A differ in numbering and content from the GDCs adopted herein for PBNP".

Although PBNP is not licensed to 10 CFR Part 50, Appendix A, the reliability of the cooling water source to the ultimate heat sink (UHS) is of high safety significance and the actions listed in GL 89-13 were addressed in a letter to the NRC, VPNPD-90-027, dated January 12, 1990. Additional letters were sent to the NRC updating them of the status of PBNP's commitments. However due to follow up regulatory inspections and observations including the Service Water System Operational Performance Inspection (SWSOPI) performed at PBNP in 1993, some of the original commitments regarding GL 89-13 have changed. This GL 89-13 Program Document was developed to:

- establish a single point of reference for what actions are taken at PBNP to address GL 89-13, specifically the continuous actions concerning Action Items I, II, and III of GL 89-13,
- provide justification for the actions taken

This document provides a summary of the independent program activities used to address the U.S. Nuclear Regulatory Committee (NRC) concerns and will be a point of reference on which programs and procedures are used at PBNP to address the NRC concerns.

3.0 GENERIC LETTER 89-13 CRITERIA

The issuance of GL 89-13 required that five action items be addressed by nuclear licensees and applicants to ensure service water systems will be maintained in compliance with 10 CFR Part 50, Appendix A, GDC 44, 45, and 46. And Appendix B, Section XI.

3.1 ACTION I:

For open-cycle service water systems, 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. A program acceptable to the NRC is described in "Recommended Program to Resolve Generic Issue 51" (Enclosure 1 of GL 89-13). It should be noted that Enclosure 1 is provided as guidance for an acceptable program. An equally effective program to preclude biofouling would also be acceptable. Initial activities should be completed before plant startup following the first refueling outage beginning 9 months or more after the date of this letter. All activities should be documented and all relevant documentation should be retained in appropriate plant records.

Details of the actions taken at PBNP to address Action I are provided in Appendix A.

3.2 ACTION II:

Conduct a test program to verify the heat transfer 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 retest 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 system as defined above. Operating experience and studies indicate that closed-cycle service water systems, such as component cooling water systems, have the potential for significant fouling as a consequence of aging-related in-leakage and erosion or corrosion. The need for testing of closed-cycle system heat exchangers has not been considered necessary because of the assumed high quality of existing chemistry control programs. If the adequacy of these chemistry control programs cannot be confirmed over the total operating history of the plant or if during the conduct of the total testing program any unexplained downward trend in heat exchanger performance is identified that cannot be remedied by maintenance of an open-cycle system, it may be necessary to selectively extend the test program and the routine inspection and maintenance program addressed in Action III, below, to the attached closed-cycle systems.

A program acceptable to the NRC for heat exchanger testing is described in "Program for Testing Heat Transfer Capability" (Enclosure 2 of GL 89-13). It should be noted that Enclosure 2 is provided as guidance for an acceptable program. An equally effective program to ensure satisfaction of the heat removal requirements of the service water system would also be acceptable.

Testing should be done with necessary and sufficient instrumentation, though the instrumentation need not be permanently installed. The relevant temperatures should be verified to be within design limits. If similar or equivalent tests have not been performed during the past year, the initial tests should be completed before plant startup following the first refueling outage beginning 9 months or more after the date of this letter.

As a part of the initial test program, a licensee or applicant may decide to take corrective action before testing. Tests should be performed for the heat exchangers after the corrective actions are taken to establish baseline data for future monitoring of heat exchanger performance. In the periodic retest program, a licensee or applicant should determine after three tests the best frequency for testing to provide assurance that the equipment will perform the intended safety functions during the intervals between tests. Therefore, in the periodic retest program, to assist that determination, tests should be performed for the heat exchangers before any corrective actions are taken. As in the initial test program, tests should be repeated after any corrective actions are taken to establish baseline data for future monitoring of heat exchanger performance.

An example of an alternative action that would be acceptable to the NRC is frequent regular maintenance of a heat exchanger in lieu of testing for degraded performance of the heat exchanger. This alternative might apply to small heat exchangers, such as lube oil coolers or pump bearing coolers or readily serviceable heat exchangers located in low radiation areas of the facility.

In implementing the continuing program for periodic retesting of safety-related heat exchangers cooled by service water in open-cycle systems, the initial frequency of testing should be at least once each fuel cycle, but after three tests, licensees and applicants should determine the best frequency for testing to provide assurance that the equipment will perform the intended safety functions during the intervals between tests and meet the requirements of GDC 44, 45, and 46. The minimum final testing frequency should be once every 5 years. A summary of the program should be documented, including the schedule for tests, and all relevant documentation should be retained in appropriate plant records.

Details of the actions taken at PBNP to address Action II are provided in Appendix B.

3.3 ACTION III:

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. The maintenance program should have at least the following purposes:

A. To remove excessive accumulations of biofouling agents, corrosion products, and silt;

B. To repair defective protective coatings and corroded service water system piping and components that could adversely affect performance of their intended safety functions.

This program should be established before plant startup following the first refueling outage beginning 9 months after the date of this letter. A description of the program and the results of these maintenance inspections should be documented. All relevant documentation should be retained in appropriate plant records.

Details of the actions taken at PBNP to address Action III are provided in Appendix C.

3.4 ACTION IV:

Confirm that the service water system will perform its intended function in accordance with the licensing basis for the plant. Reconstitution of the design basis of the system is not intended. This confirmation should include a review of the ability to perform required safety functions in the event of failure of a single active component. To ensure that the as-built system is in accordance with the appropriate licensing basis documentation, this confirmation should include recent (within the past 2 years) system walkdown inspections. This confirmation should be completed before plant startup following the first refueling outage beginning 9 months or more after the date of this letter. Results should be documented and retained in appropriate plant records.

Details of the actions taken at PBNP to address Action IV are provided in Appendix D.

3.5 ACTION V:

Confirm that maintenance practices, operating and emergency 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 recent (within the past 2 years) reviews of practices, procedures, and training modules. The intent of this action is to reduce human errors in the operation, repair, and maintenance of the service water system. This confirmation should be completed before plant startup following the first refueling outage beginning 9 months or more after the date of this letter. Results should be documented and retained in appropriate plant records.

Details of the actions taken at PBNP to address Action V are provided in Appendix .

4.0 GL 89-13 SYSTEM AND COMPONENT SCOPE

Service water systems as defined by the NRC in GL 89-13 are any "system or systems that transfer heat from safety-related (SR) structures, systems, or components to the UHS." The PBNP Service Water (SW) System provides cooling water to transfer heat from safety-related components.

4.1 The SW System shall provide sufficient flow to support the heat removal requirements of components required to mitigate the consequences of a loss of coolant accident (LOCA) in one unit while supporting the normal cooling flow requirements of the unaffected unit. Although SW is required to mitigate other plant accidents as well, a LOCA combined with normal operation of the unaffected unit imposes the greatest demands on the SW System. (FSAR Section 9.6.1)

4.2 The SW System shall continuously provide water to the Battery Room Coolers to help maintain battery temperatures within acceptable limits. This function is considered safety-related because battery temperature is a key parameter to ensure operability of safety-related station batteries. (DBD-12 Section 2.1.1.1)

4.3 The SW System shall provide water to the G01 and G02 Emergency Diesel Generator (EDG) Coolant Heat Exchangers of an operating EDG to help maintain proper engine coolant and lubricating oil temperatures. This function is considered safety-related because EDG temperature is a key parameter in ensuring the operability of safety-related EDGs. (DBD-12 Section 2.1.1.2)

4.4 The SW System shall provide water to Component Cooling Water (CC) Heat Exchangers to help serve the following safety-related CC functions:

A. Residual Heat Removal (RHR) cooldown to mitigate Main Steam Line Break (MSLB) and Steam Generator Tube Rupture (SGTR) events.
B. RHR cooling and Emergency Core Cooling Systems (ECCS) recirculation water to mitigate the consequences of a LOCA.
C. Seal water cooling to RHR and Safety Injection (SI) Pumps. (DBD-12 Section 2.1.1.3)

4.5 The SW System shall provide cooling water to Containment Accident Fan Coolers (CFCs) during a LOCA or MSLB. The CFCs remove sufficient heat from containment atmosphere to maintain the containment below its design temperature and pressure during and after the LOCA or MSLB. The CFCs are used to remove heat at the post-accident conditions for 24 hours and at the reduced temperatures and pressures for an indefinite period. (DBD-12 Section 2.1.1.4)

4.6 The SW System shall provide cooling water for the Containment Accident Fan Motor heat exchangers to support the operability of the CFCs in the post-accident environment. (DBD-12 Section 2.1.1.5)

4.7 The SW System shall provide bearing cooling water to the turbine driven Auxiliary Feedwater (AFW) pumps to cool the turbine bearings. This function is classified as safety-related because the cooling water supply directly supports operability of safety-related equipment (QA Code 6). Cooling water to the motor driven AFW pump bearings via AF-4007A-S and AF-4014A-S is not required per the pump vendor. Cooling water to the turbine driven pump bearings are also not required. (DBD-12 Section 2.1.1.6)

4.8 The SW System shall provide the long term source of water to the suction of the AFW pumps when the normal supply is exhausted during system operation. (DBD-12 Section 2.1.1.7)

4.9 The SW System shall provide water to the Spent Fuel Pool (SFP) heat exchangers to provide adequate decay heat removal from these safety-related heat exchangers. (DBD-12 Section 2.1.1.8)

4.10 The SW System shall maintain closed system integrity (inside containment) and containment isolation capabilities during all plant conditions to prevent an uncontrolled release of radioactivity. (DBD-12 2.1.1.9)

5.0 EXEMPT SYSTEMS

Closed loop intermediate systems and Augmented Quality (non safety-related) system functions, which transfer heat from safety-related structures, systems, or components, are not addressed in the PBNP response to GL 89-13.

5.1 The CC System is a closed-cycle system with safety-related functions including heat transfer from safety-related loads, such as the RHR heat exchangers and RHR and SI pump seal coolers, to the SW System. Potassium Chromate is added to the system, as an anodic corrosion inhibitor, passivating the metal surfaces by the formation of a protective anhydrous layer (DBD-02 Section 2.2.10). CC System operating experience and inspections has shown that the existing chemistry controls adequately control system degradation. Based upon this information, the system is exempt from the GL 89-13 requirements as allowed by the generic letter.

5.2 The Fire Protection (FP) System is an Appendix R system and is not designated as a safety-related system at PBNP. The FP System is a backup source of bearing cooling water to the turbine driven Auxiliary Feedwater (AFW) pumps to cool the pump/turbine bearings. Cooling water for the AF pumps and turbine bearings can be supplied from the diesel driven firewater pump during a Station Blackout (SBO). (FSAR Section 10.2.3) Supply water to the diesel firewater pump is obtained directly from Lake Michigan at the circulating water pumphouse. This function is not a safety-related function and as such is not considered within the scope of GL 89-13. However PBNP did commit to performing a flow verification of FP supply water to the turbine drive AFW pumps, details of the commitment can be found in Appendix A.

The testing requirements for the FP System fall under 10 CFR Section 50.48 which requires PBNP to meet 10 CFR 50 Appendix A GDC 3 and Appendix R Section III.G, III.J and III.O and any approved deviations. (FSAR Section 9.10.2). The system requirements are described in the PBNP Fire Protection Evaluation Report (FPER).

6.0 SEDIMENTATION AND SILT

6.1 Sedimentation and silting were never formally addressed in the PBNP response to GL 89-13. Although never formally addressed, PBNP frequently establishes flow to stagnant and low flow essential piping sections to reduce the probability of blockage due to the settling out of sedimentation and silt. Flushing is controlled by various plant procedures including normal testing practices, identified periodic flushing procedures, and normal system operation. CR 00-0267 questioned the ability of the SW System to perform as required due to high silting and sedimentation. As a result of the Condition Report an Operability Determination was performed documenting the actions taken at PBNP to verify the capability of the system to perform its required safety functions. However, no single point of reference was available documenting the actions taken to control sedimentation. As a result, those actions are being documented as part of Appendix C.

6.2 Sedimentation and silting of SW System piping and heat exchangers has the potential to reduce the heat transfer capability of safety related heat exchanger to below its design basis heat removal requirement. This heat transfer reduction can occur by flow reduction or restriction by sedimentation blockage that has compacted over time and is not readily removable when flow is established to a heat exchanger or its supply piping or by an increase in the heat exchanger fouling factor due to silt or sedimentation in heat exchanger tubes.

6.3 The effects on heat transfer due to the turbidity, suspended solids including silt, is not typically a concern since the suspended solids are expected to pass through the heat exchanger. In addition the amount of suspended solids in process water sources are typically considered in the design of a heat exchanger by the Tubular Exchanger Manufacturers Association (TEMA) due to the consideration of fouling resistances.

6.4 A flow velocity of 3 ft/sec or greater is typically used as a rule of thumb as the flow rate at which suspended solids will not settle out. The 3 ft/sec value is based upon NUREG/CR-5210, PNL-6623, as the desired minimum flow rate in order to minimize tube fouling and accumulation of sediment. Additional studies reviewed included the Hoffman and Fiege Report prepared for PBNP and a Cooper Nuclear Station Study. Cooper Nuclear Station documented a detailed analysis of sedimentation and silting in a June 10, 1999 report. The Cooper Nuclear Station Report concluded that sedimentation typically occurs when flow velocities are 1.1 ft/sec or less, silting occurs when flow velocity is 0.23 ft/sec or less, and that sedimentation can be minimized if flow velocities are maintained above 1.33 ft/sec for their specific suspended solids composition.

6.5 The Hoffman and Fiege Report reviewed turbidity data on the SW System from 1994 through 1997. The turbidity data shows that the highest lake water turbidity level occurred in the Winter and Fall during each year illustrating that lake turbidity levels are tied to seasonal changes. The maximum Winter and Fall turbidity readings from 1994 to 1997 ranged from approximately 45 NTU to 142 NTU. The average Winter and Fall turbidity readings from 1994 to 1997 ranged from approximately 8 NTU to 19.5 NTU. Turbidity data taken during low lake levels from December 1999 through January 2000 ranged from 2.8 to 22 NTU with an average of 10.5 NTU. Based on the data, it was concluded that lake turbidity, in general, is influenced by seasonal changes and does not appear to be influenced significantly by lake level variations.

Significant decreases in forebay and pump bay level would be expected to increase the turbidity in the SW System due to the circulating water flow picking up more silt and sedimentation that may have settled in the bottom of these structures. These transients are very infrequent and typically very short in duration. The bulk of any silt entering the system would be swept through the service water system since most of the flow is at a velocity of 3 ft/sec or greater. It is expected that there would be minimal effect in low flow lines, intermittently used lines and stagnant lines due to the short duration of the high turbidity water being in the system.

7.0 PROGRAM IMPLEMENTATION

Due to the safety significance of GL 89-13 as discussed above, it is imperative that the ongoing activities related to this program continue. For this to happen successfully, the responsibilities of those involved in GL 89-13 activities must be clear (including hand-offs, trending and documentation), and the activities must be clearly tied to GL 89-13. The following sections summarize those ongoing activities and provide a discussion of the program organization, reporting, periodic revision, and documentation requirements that ensure maximum program effectiveness.

7.1 Program Responsibilities:

This section outlines the responsibilities of those departments and individuals who participate in GL 89-13 activities. This will assure accountability for each of the ongoing activities, including initiation of required actions, performance of actions, review of results, and documentation filing.

7.1.1 Site Engineering Director

Primary responsibility for the implementation of this Program. Overall responsibility for the selection of the Program Administrator and to ensure that this individual adequately carries out the Departmental expectations.

7.1.2 GL 89-13 Program Administrator:

a. Maintains general knowledge of technical aspects of the GL 89-13 program
b. Collects information that documents the completion of the ongoing activities that form the basis for the Point Beach GL 89-13 Program,
c. Maintains a GL 89-13 Program notebook in accordance with FP-PE-PHS-01,
d. Completes a formal review of the GL 89-13 program status and effectiveness annually,
e. Modifies the GL 89-13 Program, including adding or deleting activities or making changes to the Program Document, as deemed necessary following completion of the annual program review,
f. Establishes performance indicators for monitoring the status of the overall GL 89-13 program,
g. Coordinates the issuance of commitment and program changes necessary to support the GL 89-13 Program.

7.1.3 Heat Exchanger Coordinator:

PBNP Program owner responsible for Coordinating the performance testing and tube degradation inspection of GL 89-13 heat exchangers. As a minimum, the Heat Exchanger Coordinator performs the following activities:

a. Coordinates performance testing of GL 89-13 heat exchangers,
b. Coordinates eddy current testing of GL 89-13 heat exchanger tubes, collects and maintains all eddy current test results,
c. Trends performance testing and eddy current testing results and provides input to the System Engineers as required,
d. In conjunction with the System Engineer, performs visual inspections of open GL 89-13 heat exchangers for obvious degradation and documents findings. Initiates corrective actions in conjunction with the System Engineer,
e. Maintains awareness of GL 89-13 heat exchanger modifications and major maintenance activities,
f. Determines tube plugging criteria in conjunction with the System Engineer and supporting plant organizations,
g. Assists the System Engineer in troubleshooting GL 89-13 heat exchanger problems and provide recommendations for corrective actions
h. Coordinates the issuance of commitment and program changes as necessary to support the Heat Exchanger GL 89-13 Program.
i. Provides GL 89-13 Program Document updates, program status and effectiveness reporting to the Program Administrator per Section 7.3.

7.1.4 Service Water System Engineer:

The PBNP Program owner responsible for System Engineering of the SW systems which are identified within the GL 89-13 Program. As a minimum, the Service Water System Engineer performs the following activities:

a. Actively monitors and trends system and component performance,
b. In conjunction with Chemistry and the GL 89-13 Program Administrator, evaluates the results of SW system corrosion monitoring programs.
c. Performs or maintains an awareness of the results of visual inspections of piping and components for degradation due to corrosion, erosion, cavitation, biofouling and sedimentation.
d. As necessary, reviews applicable site implementing procedures to ensure their compliance with the requirements of this GL 89-13 Program,
e. In conjunction with the Heat Exchanger Coordinator, Biofouling Control Program Administrator, Operations and Maintenance personnel, troubleshoots heat exchanger problems and provides recommendations for corrective actions,
f. Provides GL 89-13 Program Document updates, program status and effectiveness reporting to the Program Administrator per Section 7.3.

7.1.5 FP System Engineer:

The PBNP Program owner responsible for System Engineering of the Fire Protection systems which are identified within the GL 89-13 Program. As a minimum, the FP System Engineer performs the following activities:

a. Stays aware of industry related concerns and initiatives,
b. Determines the appropriate level of personal involvement in preventive maintenance activities, performance monitoring activities, surveillance program results, and any other activities related to the system,
c. Performs visual inspections of piping and components for degradation
d. Serves as the project coordinator for multitask activities related to system equipment,
e. Periodically updates acceptance criteria for performance and periodic surveillance testing using NFPA codes,
f. Evaluates performance and periodic surveillance testing acceptance criteria,
g. Establishes trending criteria and performs trending analysis.

7.1.6 Site Chemistry:

a. Monitors process streams to ensure that the relevant water chemistry parameters are within the desired ranges,
b. Ensures that the corrosion inhibitors utilized in closed loop systems are within the specification limits,
c. Specifies lay-up requirements for affected systems and equipment.

d. Makes recommendations for chemical treatment and cleaning,
e. Maintains chemical release rates within EPA limits.

7.1.7 Biofouling Control Program Administrator:

The PBNP Program owner responsible for the coordination of the biofouling control program identified within the GL 89-13 Program. The Biofouling Control Program Administrator is assigned overall responsibility for the biofouling control of all PBNP raw water systems. As a minimum, the Biofouling Control Program Administrator performs the following activities:

a. Coordinates the implementation of the strategies and methods for minimizing the threat of zebra mussels to the operability of the Service Water system components.
b. Coordinates the implementation strategies and methods for minimizing the effect of Service Water microbial contaminates with respect to Microbiologically Induced/Influenced Corrosion (MIC) or blockage due to excessive growth.
c. Responsible for the direct monitoring of zebra mussel and MIC infestation.
d. Is delegated the responsibilities of the PBNP Zebra Mussel program Administrator duties as defined in DG-CH01 "Zebra Mussel Tracking and Evaluation".
e. Coordinates the issuance of commitment and program changes as necessary to support the SW GL 89-13 Program.
f. Provides GL 89-13 Program Document updates, program status and effectiveness reporting to the Program Administrator per Section 7.3.

7.1.8 PBNP Service Water Inspection Program Coordinator

The SW Coordinator is assigned overall responsibility for the administration of the PBNP site Service Water Inspection Program as identified in the PBNP SW ISI Program procedure "SWP" and the Program Engineering Fleet Procedure FP-PE-SW-01 "Service Water and Fire Protection Inspection Program. This includes the following:

a. Responsible for implementing and maintaining the SW Program. Program maintenance includes updates to Program procedures, inspection drawings / sketches and the SWS/FPS Master Inspection Program Plan.
b. Initiate repair or replacement of degraded components as necessary. Repair or Replacement of ASME Class 1,2, or 3 components shall be within the ASME Section XI Repair/Replacement Program.
c. Establish the frequencies for Radiography (RT) testing and inspection of SW piping components based on formulas and statistical methods identified in the "SWP" program procedure.
d. Identify piping components to be included in each years SW ISI RT inspection schedule.

e. Responsible for performing industry experience reviews every 2 years as a minimum and reporting this review per the requirements of the Fleet procedure.

7.2 Program Performance Indicators

Program performance indicators will provide a clear indication as to whether the ongoing activities outlined in this basis document are individually or collectively meeting the intent of the GL 89-13 recommended actions and, therefore, the objectives of the GL 89-13 Program. The performance indicators are roughly broken down into categories that match the GL 89-13 recommended actions.

The GL 89-13 Program is demonstrated as effective and meeting the intent of GL 89-13 recommended actions if:

7.2.1 Biofouling Control (ref. 8.13)

a. Performance of credited ongoing activities give no indications of excessive biofouling activity that would significantly degrade the performance of safety-related or important to safety functions of the service water systems included in the scope of the program.
b. The chemical feed system (Chlorine and Copper Ion) is maintained at a high level of reliability and availability.
c. Performance of credited ongoing activities give no indications of excessive fouling of heat transfer surfaces that would significantly degrade the performance of safety-related or important to safety functions of the service water systems included in the scope of the program.

7.2.2 Erosion/Corrosion Control

Performance of credited ongoing activities give no indications of a loss of system or component pressure boundary integrity due to erosion and/or corrosion that have gone undetected to the point of degrading the performance of safety-related or important to safety functions of the service water systems included in the scope of the program. The number of recorded through wall pinhole leaks must meet the service water system's maintenance rule goal.

7.2.3 Flow Blockage Control

Performance of credited ongoing activities consistently demonstrates the ability of the Safety Related Service Water system to supply the required flow to all safety-related and important to safety components in the system.

7.2.4 Program Implementation

a. Credited ongoing activities are completed at the specified frequency.
b. Results of the credited ongoing activities are effectively trended to identify adverse trends in biofouling activity, heat transfer capability, flow blockage, and pressure boundary erosion and/or corrosion.
c. Prompt corrective actions are taken to address adverse trends in biofouling activity, heat transfer capability, flow blockage, pressure boundary erosion and/or corrosion.
d. Program effectiveness is routinely checked through periodic reviews.

7.3 Program Reporting

The GL 89-13 Program Document will be reviewed annually to ensure that the information in this document accurately reflects the actions taken at PBNP. The Heat Exchanger Coordinator, the Service Water System Engineer, the Biofouling Control Program Administrator and the Service Water Program Owner (Program Owners) will summarize their specific GL 89-13 program activities each year. This information will be submitted in the form of an annual report to the Program Administrator. The reports will include the applicable information listed below. The individual program owner reports should be issued to the Program Administrator within 45 days after the last day of each calendar year.

The GL 89-13 Program Administrator will conduct a general review of the GL 89-13 program document implementation. The Program Owner annual reports will also be reviewed and summarized. A condition report shall be initiated to document any major deficiencies identified during the review. The results of the reviews shall be documented in a GL 89-13 Annual Report that should be issued to the Site Engineering Director within 90 days after the last day of each calendar year.

The Program Administrator annual reports will discuss the plant performance areas related to GL 89-13. These will include the following as applicable:

- Reports and discussion for any blockage found in the safety related portion of the service water system.
- Results of biofouling program related to the GL 89-13 piping and components.
- Reports and discussion for any degradation found in GL 89-13 piping due to erosion/corrosion/cavitation
- Results for inspection activities for the service water system piping
- Results for heat exchanger performance testing for GL 89-13 heat exchangers.
- Results of cleaning and inspections performed for GL 89-13 heat exchangers.
- Overall analysis of the program effectiveness and recommendations for changes to the future program implementation.

8.0 REFERENCES

8.1 U.S. NRC Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment"

8.2 Point Beach Letter, VPNPD-90-027, "Response to Generic Letter 89-13 Safety-Related Service Water Problem Point Beach Nuclear Plant"

8.3 U.S. NRC Generic Letter 89-13, Supplement 1, "Service Water System Problems Affecting Safety-Related Equipment"

8.4 Point Beach Letter, VPNPD-90-474, "Update on Generic Letter 89-13 Service Water System Problems Affecting Safety-Related Equipment Implementation Schedule"

8.5 Point Beach Letter, VPNPD-91-013, "Update on Generic Letter 89-13 Spent Fuel Pool Heat Exchangers"

8.6 NRC Inspection Report, NPC 93-02873, "Service Water System Operational Performance Inspection"

8.7 Point Beach Final Safety Analysis Report (FSAR)

8.8 Point Beach Fire Protection Evaluation Report (FPER)

8.9 Point Beach Design Basis Document, DBD-12 Service Water

8.10 Point Beach Design Basis Document, DBD-02 Component Cooling Water

8.11 NUREG/CR-5210

8.12 NP 7.7.15, Biofouling Control Methods

8.13 AM 3-19, Zebra Mussel Control Program

8.14 DG-CH01, Zebra Mussel Tracking and Evaluation Guide

8.15 NMC Program Engineering Fleet Procedure FP-PE-SW-01,"Service Water and Fire Protection Inspection Program"

8.16 NMC Corporate Directive CD 5.25, "Generic Letter 89-13 Standard"

8.17 HX-01, Heat Exchanger Condition Assessment Program

8.18 Service Water Inspection Program

8.19 CCE 2001-001, Containment Fan Coolers

8.20 CCE 2001-002, Fire Protection System Emergency Back-up to the Aux FW Pumps

8.21 CCE 2001-003, CCW Heat Exchangers

8.22 CCE 2001-004, Discharge Flumes & Intake Structure

8.23 CCE 2001-005, Forebay

8.24 CCE 2001-010, Auxiliary Feedwater Pump & Turbine Cooling

APPENDIX A
ACTION I ITEMS SUMMARY AND DATA SHEETS

Summary:

Unit	Equipment ID	System	Description	Activity ID	Frequency
O	Intake Crib	CW	Lake Michigan Intake Structure	C-A-1 and C-A-2	Annual
1 & 2	N/A	CW	Lake Michigan Discharge Flume	C-R RMP 9155-1,2,3,4	At least every 5 years
1 & 2	U1/2 – Forebay	CW	PBNP Forebay	M-OD RPM 9155-1,2,3,4	At least every 5 years
1 & 2	N/A	N/A	Biofouling Control Program	AM 3-19 NP 7.7.15 DG-CH01	Ongoing
0, 1 & 2	HX-012A/B/C/D	CC	Component Cooling Water Heat Exchangers Blowdown Frequency	SOP-CC-001	Per procedure
1 & 2	P-029	FP	Auxiliary Feedwater Turbine Pump Fire Water Cooling Water	OT PC-73 Part 6	Yearly

APPENDIX A
ACTION I ITEMS SUMMARY AND DATA SHEETS

Unit: 0 **Equipment ID:** INTAKE CRIB **System:** CW

Description: Lake Michigan Intake Structure

Activity Type: Callup **Activity. ID:** C-A-1 and C-A-2 **Activity Owner:** CE

Procedure: Per callup text **Frequency:** Annual

Safety-Related Function:
None

Basis:
PBNP's response to GL 89-13 Action I requires inspecting the outside of the intake crib for macroscopic biofouling and corrosion. The outside of the intake crib was selected since the water conditions which promote zebra mussel attachment will not vary significantly between the inside and the outside of the intake structure. Therefore, by inspecting the outside of the intake structure for mussel intrusion the presence of mussels inside the structure can be determined. This method is safer for divers than visually inspecting the inside.

The intake crib has been recently modified to eliminate impact to migratory birds that were using the structure to roost. The structure was changed as part of modification MR 01-001. This change removed the upper portion of the structure down to approximately 11 feet off of the lakebed. The remaining 60 foot diameter intake opening has had a trash rack added. The intake crib inspection will continue to be performed for the outside portion of the remaining structure.

Implementation:
The intake crib inspection for macroscopic biofouling and corrosion were added to the annual intake crib fish screen installation and removal callups:, C-A-1 and C-A-2, respectively. The intake crib inspection and screen installation are performed by diving contractors with the removal of zebra mussels as required. Results of the inspection are to be recorded in the callup work orders.

References:
Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment"
PBNP Letter, VPNPD-90-027, "Response to GL 89-13"
DG-CH01, "Zebra Mussel Tracking and Evaluation"
FSAR Section 2.7
Callup ID C-A-1 under Equipment ID Intake Crib
Callup ID C-A-2 under Equipment ID Intake Crib
Modification MR 01-001

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Unit: 1/2 **Equipment ID:** N/A **System:** CW
Description: Lake Michigan Discharge Flume
Activity Type: Callup **Activity. ID:** M-OD **Activity Owner:** MM
Procedure: RMP-9155- 1,2,3,4 **Frequency:** At least every 5 years

Safety-Related Function:
None

Basis:
PBNP's response to GL 89-13 Action I requires inspecting the Unit 1 and Unit 2 discharge flumes for macroscopic biofouling. The discharge flumes were selected as a result of the warmer water conditions, which would provide zebra mussels, a preferred site for attachment. Therefore inspection of the discharge flumes would provide a good indicator of PBNP biological fouling.

Previous inspections of the discharge flumes have shown that due to higher flow velocities zebra mussel intrusion and subsequent mussel growth is minimal and is rarely if ever specifically cleaned due to zebra mussel growth.

Implementation:
Inspection of the discharge flumes was incorporated into the Unit 1 and Unit 2 Forebay inspections. The inspection is performed at least every 5 years per CCE 2001-004 via a periodic callup, M-OD on equipment ID U1-Forebay and U2-Forebay, the callup is controlled by Routine Maintenance Procedure, RMP-9155-1,2,3,4, "Diver Inspection of Pumphouse." The procedure requires both an inspection and removal of debris as required. Results of these inspections are recorded in the callup work orders and a copy of the results forwarded to the PBNP Biofouling Control Program Coordinator.

References:
Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment"
PBNP Letter, VPNPD-90-027, "Response to GL 89-13"
DG-CH01, "Zebra Mussel Tracking and Evaluation"
FSAR Section 2.7
Callup ID C-R under Equipment ID U1-Forebay
Callup ID C-R under Equipment ID U2-Forebay
CCE 2001-004
RMP-9155- 1,2,3,4 "Diver Inspection of Pumphouse"

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ACTION I ITEMS SUMMARY AND DATA SHEETS

Unit: 1/2 **Equipment ID:** U1/2-FOREBAY **System:** CW

Description: PBNP Forebay

Activity Type: Callup **Activity. ID:** M-OD **Activity Owner:** MM

Procedure: RMP-9155-1,2,3,4 **Frequency:** At least every 5 years

Safety-Related Function:
None

Basis:
PBNP's response to GL 89-13 Action I requires inspecting the facilities forebay and pumphouse for macroscopic biofouling and silt. The inspection is for inspection and removal of excessive debris, which may impede the ability of the SW System to provide continuous water to safety-related systems, structures, or components.

Implementation:
The inspection for zebra mussels was incorporated into the forebay and pumphouse. The inspection is performed at least every 5 years and is controlled by a Routine Maintenance Procedures, RMP-9155-1,2,3,4, "Diver Inspection of Pumphouse." The procedure requires both an inspection and removal of debris as required. Results of these inspections are recorded in the RMPs associated work order and a copy of the results are forwarded to the PBNP Biofouling Control Program Coordinator.

References:
Generic Letter 89-13, " Service Water System Problems Affecting Safety-Related Equipment"
PBNP Letter, VPNPD-90-027, "Response to GL 89-13"
DG-CH01, "Zebra Mussel Tracking and Evaluation"
FSAR Section 2.7
Callup ID C-R under Equipment ID U1-Forebay
Callup ID C-R under Equipment ID U2-Forebay
CCE 2001-005
RMP-9155-1,2,3,4, "Diver Inspection of Pumphouse"

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ACTION I ITEMS SUMMARY AND DATA SHEETS

Unit: 1/2 **Equipment ID:** N/A **System:** N/A
Description: **Biofouling Control Program**
Activity Type: N/A **Activity. ID:** N/A **Activity Owner:** Biofouling CPA
Procedure: NP 7.7.15 & AM 3-19 **Frequency:** N/A

Safety-Related Function:
The Zebra Mussel Control Methods utilized at PBNP are directly applied to the SW System for mussel control and eradication to prevent fouling of safety-related components. The SW system shall provide sufficient flow to support the heat removal requirements of components required to mitigate the consequences of a LOCA in one unit, while supporting the normal flow of the unaffected unit (FSAR Section 9.6).

Basis:
PBNP's response to GL 89-13 Action I requires PBNP utilize current research data and information from industry peers to determine the appropriate zebra mussel control method using the chlorination system or an alternate system. In 1990 all Wisconsin Electric generating facilities created a corporate task force to discuss and develop methods for controlling zebra mussels at this time zebra mussel infestation had not been observed at PBNP. Point Beach began a zebra mussel monitoring program, which included substrate sampling of the forebay and biobox installation in the SW and CW system piping. The monitoring program first observed zebra mussels at PBNP in 1992.

Concurrent with the monitoring efforts PBNP modified its Chlorination System to allow for chlorination to the intake structure for mussel control. Until the discovery of mussel intrusion the PBNP chlorination system was primarily used for microscopic biofouling control (MIC) through the use of intermittent sodium hypochlorite injections. After mussel intrusion was discovered PBNP attempted to control mussel intrusion using 3 week long continuous sodium hypochlorite injection due to the mussels capability of self-isolation. The attempts to use the chlorination system in a continuous manner failed. The reason for failure was due to increased levels of halogenated hydrocarbons entering the steam generators via the water treatment (WT) system. WT is supplied by SW and does not have the ability to remove the halogenated hydrocarbons. The increase in halogenated hydrocarbons increases the possibility of free chlorine attack on the steam generators. Therefore continuous chlorination was rejected and the chlorination system is used for microscopic biofouling control. Use of the Chlorination System is controlled under CAMP 909 and CAMP 909.1 through CAMP 909.12.

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As a result of mussel intrusion and failed continuous chlorination PBNP performs periodic mussel treatments. These treatments are intended to eradicate any living mussels within the SW System. The treatments consist of injecting a known mussel poison such as chlorine dioxide or other biocides such as EVAC as allowed by the PBNP Wisconsin Pollutant Discharge Elimination System (WPDES) Permits. The treatments are to be performed as directed by the Biofouling CPA to ensure that safety-related components within the SW System are not affected. This is accomplished by treating the SW System prior to adult mussels growing larger than critical component dimensions.

A 1998 INPO plant evaluation identified concerns with the PBNP zebra mussel control program. Specifically, INPO identified reoccurring biofouling of the EDG glycol coolers and CFCs making both components inoperable and differing plant personnel viewpoints on mussel intrusion have led to an ineffective mussel control program. In response PBNP established a formal zebra mussel control program to better trend mussel intrusion, evaluate periodic control techniques, and modify mussel control methods as required to reduce the effects of mussel intrusion on critical plant components.

In late 2001, an additional treatment system was added to the service water system under modification MR 98-024*O. This system adds water that has been processed through copper ion treatment cells. This treated water is injected into the north and south service water system headers at the strainer bypass lines. This treated water reduces the likelihood of zebra mussels attaching to piping downstream of the treatment.

Implementation:
The Zebra Mussel Control Program is documented under AM 3-19, NP 7.7.15, and DG-CH01. These procedures document the personnel involved with Zebra Mussel control strategies at PBNP, the control method(s) utilized, and the zebra mussel information collection and evaluation techniques.

References:
Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment"
PBNP Letter, VPNPD-90-027, "Response to GL 89-13"
IEV 98-EQ.1-1, "1998 Plant Findings"
AM 3-19, "Zebra Mussel Control Program"
DG-CH01, "Zebra Mussel Tracking and Evaluation".
NP 7.7.15, "Biofouling Control Methods"
FSAR Section 2.7
CAMP 909.0 - 909.12

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ACTION I ITEMS SUMMARY AND DATA SHEETS

Unit: 0/1/2 **Equipment ID:** HX-012A/B/C/D **System:** CC

Description: Component Cooling Water Heat Exchangers Blowdown Frequency

Activity Type: N/A **Activity. ID:** N/A **Activity Owner:** OPS

Procedure: SOP-CC-001 **Frequency:** Per Procedure

Safety-Related Function:
The CCW heat exchangers shall transfer heat from the CC System to the SW System to support CC System safety-related functions. These CC System safety-related functions include transferring heat from:

Residual Heat Removal (RHR) heat exchangers during containment sump recirculation,
RHR and Safety Injection (SI) pump seal coolers during containment sump recirculation,
RHR heat exchangers to mitigate a MSLB or SGTR.

Basis:
PBNP's response to GL 89-13 Action I required a review of the CC heat exchanger blowdown frequency. Cooling water to the CC heat exchanger is supplied by SW. The SW system is an open-cycle service water system as defined in GL 89-13. Therefore, cooling water supplied to the heat exchanger tubes is Lake Michigan water and may introduce fouling agents into the heat exchangers, such as silt and zebra mussels.

Blowdown of the heat exchanger reduces the probability of flow blockage as a result of fouling agents by flushing out the accumulated silt that settles in the heat exchanger inlet and outlet channel to prevent the silt layer from building up. This prevents the creation of a stagnant layer where biofouling growth could occur and it prevents the silt from building to a level where the lower tubes are blocked off from Service Water flow, which would both reduce the available tubes in service and provide a stagnant flow area in those tubes where biofouling growth could occur.

Implementation:
Blowdown of the CC heat exchangers is performed using Standard Operating Procedures, 1-SOP-CC-001 and 2-SOP-CC-001, for each unit. The procedure controls the frequency of blowdown as required by plant conditions.

References:
Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment"
PBNP Letter, VPNPD-90-027, "Response to GL 89-13"
1-SOP-CC-001, "Component Cooling System"
2-SOP-CC-001, "Component Cooling System"
DBD-02, "Component Cooling Water"

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ACTION I ITEMS SUMMARY AND DATA SHEETS

Unit: 1/2 **Equipment ID:** P-029 **System:** FP

Description: Auxiliary Feedwater Turbine Pump Fire Water Cooling Water

Activity Type: Callup **Activity ID:** OT **Activity Owner:** FP

Procedure: PC-73 Part 6 **Frequency:** Yearly

Safety-Related Function:
Each AFW pump shall automatically start and deliver adequate AFW System flow to maintain adequate steam generator levels during accidents which may result in steam generator pressure safety relief valve opening, accidents which require rapid cooldown to achieve the cold shutdown conditions within the limits of analysis, and accidents which require only long-term decay heat removal achieved by controlled steam dumping from the steam generators.

Basis:
PBNP's response to GL 89-13 Action I required a review and testing of FP water supply to the turbine driven AF pump bearing coolers. The FP supply to the bearing coolers is a normally isolated line and would be required to provide cooling flow to the turbine bearing coolers in the event of a SBO. FP supply water is directly supplied by Lake Michigan. Due to no flow conditions the line is susceptible to blockage caused by silt. Therefore the line is flushed annually to verify flow to the bearing coolers can be achieved.

Zebra mussel infestation of the FP system has not been identified at PBNP. This is expected since testing of the line is performed during chlorination or during cold lake water periods with lake temperatures below 45°F. In addition the FP system is not a continuous flow system. Flow is established during functional testing and then secured. Therefore it is expected that biofoulers introduced into the system would not be supplied a food source.

Implementation:
Flow verification of the FP supply to the turbine driven AF pumps is performed annually under PC 76 Part 6. The CCE 2001-002 Minimum frequency is once every 5 years.

References:
Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment"
PBNP Letter, VPNPD-90-027, "Response to GL 89-13"
PC 73 Part 6
DBD-01, "Auxiliary Feedwater"
CCE 2001-002

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Summary:

Unit	Equipment ID	System	Description	Method	Activity ID	Frequency
1 & 2	P-029-T	AF	Turbine Driven Auxiliary Feedwater Pump Turbine	Clean & Inspect turbine bearing coolers	Equipment PM	At least every 5 years
0, 1 & 2	HX-012A/B/C/D	CC	Component Cooling Water Heat Exchanger Performance Testing	Testing	OI 151/152	At least every 4.5 years
0	HX-055A-1/ A-2/B-1/B02	DG	Emergency Diesel Generator Coolant Heat Exchanger	Clean & Inspect	Equipment PM	At least Annual
0	HX-105A/B	VNBI	Primary Auxiliary Building Battery Room Vent Coolers	Clean & Inspect	Equipment PM	Annual Cooler Cleaning and Inspection
0	HX-013A/B	SFP	Spent Fuel Pool Heat Exchanger	Testing	OI-173	At least every 18 months
1 & 2	HX-015 D1 – D8	VNCC	Containment Accident recirculation Heat Exchanger	Testing	OI 130/131	Annual
1 & 2	HX-015 A,B,C,D	VNCC	CFC Motor Cooler	Clean & Inspect	Equipment PM	Refueling

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Unit: 1/2 **Equipment ID:** **P-029-T** **System:** AF

Description: **Turbine Driven Auxiliary Feedwater Pump (TDAFWP)**
Method: Clean / Inspect **Procedure:** Equipment PM
Frequency: Refueling

Safety-Related Function:
Each pump shall automatically start and deliver adequate AFW System flow to maintain adequate steam generator levels during accidents which may result in steam generator pressure safety relief valve opening, accidents which require rapid cool down to achieve the cold shutdown conditions within the limits of analysis, and accidents which require only long-term decay heat removal achieved by controlled steam dumping from the steam generators.

Basis:
PBNP's response to GL 89-13 Action II required functional testing of the auxiliary feedwater pumps, both steam driven and electrically driven, to verify the heat transfer capability of pumps for emergency conditions. The methodology used records the bearing oil temperatures during functional testing. The temperatures are then reviewed against the bearing coolers acceptance criteria. The vendor determined the method devised by PBNP was valid due to the design of the pumps and a lack of testing data on the style of pumps supplied to PBNP.

A PBNP Engineering Work Request, EWR 99-050, was written to determine if the SW cooling supply to the Motor Driven Auxiliary Feedwater Pumps (MDAFWP) was required. Information supplied by the Vendor in letter dated, Feb. 11, 2000, indicated that the style of pumps supplied to PBNP came with a standard water jacket in the stuffing boxes and bearing housings. However, cooling water to the stuffing boxes is required with a product temperature of 175°F or greater and is required to the bearing housings with a product temperature of 250°F or greater. Based on this information cooling flow to the pump stuffing boxes and bearing housings is not required. Therefore, the only cooling supply required is bearing cooling to the TDAFWP turbine bearing coolers.

A review of the TDAFWP bearing cooler testing methodology was reviewed under NUTRK item CR 99-2090. This review indicated that visual inspection with cleaning was a better method in determining bearing cooler fouling. This method was suggested by the vendor during initial discussions relating to GL 89-13 and was considered an acceptable alternative to testing based on guidance in GL 89-13 for bearing coolers.

CCE 2001-010 was filed to change to open and inspect, with an initial frequency of 18 months (refueling) until a satisfactory baseline trend is observed. Equipment PM M-R-1 was created to implement the inspection and cleaning.

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ACTION II ITEMS SUMMARY AND DATA SHEETS

Implementation:

Equipment PM M-R-1 to inspect inboard and outboard bearing oil coolers.

References:
Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment"
PBNP Letter, VPNPD-90-027, "Response to GL 89-13"
DBD-01, "Auxiliary Feedwater"
CR 99-2090
EWR 99-050
Flowserve Letter, dated February 11, 2000
Commitment Change Evaluation CCE 2001-010
Equipment PM M-R-1

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ACTION II ITEMS SUMMARY AND DATA SHEETS

Unit: 0/1/2 **Equipment ID:** HX-012A/B/C/D **System:** CC

Description: Component Cooling Water Heat Exchanger Performance Testing
Method: Testing **Procedure:** OI 151/152
Frequency: At least every 4.5 years

Safety-Related Function:
The CCW heat exchangers shall transfer heat from the CC System to the SW System to support CC System safety-related functions. These CC System safety-related functions include transferring heat from:

Residual Heat Removal (RHR) heat exchangers during containment sump recirculation,
RHR and Safety Injection (SI) pump seal coolers during containment sump recirculation,
RHR heat exchangers to mitigate a MSLB or SGTR.

Basis:
PBNP's original response to GL 89-13 Action II, required periodic cleaning and inspection using eddy current examinations and hydro lancing of the heat exchanger tubes. A review of PBNP's response to GL 89-13 was performed by the NRC during the 1993 Service Water System Operational Performance Inspection (SWSOPI). The SWSOPI team identified that due to low flow/velocity conditions of SW to the heat exchangers, heavy fouling may result in degradation of the heat exchanger capability to remove design heat loads. Therefore the NRC determined that testing of the heat exchangers was required to verify the heat transfer capability of the CC heat exchangers.

In response to the SWSOPI report PBNP committed to developing an approach for recording CC heat exchanger data for trending of the CC heat exchanger fouling factors and determination of heat transfer capability. Development of the testing methodology was tracked under IR 93-012 Action Number 2. The test procedure was developed by Power Generation Technologies (PGT) and the basis documented in TIN No. 97-1177. The testing methodology requires that a higher than normal operation heat load be available, specifically a unit cooldown evolution, on the CC heat exchanger to reduce test uncertainties. The collected data is then used to determine the heat exchangers fouling factor, which is in turn used to determine the heat exchangers heat, transfer capability at limiting design accident conditions.

CCE 2001-003 was filed to update our commitment to allow for performance testing, or frequent regular maintenance, to be performed on an appropriate frequency based on the results of the performance testing and in accordance with the time period guidance in GL 89-13.

By 2003 the baseline testing of the CCW HX's was complete with very good results (see below). As a result the maximum test frequency is being increased from every 1.5 Years (outage) to every 4.5 Years (3 outages). This is within the maximum allotted window of 5 years (CCE 2001-003).

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CCW Thermal Performance Test Results (Results in MBtu/Hr)

Acceptance Criteria 34.85 MBtu/Hr (EE 2001-0036)*

Test Uncertainty Acceptance Criteria 4.11 MBtu/Hr (PGT 2002-1270)**

		HX-012A		HX-012B		HX-012C		HX-012D	
Date	Calculation	Test Results	Test Uncertainty	Test Results	Test Uncertainty	Test Results	Test Uncertainty	Test Results	Test Uncertainty
Dec 98	PGT 99-1086					44.22	2.42	42.78	2.44
Oct 99	PGT 99-1416	45.30	2.35	43.78	2.34				
Oct 00	TIN 2000-1382 Rev 1 ***					45.49	2.52	44.93	2.53
Apr 01	PGT 2001-1180 TIN 2001-1643	45.53	2.52	43.74	2.52				
Apr 02	PGT 2002-1270					43.482	2.506	45.147	2.527
Sep 02	PGT 2003-1189	47.245	2.629	46.293	2.628				

* Original Acceptance Criteria was 36 MBtu/Hr (used for Dec 98 to Apr 01 test).
** Original Test Uncertainty Acceptance Criteria was 3.82 MBtu/Hr (Dec 98 to Apr 01 test).
*** Revision of this calculation used 34.85 & 4.11 Mbtu/Hr values.

Implementation:
OI-151, "HX-012C&D Component Cooling System Heat Exchanger Data Collection," and OI-152, "HX-012A&B Component Cooling System Heat Exchanger Data Collection," are used to performance test the CC heat exchangers per the requirements of TIN No, 97-1177, developed by PGT. The test ensure that the heat transfer capability of the heat exchangers is adequate to remove the required heat load at design limiting conditions as defined in TIN No. 97-1177.

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References:
Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment"
PBNP Letter, VPNPD-90-027, "Response to GL 89-13"
NPC 93-02873, "Service Water System Operational Performance Inspection"
PPL-0158, "Response to NRC SWSOPI Concern 93012-02"
IR 93-012
TIN No. 97-1177
OI-151, "HX-012C&D Component Cooling System Heat Exchanger Data Collection"
OI-152, "HX-012A&B Component Cooling System Heat Exchanger Data Collection"
DBD-02, "Component Cooling Water System"
Commitment Change Evaluation CCE 2001-003

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ACTION II ITEMS SUMMARY AND DATA SHEETS

Unit: 0 **Equipment ID:** HX-055A-1/A-2/B-1/B-2 **System:** DG

Description: **Emergency Diesel Generator Coolant Heat Exchanger (G01 & G02 only)**
Method: Clean/Inspect **Procedure:** Equipment PM
Frequency: At least Annual.

Safety-Related Function:
During a design basis accident and/or loss of offsite power, the Emergency Diesel Generator (EDG) Cooling System shall provide a means of removing heat from the diesel generator components and provide a means of cooling the combustion air after it has been compressed in the turbocharger to support operation of the EDG to carry its minimum required loads. (DBD-16 Section 3.5.1)

Basis:
PBNP's original response to GL 89-13 Action II required that the EDG coolant heat exchangers on G-01 and G-02 be monitored during functional testing. A direct calculation between the coolant/SW heat exchanger performance using flow rates cannot be performed since coolant flow is modulated to maintain a constant engine temperature and the location of the flow control valve does not allow for flow instrumentation. Therefore the original method monitored the heat exchangers SW outlet temperature, coolant/SW differential pressure, lube oil temperature, and coolant temperature. These parameters are trended since an increase in fouling would cause an increase in the engine coolant temperature once the thermostat reaches 100% open. Therefore an upward trend in coolant temperatures would require the heat exchangers to be inspected prior to their periodic inspections.

CR 97-1465 Action Number 1 identified that the current testing method to trend critical heat exchanger parameters is invalid since trending does not provide information on the heat transfer capability of the heat exchanger at design accident conditions. The only indication of degradation based upon the original trending method would be after the heat exchanger thermostat reached 100% and SW outlet temperature and engine coolant temperature were increasing. In addition, multiple plant records indicated that the heat exchangers were observed to have tube blockage caused by zebra mussel shell intrusion. As a result of CR 97-1465, the heat exchangers are required to be cleaned annually to limit the amount of fouling which could degrade heat exchanger performance.

Mod's 00-102/103 were installed in 2001 to complete the SW piping and strainer portion of Mod MR 97-026 that was previously canceled. This mod converted the Diesel Coolant HX's to constant SW flow.

HX-55 Lake weed fouling issues developed after conversion to full SW flow service. This was first identified in January 2002 (CAP001861) and was thought to be caused by the tube ends sticking out, such that they were "catching" the lake weed. Tube ends were trimmed under WO's 0205749, 50, 51, 52 in June (G0-1) and August (G0-2) of 2002. The extent of the lake weed fouling for the June and August cleaning were documented in CAP's 028437 and 029092. Note that the lake weed is technically a form of algae (Cladophora).

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In Dec. 2002 continuing lake weed fouling was identified, which persisted into 2003. Trimming the tube ends was not effective. CAP's 030353, 030499, 030640 and ultimately ACE 001157 were issued. The PBNP is currently cleaning every 12 weeks during the winter and every 4 weeks over the summer months to remove the lake weed fouling.

Replacement of the HX-55's with HXS not prone to lake weed fouling is currently in the design study phase.

Engineering Evaluation, EE 2003-0037 has been written to document the method of counting effective plugged tubes due to the lake weed fouling, in accordance with the requirements of the Heat Exchanger Condition Assessment Program for unusual fouling mechanisms that are not subject to counting by the simple method of observing a few plugged tubes.

CAP034989 was written August 18, 2003 concerning the issue that it appears that the PBNP commitment to the NRC was to monitor heat transfer capability, but that we are using inspect and clean to verify heat transfer capability (monthly functional testing has been shown to not be an indicator of HX fouling).

Commitment Change Evaluation (CCE) # 2003-005 issued in December 2003 changed the commitment to "The G-01 and G-02 Diesel Glycol Coolers will be inspected and maintained in accordance with guidance in Generic Letter 89-13 and Supplement 1. The Frequency will not be less than once every 5 years." However, due to known fouling issues, at this time (January 2004) the Diesel Coolers will be cleaned at least annually or more frequently as needed.

Implementation:
TS 81, "Emergency Diesel Generator G-01 Monthly," and TS-82, "Emergency Diesel Generator G-02 Monthly," are periodic Technical Specification tests utilized to verify operability of the EDGs monthly at current conditions. In addition to the monthly Technical Specifications surveillance, annual inspections with a hydro lance cleaning are performed by callup HX-HDYL001 under the associated heat exchanger equipment ID due to the inability to perform an accident design condition performance test. In addition, the HXs are opened for inspection and cleaned to remove lake grass on a more frequent basis per equipment PMs and/or Work Orders.

References:
Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment"
PBNP Letter, VPNPD-90-027, "Response to GL 89-13"
TS 81, "Emergency Diesel Generator G-01 Monthly"
TS-82, "Emergency Diesel Generator G-02 Monthly"
CR 97-1465
Callup ID HX-HDYL001 under Equipment ID HX-055A-1
Callup ID HX-HDYL001 under Equipment ID HX-055A-2
Callup ID HX-HDYL001 under Equipment ID HX-055B-1
Callup ID HX-HDYL001 under Equipment ID HX-055B-2
MR 97-026*A
MR 97-026*B
DBD-16, "Emergency Diesel Generator System"
EE 2003-0037, "Diesel Cooler Lakegrass Fouling Acceptance Criteria"
HX-01, "Heat Exchanger Condition Assessment Program"
CCE-2003-005

APPENDIX B
ACTION II ITEMS SUMMARY AND DATA SHEETS

Unit: 0 **Equipment ID:** HX-105A/B **System:** VNBI

Description: Primary Auxiliary Building Battery Room Vent Coolers
Method: Clean/Inspect **Procedure:** Equipment PM
Frequency: Annual

Safety-Related Function:
VNBI System cooling coils shall cool the air supplied to the area during accident conditions to maintain battery and inverter room temperatures below maximum allowable limits.

Basis:
PBNP's response to GL 89-13 Action II required that a method for monitoring the PAB battery room coolers be determined. Initially PBNP used performance testing to meet the requirements of GL 89-13. However during the 1993 Service Water System Operational Performance Inspection (SWSOPI) a number of deficiencies were identified with the functional testing. In response to the SWOPSI findings PBNP committed to review the testing methodology and acceptance criteria of the test. The reviewdetermined that instrument inaccuracies in conjunction with modeling difficulties would not allow the heat exchanger tube and fin material to be modeled accurately by PBNP which resulted in invalid testing.

There is conflicting information in the records on the reasons and thought process for actually changing to cleaning and inspection as attempts were made to improve the thermal performance test after the SWSOPI. Previously, this document cited parts of a 1999 memo NPM 99-0725 that states, in part, that the tubes were in good condition in 1996 after 5.5 years without cleaning, with a recommendation for a cleaning cycle of every 2 years.

However, the same memo indicates that scale was visible in the tubes and it appears that the authors of that memo did not consider scaled tubes a form of macro fouling. The recommendation for the 2-year cleaning interval was specifically to limit further scale buildup. CHAMPS WO records further indicate that the reason that the coolers were actually opened after 5.5 years of continuous operation is that the coolers could not maintain battery room temperature in warm weather (WO 935016 & 935017).

In addition Power Generation Technologies (PGT) developed a new thermal performance test during 1997 and 1998 that was accepted by PBNP but never implemented.

In February 2003 the scale issue was rediscovered during eddy current testing and documented in CAP031247. WO records indicate that the HX-105A/B tubes have observable scale that was getting worse since their first opening in 1996 (2 year cleaning was not sufficient to eliminate scale growth). An operability determination (OPR000046) initially determined that the coolers are operable, but degraded while the Service Water (SW) is below 70°F. Later calculations remove the degraded condition when it was calculated the tubes could be heavily scaled down the full length and still operate satisfactorily at 80 F SW (as long as we can get a 0.500" probe down the tubes; which is the eddy current probe size used in February on HX-105B). Airside fouling and fin air film effects dominates the overall fouling of a water-cooled air coil such that tube ID fouling has minimal effect on the overall heat transfer capabilities of the coil.

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The cleaning interval was changed to annual and special scale removal tube cleaning tools were acquired to remove the scale (HX-105A descaled in May 2003).

The June 2003 closeout of CA000399 (CR 00-1566 / CAP000195) answered the questions related to the decision to cancel the PGT developed thermal performance test. Review of the history and the developed PGT test indicated that the actual decision to cancel the test and move to clean and inspect was the right decision, but not for any of the reasons used to justify canceling the test in 1999. It would probably not be possible to do a thermal performance test of the battery room coolers due to the fact that it would be very unlikely that you would get warm enough SW for adequate turbulent tube flow, and low humidity for non-condensing coil operation except for a few random days each year. The SW is too cold in the winter for the necessary turbulence when there is low humidity, and the humidity is normally too high during the warm SW portions of the summer for non-condensing operation of the cooling coils. Turbulence is affected by fluid temperature, and is critical in this case.

Implementation:
Each heat exchanger is cleaned and inspected every year under the associated equipment callup. The callup requires that the heat exchanger be inspected and documented prior to any cleaning.

References:
Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment"
PBNP Letter, VPNPD-90-027, "Response to GL 89-13"
NPC 93-02873, "Service Water System Operational Performance Inspection"
PBNP Letter, PBL-0163, "Response to NRC SWSOPI Concern 93012-05"
NPM 99-0725
Equipment Callup HX-HDYL001 under HX-105A/B
DBD-29, "Auxiliary Building and Control Building HVAC"

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Unit: 0 **Equipment ID:** HX-013A/B **System:** VNBI

Description: Spent Fuel Pool Heat Exchanger

Method: Testing **Procedure:** OI 173

Frequency: At Least Once Every 18 months

Safety-Related Function:
The Service Water System shall provide water to the spent fuel pool cooling heat exchangers to provide adequate decay heat removal from these safety-related heat exchangers. In Response to NRC Generic Letter 83-28, WE upgraded the classification of the Spend Fuel Pool Cooling function to safety-related. Based on its direct supporting function, Service Water piping which serves the SFPC System was also classified as safety-related. [Ref DBD-12]

Basis:
PBNP's original response to GL 89-13 Action II required that the Spent Fuel Pool (SPF) Heat Exchangers be instrumented for monitoring the heat transfer capability. MR 90-056*B installed the required instrumentation and a performance test was created. During the 1993 Service Water System Operational Performance Inspection (SWSOPI) a number of deficiencies were identified with the initial performance test. In response to the SWOPSI findings PBNP committed to review the testing methodology and acceptance criteria of the test. The review determined that due to the low heat load established during testing instrument inaccuracies were compounded causing the calculated heat transfer to be erroneous.

The test protocol at the time, IT 11A, was improved by raising SF Pool temperature, increasing SW flow rate, and utilizing more accurate temperature indication.

CR 01-3590 (CAP001413) documented that IT 11A did not properly implement the test methodology from ASME OM-S/G Part 21 and did not properly account for instrument inaccuracies. CA002590 tracked the development of the replacement test protocol.

To meet current EPRI standards, Power Generation Technologies (PGT) developed a new test protocol; TIN No. 2002-1606. IT-11A was retired and replaced by OI 173 for the heat exchanger operations part of the thermal performance test. One part of the IT 11A that did not carry over to OI 173 was the stated IT 11A requirements to meet INPO SOER 84-01. SOER 84-01 was one of the early industry action items on service water fouling of heat exchangers, and it applied to all of the safety related SW cooled hear exchangers. This was a precursor to GL 89-13. PBNP management decided in MSSM 89-19 that all SOER 84-01 action items would be addressed under GL 89-13. Review of SOER 84-01 and GL 89-13 indicates that GL 89-13 covers all aspects of the SOER issues.

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Implementation:
OI-173 "Performance Test For Spent fuel Pool Heat Exchangers HX-13A/B". Starting in 2003 with the PGT test protocol, the performance test is performed at least once every 18 months (a fuel cycle) until a suitable 3-test baseline is developed that would warrant an extension of the test period. Any change in the test period beyond 18 months will require an engineering evaluation or calculation to support the new test period and an update to this section.

References:
OI-173, "Performance Test for the Spent Fuel Pool Heat Exchangers HX-13A/B"
ASME OM-S/G-1994 Part 21, "Inservice Performance Testing of Heat Exchangers in Light-Water Reactor Power Plants"
PGT TIN NO. 2002-1606, "Test Protocol Point Beach Nuclear Plant Spent Fuel Pool Heat Exchangers"
FSAR Section 9.9, "Spent Fuel Cooling & Filtration"
DBD-12

APPENDIX B
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Unit: 1/2 **Equipment ID:** HX-015D1-D8 **System:** VNCC

Description: Containment Accident Recirculation Heat Exchanger
Method: Testing **Procedure:** OI 130/131
Frequency: Annual

Safety-Related Function:
The containment accident recirculation heat exchangers shall remove heat from containment following a loss of coolant accident or main steam line break inside containment, to maintain the containment below its design pressure and temperature.

Basis:
PBNP's original response to GL 89-13 Action II required that "D" containment accident recirculation heat exchangers on both Unit 1 and 2 be instrumented and performance tested annually for maintaining heat transfer capability. MR 90-056*A and D installed the required instrumentation and a performance test was created. The "D" heat exchanger in each containment was selected as a representative heat exchanger of the system. Testing a representative heat exchanger is considered acceptable as stated in Supplement 1 to GL 89-13.

The 1993 Service Water System Operational Performance Inspection identified that the initial test results were not repeatable and differed by as much as a factor of 1.4, negative fouling factors were calculated, and the pressure drop for a fouled cooler was less than that of a clean cooler. PBNP committed to reviewing the performance test methodology and acceptance criteria.

On November 15, 1995, PBNP received NRC Inspection Report, IR 95-011. The report identified that performance testing results determined inadequate heat transfer of the "D" heat exchanger during limiting design conditions and were disregarded due to assumed uncertainties associated with the test. In response to the NRC concerns documented in the report PBNP committed to pursue and evaluate improved test methods for the CFCs and pursue other means as allowed by GL 89-13 to ensure the heat exchanger's capability to remove its design basis heat load.

As a result of the PBNP review, an improved performance test was created by Power Generation Technologies for PBNP. The improved testing methodology increased the heat load during testing and utilizes more accurate instrumentation reducing test uncertainty. The performance test is used to determine the heat exchangers fouling factor which is in turn used to determine the heat exchangers heat transfer capability at limiting design accident conditions.

A 2001 review of our commitment indicated that the original commitment was to test every year, while GL 89-13 allows testing to be extended up to 5 years if a suitable baseline of tests exist. CCE 2001-001 was filed to update the commitment to allow testing frequencies to be extended within the guidance of GL 89-13, or frequent regular maintenance to be used, based on the results of performance testing.

In 2001/02 all containment accident recirculation heat exchanger coils were replaced with a new design. This resulted in the revision of the Power Generation Test protocol and the restart of a new annual baseline test series.

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In addition, while not part of the commitment PBNP is opening, inspecting and cleaning as necessary, the cooling coils every other outage in order to monitor fouling of the new cooling coil design.

Implementation:
OI 130, "Performance Test of 1HX-15D1-D8 Containment Fan Cooler," and OI 131, "Performance Test of 2HX-15D1-D8 Containment Fan Cooler," are used to verify that the containment accident recirculation heat exchangers are capable of meeting the required design basis heat transfer rate at the limiting design conditions. Additional fouling inspections are being performed under call up M-R3.

References:
Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment"
PBNP Letter, VPNPD-90-027, "Response to GL 89-13"
NPC 93-02873, "Service Water System Operational Performance Inspection"
PBNP Letter, PBL-0163, "Response to NRC SWSOPI Concern 93012-05"
NRC Inspection Report, NPC95-14170/IR 95-011
OI 130, "Performance Test of 1HX-15D1-D8 Containment Fan Cooler"
OI 131, "Performance Test of 2HX-15D1-D8 Containment Fan Cooler"
DBD-30, "Containment Heating and Ventilation"
MR 98-024 *J,K,X,Y
Commitment Change Evaluation CCE 2001-001
Callup M-R3

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Unit: 1/2 **Equipment ID:** HX-015A/B/C/D **System:** VNCC

Description: Containment Accident Recirculation Fan Motor Cooling Coils

Method: Clean & Inspection **Procedure:** Equipment PM

Frequency: Refueling

Safety-Related Function:
The containment accident recirculation fan motor cooling coils shall remove sufficient heat from the motor enclosures during normal operation to maintain motor pre-aging assumptions. The containment accident recirculation fan motor cooling coils shall remove sufficient heat following a loss-of-coolant accident or main steam line break inside containment to allow the motor to operate in the post-accident environment. (DBD 30 Section 3.10)

Basis:
No specific commitments were made for these coolers to the NRC. However, they are safety related coolers cooled by Service Water and they must function properly in order for the containment accident recirculation fans to function.

These coolers are open & inspected every outage to ensure no major fouling and to assess conditions. Thermal performance testing is not practical due to the design of the coolers.

Implementation:
Equipment PM's open, inspect, and clean if necessary every outage.

References:
Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment"
PBNP Letter, VPNPD-90-027, "Response to GL 89-13"

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Summary:

Unit	Equipment ID	System	Description	Method	Procedure	Frequency
0, 1 & 2	N/A	SW	Service Water Inservice Inspection Program	Program	Service Water Inservice Inspection Program	Ongoing
0,1 & 2	Various	SW	HX Degradation Inspection	Program	Heat Exchanger Condition Assessment Program	Per Procedure
0	HX-055A-1/ A-2/B-1/B-2	DG	Flushing of EDG Coolant Heat Exchanger alternate supply lines	Flushing of alternate supply lines	PC 43 Part 3	Quarterly
0, 1 & 2	P-029 and P-038 A/B	AF	Flushing of the AFW Pump SW Supply Piping	Flushing	PC 43 Part 5	Monthly
1 & 2	P-029 and	AF	Flushing of the Auxiliary Feedwater Terry Turbine Oil Bearing Coolers	Flushing	IT 08A and IT 09A	Quarterly
0, 1 & 2	HX-012A/ B/C/D	CC	Component Cooling Water Heat Exchangers Blowdown & Cleaning Frequency	Flushing per Normal Ops Clean & inspect	SOP-CC-001 Equipment PM	Per Procedure Per Equipment PM
0	HX-105A/B	VNBI	Primary Auxiliary Building Battery Room Vent Cooler Cleaning	Clean & Inspect	Equipment PM	Annual cooler cleaning and inspection
0	HX-105 A/B	VNBI	Flushing cross-connect lines for PAB Battery Room Coolers	Flushing	PC 43 Part 3	Quarterly
1 & 2	HX-015 A1-A8, B1-B8, C1-C8 and D1 – D8	VNCC	Flushing of the Containment Accident Recirculation Heat Exchangers	T.S. Flow Testing	TS 33/34	Monthly
1 & 2 (new style)	HX-015 A/B/C/D	VNCC	Flushing of the Containment Accident Recirculation Fan Motor Cooling Coils	Flushing	PC24 TS 33/34	Quarterly
0	HX-013 A/B	SFP	Spent Fuel Pool Heat Exchangers	Flushing	PC43 Part 3	Quarterly

APPENDIX C
ACTION III ITEMS SUMMARY AND DATA SHEETS

Unit: 0/1/2 **Equipment ID:** N/A **System:** SW
Description: **Service Water Inservice Inspection Program**
Method: Program **Procedure:** Service Water Inservice Inspection Program
Frequency: Varies

Safety-Related Function:
The Service Water (SW) System shall provide sufficient flow to support the heat removal requirements of components required to mitigate the consequences of a Loss of Coolant Accident (LOCA) in one unit, while supporting the normal flow of the unaffected unit. Although SW is required to mitigate other plant accidents as well, a LOCA combined with normal operation of the unaffected unit is the most limiting event for the heat load imposed on the SW System.

Basis:
PBNP's response to GL 89-13 Action III required that representative areas of the SW System be inspected for degradation based on susceptibility to corrosion, erosion, and silting. The primary inspection method utilized at PBNP to detect and measure piping degradation is Tangential Radiography. Ultrasonic or remote visual inspection methods are also used when necessary to compliment radiography. SW inspection is controlled by the Service Water Inservice Inspection Program (SW ISI).

Tangential Radiography was selected as the primary method of inspection over other NDE techniques for a variety of reasons. These include the ability to inspect both insulated and bare piping for internal piping degradation due to internal corrosion by nodule growth, cavitation, and erosion; the ability to inspect insulated piping for exterior corrosion, and the ability to inspect piping for flow blockage due to sedimentation, silt, and nodule growth with one primary examination method.

Examination locations are selected by the SW ISI Program coordinator based upon portions of the SW System susceptible to degradation including low flow piping sections, stagnant flow sections, and high velocity sections. Results from the examinations are recorded in a SW ISI database. The database is used to document shot locations taken, wall thinning observed, blockage observed, and record corrective actions taken on problem areas observed during examination, as necessary.

In 2000 a new Service Water database was created and populated with a representative sample of piping components from the systems known to be susceptible to wall thinning and Flow Blockage. The initial examination sample size was based on approximately 10 percent of the total piping in the susceptible systems. The selection of the components locations was based on the following:

1. the evaluation of historical inspection locations and the RT inspection results contained in the previous Paradox software SW Database.
2. the selection of additional new locations identified during system engineer walk downs using current industry criteria as identified in the Service Water Program Document.

Beginning in 2000, Service Water inspections were performed on a quarterly basis in order to establish a current baseline for all of components in the initial population of components being monitored.

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With the completion of the June and December, 2002 inspections, all of the database components which were included in the Service Water ISI Program representative sample have been inspected at least one time since 2000. Some of the components in this population have received up to two follow-on inspections in that same time frame. With the inspection of the initial sample completed, the Service Water Program will now use this baseline data to identify and refine the normal inspection rotation schedule for future follow-on inspections and piping component monitoring. It will no longer be necessary to schedule quarterly inspection for the sole purpose of completing the "initial inspection" of the components in the database. The normal inspection rotation (based on past inspection results) for the individual components in this database, along with the selection of any new components, will make up the population of component samples scheduled for future Service Water RT inspection cycles.

The program generally complies with the NMC requirements specified in the Corporate Directive CD 5.17. The Program Engineering Fleet Procedure FP-PE-SW-01 was issued for use at PBNP in 2003 as NP 7.7.22. The SWP will be revised to augment the NP 7.7.22 by addressing the PBNP site specific administrative and regulatory commitments.

Implementation:
The SW Inspection Program uses NDE methods, primarily tangential radiography, to inspect for system degradation due to corrosion, erosion, cavitation, and flow blockage. The results of these inspections are recorded in the SW database for tracking of shot locations and corrective work required on identified problem areas. Follow-on inspections are based on predictive methodology formulas for component remaining time to specific wall loss and flow blockage limits identified in the PB Service Water Inspection Program document.

References:
Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment"
PBNP Letter, VPNPD-90-027, "Response to GL 89-13"
Service Water Inservice Inspection Program
Glen Spiering Report, "Assessment of the Service Water Inspection Program for PBNP"
NMC Corporate Directive CD 5.17 "Flow Accelerated Corrosion and Service Water Inspection Program Standard"
PBNP NP 7.7.22 "NMC Program Engineering Fleet Procedure FP-PE-SW-01 "Service Water and Fire Protection Inspection Program"

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Unit: 0/1/2 **Equipment ID:** **Various HX's** **System:** SW

Description: **Heat Exchanger Condition Assessment Program**

Method: Program **Procedure:** Heat Exchanger Condition Assessment Program

Frequency: Varies

Safety-Related Function:
The Service Water (SW) System shall provide sufficient flow to support the heat removal requirements of components required to mitigate the consequences of a Loss of Coolant Accident (LOCA) in one unit, while supporting the normal flow of the unaffected unit. Although SW is required to mitigate other plant accidents as well, a LOCA combined with normal operation of the unaffected unit is the most limiting event for the heat load imposed on the SW System.

Basis:
PBNP's response to GL 89-13 Action III required that representative areas of the SW System be inspected for degradation based on susceptibility to corrosion, erosion, and silting. The Service Water Inspection Program specifically excludes the monitoring of components for material degradation and references the PBNP heat exchanger program for monitoring of heat exchangers.

The primary inspection methods used for heat exchanger degradation monitoring are eddy current testing and visual inspection for general corrosion. More specialized testing or other inspection techniques may be used for specific situations on a case-by-case basis.

Examination scope and frequency is determined by the Heat Exchanger Condition Assessment Program Engineer based on component condition and history. Eddy current testing is typically a long term trending program with specific trend data being maintained in the individual eddy current reports, although the Heat Exchanger Condition Assessment Program contains section for summary history and recommendations for each heat exchanger.

Implementation:

The Heat Exchanger Condition Assessment Program uses NDE methods; primarily eddy current testing and general visual inspection to inspect heat exchanger end bells and tubes for corrosion, erosion, or tube pitting.

The following GL 89-13 HX's are inspected for tube degradation:

HX-012A/B/C/D	CCW
HX-013A/B	Spent Fuel Pool Cooler
HX-055A-1/2 & B-1/2	G01/G02 Glycol Coolers
HX-105A/B	PAB Battery Room Coolers

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Concerns with degradation of end bells or unusual tube degradation are documented via CAP and long-term eddy current trends are maintained in the individual eddy current reports.

References:
Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment"
PBNP Letter, VPNPD-90-027, "Response to GL 89-13"
Service Water Inservice Inspection Program
Heat Exchanger Condition Assessment Program

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Unit: 0 **Equipment ID:** HX-055A-1/A-2/B-1/B-2 **System:** DG

Description: Flushing of the EDG Coolant Heat Exchanger Alternate Supply Lines

Method: Flushing **Procedure:** PC 43 Part 3

Frequency: Per Procedure

Safety-Related Function:
During a design basis accident and/or loss of offsite power, the Emergency Diesel Generator (EDG) Cooling System shall provide a means of removing heat from the diesel generator components and provide a means of cooling the combustion air after it has been compressed in the turbocharger to support operation of the EDG to carry its minimum required loads. (DBD-16 Section 3.5.1)

Basis:
CR 00-0267 expressed concerns of sedimentation and silt on safety-related SW components. The associated Operability Determination provided information on the methods used at PBNP to minimize the impact of silt and sedimentation. As a result of the CR 00-0267 it was decided that the practices used to minimize the impact of sedimentation and silt at PBNP be summarized in the GL 89-13 Background Document for a single point of reference.

The completion of Mod's 00-102/103, which completed the previously canceled Mod MR 97-026 MR 97-026*A and *B converted the Emergency Diesel Generator (EDG) heat exchangers to full flow operation with water velocities greater than 3ft/sec. The heat exchangers are opened for inspection at least annually and no tube blockage due to sedimentation or silting has been observed. Also, the previously observed growth of biofouling in the heat exchanger endbells, due to stagnant water, has not been observed since the conversion to full flow. The heat exchanger tubes are cleaned at least annually to prevent the formation of scale in the tubes. As such, flushing of the Diesel Coolers is no longer required.

The conversion to full flow operation has identified the issue of "lakegrass" type fouling of the tubesheet (Cladophora algae). This has resulted in much more frequent opening and cleaning of the heat exchangers while redesigned heat exchangers are being pursued. For more details see the discussion in Appendix B as this affects thermal performance.

Each set of Diesel Coolers have an alternate SW Supply line, and these alternate supply lines are subject to sedimentation and fouling.

On a quarterly basis, the alternate supply lines are flushed per Periodic Callup PC 43 Part 3. This quarterly flushing activity will introduce full flow (i.e. > 3 ft/sec) through the alternate supply lines to both the G01 and G02 EDG H/X to remove any silt and sedimentation that may have settled out to help ensure the alternate lines are ready to perform their function if needed.

Implementation:
PC 43, Part 3 establishes sufficient flow velocities in the alternate SW supply lines to ensure that sedimentation does not affect that capacity of these lines to function when needed.

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References:
CR 00-0267

PC 43 Part 3
DBD-16, "Emergency Diesel Generator System
MR 97-026*A and *B, Installation of new duplex strainers.
Mod 00-102/103

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Unit: 0/1/2 **Equipment ID:** **P-029 and P-038A/B** **System:** AF

Description: **Flushing of the AFW Pump SW Supply Piping**

Method: Flushing **Procedure:** PC 43 Part 5

Frequency: Per Procedure

Safety-Related Function:
Each pump shall automatically start and deliver adequate AFW System flow to maintain adequate steam generator levels during accidents which may result in steam generator pressure safety relief valve opening, accidents which require rapid cooldown to achieve the cold shutdown conditions within the limits of analysis, and accidents which require only long-term decay heat removal achieved by controlled steam generator dumping from the steam generators.

Basis:
CR 00-0267 expressed concerns of sedimentation and silt on safety-related SW components. The associated Operability Determination provided information on the methods used at PBNP to minimize the impact of silt and sedimentation. As a result of the CR 00-0267 it was decided that the practices used to minimize the impact of sedimentation and silt at PBNP be summarized in this GL 89-13 Program Document for a single point of reference.

The SW supply piping to the suction of the AFW pumps consists of 8" supply headers and branch lines which tap off the header and supply each individual AFW pump 4" branch lines supply the motor driven pumps and 6" branch lines supply the turbine driven pumps. The headers normally are aligned with continuous flow supplying the Control Room (CR) and Cable Spreading Room (CSR) chillers units. The normal flow rate has a relatively low velocity and is expected to deposit some sedimentation and silt.

The supply headers tap off the bottom of the 24" supply header. This configuration increases the likelihood of silting and sedimentation deposition. The supply headers to the AFW pump suction are flushed monthly per plant procedures. The expected flushing flow rate through the header is between approximately 1.75 ft/sec and 3 ft/sec depending on the lake temperature which effects flow to the chiller units. The flushing velocity would minimize deposition but may not completely remove them.

The effects of silt and sedimentation in the SW System on the AFW pumps was analyzed and documented in NPM 99-1323. Flush water samples were collected after 2 years of service with out a flush. The samples were sent to Laboratory Service for sieve analysis. The results were than forwarded to the pump vendor, Flowserve, to determine effects on pump operation. The Flowserve results stated that the operability of the AFW pumps would not be affected by the amount of silt/particulate in the SW system.

Hard piped flush lines were added to the 1P-29 and P-38A AFW pump supply piping during U1R25 under MR 98-024*D. MR 98-024*R installed piped flush lines to P-38B and 2P-29 during U2R24. After completion of the modifications, the current monthly flushing of the AFW piping using the hard piped flush lines has been incorporated. The Frequency is based on engineering judgment supported by system inspections and the evaluations done in NPM 99-123 and OPR 82 Rev. 1. The installation of these flush lines will allow for higher velocity flushing of the AFW pump suction supply piping.

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Implementation:
PC 43 Part 5, "Service Water to Auxiliary Feedwater Pump Line Flush," is a monthly periodic callup performed to remove sediment deposits in the service water supply line to the auxiliary feed pumps.

References:
CR 00-0267
NPM 99-1323
PC 43 Part 5
DBD-01, "Auxiliary Feedwater"

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Unit: 0/1/2 **Equipment ID:** P-029 **System:** AF

Description: Flushing of the Auxiliary Feedwater Terry Turbine Oil Bearing Coolers
Method: Flush **Procedure:** IT-08A and IT-09A
Frequency: Quarterly

Safety-Related Function:
Each pump shall automatically start and deliver adequate AFW System flow to maintain adequate steam generator levels during accidents which may result in steam generator pressure safety relief valve opening, accidents which require rapid cooldown to achieve the cold shutdown conditions within the limits of analysis, and accidents which require only long-term decay heat removal achieved by controlled steam generator dumping from the steam generators.

Basis:
CR 00-0267 expressed concerns of sedimentation and silt on safety-related SW components. The associated Operability Determination provided information on the methods used at PBNP to minimize the impact of silt and sedimentation. As a result of the CR 00-0267 it was decided that the practices used to minimize the impact of sedimentation and silt at PBNP be summarized in this GL 89-13 Program Document for a single point of reference.

The Auxiliary Feedwater pump oil bearing coolers are normally stagnant lines. The upstream solenoid valves are normal closed valves and are opened during quarterly test of the pumps and during abnormal operations in which the pumps are required.

The SW System provides cooling to the AFW turbine driven pumps and motor driven pumps and the AFW turbines. A PBNP Engineering Work Request, EWR 99-050, was written to determine if the SW cooling supply to the Motor Driven Auxiliary Feedwater Pumps (MDAFWP) was required. The parent record of CR 99-2090 documented that the Terry Turbine bearing reservoirs are the only bearings that require SW cooling for operability. Information supplied by the vendor, Flowserve, in a letter dated, Feb. 11, 2000, indicated that the style of pumps supplied to PBNP came with a standard water jacket in the stuffing boxes and bearing housings. However, cooling water to the stuffing boxes is required with a product temperature of 175°F or greater and is required to the bearing housings with a product temperature of 250°F or greater. Based on this information cooling flow to the pump stuffing boxes and bearing housings is not required. Therefore, the only cooling supply required is bearing cooling to the TDAFWP turbine oil bearing coolers.

During the 1999 chlorine dioxide treatment flow through the SW turbine bearing lines was trended. The data showed that all flows were above the documented Auxiliary Feedwater DBD required flow of 1.5 gpm. The nominal observed flow rate was greater than 2.5 gpm equating to a flow velocity well over the recommended 3 ft/sec per cooler. In addition, both of the bearing coolers for the 1P-29 Terry Turbine were removed and replaced during U1R25 in 1999. The removed coolers were visually inspected. No accumulation of sedimentation or silt was observed in the oil bearing coolers. One of the bearing cooler heat exchangers had been in service for approximately 1 year while the other bearing cooler had been in service since the last P-029-T overhaul, approximately ten years ago or longer. Based upon the inspection of the turbine driven AF heat exchanger after an extended in-service period and observed flow rates taken during the 1999 chlorine dioxide treatment there is not a concern with Terry turbine bearing cooler heat exchanger due to sedimentation or silt.

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A review of the turbine driven AF pump bearing cooler testing method is currently under review and is being tracked under NUTRK item CR 99-2090. Preliminary review of the monitoring method indicates that a visual cleaning and inspection method may be a more effective method in determining bearing cooler fouling.

Implementation:
IT-08A, "Cold Start of Turbine-Driven Auxiliary Feed Pump and Valve Test Unit 1 (Quarterly)," and IT-09A, "Cold Start of Turbine-Driven Auxiliary Feed Pump and Valve Test Unit 2 (Quarterly)," establish flow to the Terry Turbine oil bearing coolers. Normal flow to the coolers is above the recommended 3 ft/sec flow velocity to minimize sedimentation and silt.

References:
CR 00-0267
CR 99-2090
IT-08A, "Cold Start of Turbine-Driven Auxiliary Feed Pump and Valve Test Unit 1 (Quarterly)"
IT-09A, "Cold Start of Turbine-Driven Auxiliary Feed Pump and Valve Test Unit 2 (Quarterly)"
DBD-01, "Auxiliary Feedwater"

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Unit: 0/1/2 **Equipment ID:** HX-012A/B/C/D **System:** CC

Description: **Component Cooling Water Heat Exchangers Blowdown Frequency, Inspection and Cleaning**

Method: Normal Ops **Procedure:** SOP-CC-001, Equipment PM

Frequency: Per Procedure, per equipment PM

Safety-Related Function:
The CC heat exchangers shall transfer heat from the CC System to the SW System to support CC System safety-related functions. These CC System safety-related functions include transferring heat from:

Residual Heat Removal (RHR) heat exchangers during containment sump recirculation,
RHR and Safety Injection (SI) pump seal coolers during containment sump recirculation,
RHR heat exchangers to mitigate a MSLB or SGTR.

Basis:
CR 00-0267 expressed concerns of sedimentation and silt on safety-related SW components. The associated Operability Determination provided information on the methods used at PBNP to minimize the impact of silt and sedimentation. As a result of the CR 00-0267 it was decided that the practices used to minimize the impact of sedimentation and silt at PBNP be summarized in this GL 89-13 Program Document for a single point of reference.

HX-012A and HX-012D CCW heat exchangers are typically aligned for normal operation with continuous flow with the HX-012B and HX-012C isolated. Normal flow through a CCW heat exchangers is continuous but has a relatively low velocity creating the potential for silt and sedimentation buildup. Higher flows velocities, approximately equal to or greater than 3ft/sec, are established during RHR system operations on a refueling basis and during performance testing of the heat exchangers. If the sediment in the heat exchangers remains loose and does not compact then the higher flow velocities established would remove any silt and sedimentation.

Blowdown of the heat exchanger outlet waterboxes reduce the probability of flow blockage as a result of fouling agents by flushing out the accumulated silt that settles in the heat exchanger inlet and outlet channel to prevent the silt layer from building up. This prevents the creation of a stagnant layer where biofouling growth could occur and it prevents the silt from building to a level where the lower tubes are blocked off from Service Water flow, which would both reduce the available tubes in service and provide a stagnant flow area in those tubes where biofouling growth could occur. The tubes are then cleaned by hydro lance cleaning every other year to prevent the silt from hardening into scale. Based on experience the PBNP blowdown frequency has kept the silt buildup from blocking tubes, becoming compacted, and prevented the formation of a stagnant flow area which would allow biofouling growth to occur. This prevents affecting the ability of the CCW H/Xs to adequately remove normal CC heat loads or from passing performance tests based on the refueling frequency (see Appendix B for performance test results).

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Implementation:
Blowdown of the CC heat exchangers is performed using Standard Operating Procedure, SOP-CC-001, for each unit. The procedure controls the frequency of blowdown as required by plant conditions.

Cleaning is controlled by Equipment PM

References:
CR 00-0267
1-SOP-CC-001, "Component Cooling System"
2-SOP-CC-001, "Component Cooling System"
DBD-02, "Component Cooling Water"

APPENDIX C
ACTION III ITEMS SUMMARY AND DATA SHEETS

Unit: 0 **Equipment ID:** HX-105A/B **System:** VNBI

Description: Primary Auxiliary Building Battery Room Vent Cooler Cleaning

Method: Clean/Inspect **Procedure:** Equipment PM

Frequency: Annual

Safety-Related Function:
VNBI System cooling coils shall cool the air supplied to the area during accident conditions to maintain battery and inverter room temperatures below maximum allowable limits.

Basis:
CR 00-0267 expressed concerns of sedimentation and silt on safety-related SW components. The associated Operability Determination provided information on the methods used at PBNP to minimize the impact of silt and sedimentation. As a result of the CR 00-0267 it was decided that the practices used to minimize the impact of sedimentation and silt at PBNP be summarized in this GL 89-13 Program Document for a single point of reference.

Both of the PAB battery room heat exchangers are normally aligned with continuous flow below 3 ft/sec. The nominal flow through the 2 in. supply piping to the HX-105A coolers is approximately 65 gpm and flow to the HX-105B cooler is approximately 45 gpm. A nominal flow rate of 35 gpm has an equivalent flow velocity of greater than 3 ft/sec in the heat exchanger supply piping. However flow velocities in the heat exchanger tubes based upon the nominal flow velocities are 2.87 ft/sec for HX-105A and 1.99 ft/sec for HX-105B.

There is conflicting information in the records on the bio/silt fouling of the HX-105's. Previously, this document cited parts of a 1999 memo NPM 99-0725 that states, in part, that the tubes were in good condition in 1996 after 5.5 years without cleaning, with a recommendation for a cleaning cycle of every 2 years.

However, the same memo indicates that scale was visible and the recommendation for the 2-year cleaning interval was specifically to limit further scale buildup. CHAMPS WO records further indicate that the reason that the coolers were actually opened after 5.5 years of continuous operation is that the coolers could not maintain battery room temperature in warm weather (WO 935016 & 935017).

Visual inspection over the last several years indicate that the tubes have a light to modest layer of silt, with heavy silting in the lower row of each tube bundle.

In February 2003 the scale issue was rediscovered during eddy current testing and documented in CAP031247. WO records indicate that the HX-105A/B tubes have had observable scale that was getting worse since their first opening in 1996 (2 year cleaning was not sufficient to eliminate scale growth).

The cleaning interval has been changed to annual and special scale removal tube cleaning tools were acquired to remove the scale (HX-105A descaled in May 2003). Please see details in Appendix B in regards to effects on thermal performance.

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Implementation:
Normal system operation maintains flow in the heat exchanger supply piping above 3 ft/sec. Due to the fouling observed, the heat exchangers are cleaned and inspected every year under the associated equipment callup. The callup requires that the heat exchanger be inspected and documented prior to any cleaning.

References:
CR 00-0267
NPM 99-0725
Callup ID IST-002 under Equipment ID SW-00396A
Callup ID IST-002 under Equipment ID SW-00397A
DBD-29, "Auxiliary Building and Control Building HVAC"

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ACTION III ITEMS SUMMARY AND DATA SHEETS

Unit: 0 **Equipment ID:** HX-105A/B **System:** VNBI

Description: Primary Auxiliary Building Battery Room Vent Cooler Cross-Connect Line Flushing

Method: Flush **Procedure:** PC 43 Part 3

Frequency: Quarterly

Safety-Related Function:
VNBI System cooling coils shall cool the air supplied to the area during accident conditions to maintain battery and inverter room temperatures below maximum allowable limits.

Basis:
CR 00-0267 expressed concerns of sedimentation and silt on safety-related SW components. The associated Operability Determination provided information on the methods used at PBNP to minimize the impact of silt and sedimentation. As a result of the CR 00-0267 it was decided that the practices used to minimize the impact of sedimentation and silt at PBNP be summarized in this GL 89-13 Program Document for a single point of reference.

Both of the PAB battery room heat exchangers are normally aligned with continuous flow below 3 ft/sec. The nominal flow through the 2 in. supply piping to the HX-105A coolers is approximately 65 gpm and flow to the HX-105B cooler is approximately 45 gpm. A nominal flow rate of 35 gpm has an equivalent flow velocity of greater than 3 ft/sec in the heat exchanger supply piping. However flow velocities in the heat exchanger tubes based upon the nominal flow velocities are 2.87 ft/sec for HX-105A and 1.99 ft/sec for HX-105B.
As described in the preceding section, periodic cleaning is used to remove deposits in the H/Xs.

The supply piping for the HX-105A & HX-105B H/Xs has a cross connect line with two normally shut isolation valve in series. This cross connect line allows either H/X to be supplied from either the North or South SW header if needed. The normally stagnant cross-connect piping is subject to silt and sediment accumulation over time. To remove the silt and sediment and prevent it from hardening and blocking the cross-connect line, the cross-connect line is flushed quarterly per Periodic Callup PC 43 Part 3. The PC establishes full flow through the cross-connect line at greater than 3 ft/sec to remove any silt or sediment.

Implementation:
Periodic Callup PC 43 Part 3 flushes the HX-105A/B supply piping cross-connect line at full flow on a quarterly frequency to remove any silt or sediment that may have accumulated in this normally stagnant piping section.

References:
CR 00-0267
NPM 99-0725
Callup ID IST-002 under Equipment ID SW-00396A
Callup ID IST-002 under Equipment ID SW-00397A
DBD-29, "Auxiliary Building and Control Building HVAC"
PC 43 Part 3
CAP 033104 / CA030163

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ACTION III ITEMS SUMMARY AND DATA SHEETS

Unit: 1/2 **Equipment ID:** **HX-015 A1–A8, B1–B8, C1–C8 and D1-D8** **System:** VNCC

Description: **Flushing of the Containment Accident Recirculation Heat Exchanger**
Method: T.S. Testing **Procedure:** TS 33/34
Frequency: Monthly

Safety-Related Function:
The containment accident recirculation heat exchangers shall remove heat from containment following a loss of coolant accident or main steam line break inside containment, to maintain the containment below its design pressure and temperature.

Basis:
CR 00-0267 expressed concerns of sedimentation and silt on safety-related SW components. The associated Operability Determination provided information on the methods used at PBNP to minimize the impact of silt and sedimentation. As a result of the CR 00-0267 it was decided that the practices used to minimize the impact of sedimentation and silt at PBNP be summarized in this GL 89-13 Program Document for a single point of reference.

Flow through the containment accident recirculation heat exchangers is continuous. Nominal flow through the H/Xs, supply and return piping is approximately equal to or greater than a flow velocity of 3 ft/sec.

Accident flow rate conditions are established monthly to the heat exchangers to verify accident flow is within the required accident analysis under plant Technical Specifications Tests. These test nearly doubles the amount of flow to the containment accident recirculation heat exchangers. These flow rates ensure that the coolers are flushed at higher flow velocities.

Past history of the heat exchangers, LER 1998-015-00, has documented occurrences of blockage in the heat exchangers. A supplement to LER 1998-015-00 stated that the radiography showed little if any silting and the only large scale blockage observed was a result of zebra mussel shells located in the heat exchangers supply manifold.

Implementation:
Normal system operation maintains flow rates in the heat exchanger approximately equal to or greater than the recommended 3ft/sec to minimize sedimentation and silt. Higher velocity flow is established to the containment accident recirculation heat exchangers monthly during Technical Specification Testing per TS 33, "Containment Accident Recirculation Fan-Cooler Units (Monthly) Unit 1," and TS 34, "Containment Accident Recirculation Fan-Cooler Units (Monthly) Unit 2," Equipment PM callup M-R3 is used to open, inspect and clean select heat exchangers every outage.

References:
CR 00-0267
LER 1998-015-00
TS 33, "Containment Accident Recirculation Fan-Cooler Units (Monthly) Unit 1"
TS 34, "Containment Accident Recirculation Fan-Cooler Units (Monthly) Unit 2"
DBD-30, "Containment Heating and Ventilation"
CA 053461
M-R3

APPENDIX C
ACTION III ITEMS SUMMARY AND DATA SHEETS

Unit: 1/2 **Equipment ID:** HX-015A/B/C/D **System:** VNCC

Description: Flushing of the Containment Accident Recirculation Fan Motor Cooling Coils

Method: Flushing **Procedure:** TS 33/34 and PC 24

Frequency: Monthly per TS 33/34
Quarterly per PC 24

Safety-Related Function:
The containment accident recirculation fan motor cooling coils shall remove sufficient heat from the motor enclosures during normal operation to maintain motor pre-aging assumptions. The containment accident recirculation fan motor cooling coils shall remove sufficient heat following a loss-of-coolant accident or main steam line break inside containment to allow the motor to operate in the post-accident environment. (DBD 30 Section 3.10)

Basis:
CR 00-0267 expressed concerns of sedimentation and silt on safety-related SW components. The associated Operability Determination provided information on the methods used at PBNP to minimize the impact of silt and sedimentation. As a result of the CR 00-0267 it was decided that the practices used to minimize the impact of sedimentation and silt at PBNP be summarized in this GL 89-13 Program Document for a single point of reference.

The containment accident recirculation fan motor cooling coils experience flow conditions slightly less than 3 ft/sec during normal system operation with the containment fan cooler accident valves closed, SW-02907 or SW-02908. Monthly Technical Specification Tests increase flow to the motor coolers by opening the accident valves. Resultant flow rates are typically in the 40-50 gpm range which results in flow velocities above 3 ft/sec in the motor coolers and associated piping. On a quarterly basis, flow through each motor cooler is checked per PC 24 U1(U2) with one of the accident valves open. The above described flushing practices have been effective at eliminating silting and sedimentation in the motor coolers based on review of the quarterly flow check results and the periodic inspections.

The minimum flow required to the heat exchangers is 8 gpm per WE Calculation 98-0020, Rev. 1. PC 24 states the minimum allowed flow for operability is 15 gpm (to account for instrument inaccuracies and possible differences in SW header pressures between test and accident conditions). If flow is found below 15 gpm or flow is trending downward, the motor cooler can be flushed at even higher flow rates per an Attachment in PC 24.

The eight containment fan motor cooler heat exchangers have been replaced in conjunction with containment accident recirculation heat exchangers under MR 98-024*J for Unit 1 (motor coolers A and B) and MR 98-024*K for Unit 2 (all four motor coolers). The modifications were installed during U1R27 (Spring 2002),U1R26 (Spring 2001) and U2R24 (Fall 2000). The new fan motor coolers are designed with a removable end bell to allow for visual inspection and cleaning of the coolers.

Implementation:
The motor coolers are flushed monthly by TS 33 and TS 34. Flow checks are performed quarterly per PC 24. If required, a high velocity flush of the motor coolers can be performed per an Attachment to PC 24 to restore flow to the required flow rates. Equipment PM callup M-R3 is used to open, inspect and clean select heat exchangers every outage.

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References:
CR 00-0267
CR 98-0066
CR 98-0099
MR 98-024*J
MR 98-024*K
PC 24, "Containment Inspection Checklist Unit 1"
PC 24, "Containment Inspection Checklist Unit 2"
TS 33, "Containment Accident Recirculation Fan-Cooler Units Unit 1"
TS 34, "Containment Accident Recirculation Fan-Cooler Units Unit 2"DBD-30, "Containment Heating and Ventilation"
CA 053461
M-R3

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ACTION III ITEMS SUMMARY AND DATA SHEETS

Unit: 0 **Equipment ID:** HX-013A/B **System:** SF

Description: Spent Fuel Pool Heat Exchanger
Method: Flushing **Procedure:** PC 43 Part 3
Frequency: Quarterly

Safety-Related Function:
The Service Water System shall provide water to the spent fuel pool cooling heat exchangers to provide adequate decay heat removal from these safety-related heat exchangers. In Response to NRC Generic Letter 83-28, WE upgraded the classification of the Spend Fuel Pool Cooling function to safety-related. Based on its direct supporting function, Service Water piping which serves the SFPC System was also classified as safety-related. [Ref DBD-12]

Basis:
CR 00-0267 expressed concerns of sedimentation and silt on safety-related SW components. The associated Operability Determination provided information on the methods used at PBNP to minimize the impact of silt and sedimentation. As a result of the CR 00-0267 it was decided that the practices used to minimize the impact of sedimentation and silt at PBNP be summarized in this GL 89-13 Program Document for a single point of reference.

The spent fuel pool heat exchangers are normally aligned under low flow conditions, approximately 300-400 gpm based upon header pressure and lake water temperature, with flow velocities less than 3 ft/sec. Unlike other heat exchangers the SW flow is through the shell side of the heat exchangers and tube blockage is not a concern.

Based upon the supplied vendor documentation a flow rate of 62.23 lb/ft^3, approximately equal to 1240 gpm, is equivalent to a flow velocity 2.904 ft/sec. Flushing of the heat exchangers increases flow to approximately 1300 to 1400 gpm by fully opening the outlet throttle valves to the back seat position. This equates to flow velocities greater than 3 ft/sec.

Implementation:
PC 43 Part 3, "Service Water Strainers," performs a flush of the Spent Fuel Pool heat exchangers to remove sediment deposits. The procedure is performed quarterly and includes a flush of the HX normal and alternate supply and return lines.

References:
CR 00-0267
CIM 00439 "The Bahnson Company"
PC 43 Part 3
FSAR Section 9.4, "Fuel Handling System"
DBD-12

APPENDIX D

Unit: 0/1/2 **Equipment ID:** N/A **System:** SW
Description: **Required Review of SW System for GL 89-13 Action Item IV**

Safety-Related Function:
The Service Water (SW) System shall provide sufficient flow to support the heat removal requirements of components required to mitigate the consequences of a Loss of Coolant Accident (LOCA) in one unit, while supporting the normal flow of the unaffected unit. Although SW is required to mitigate other plant accidents as well, a LOCA combined with normal operation of the unaffected unit is the most limiting event for the heat load imposed on the SW System.

Basis:
PBNP's original commitment required that walk downs be completed for development of a SW hydraulic model and component cooling water (CC) model. The models are to be used to verify the systems ability to perform their safety-related functions. The PBNP CC System is considered an exempt system with respect to GL 89-13. The CC System is exempt since it is closed loop system utilizing treated water for corrosion control and operational history of the system does not warrant inclusion into the GL 89-13 Program. However, the CC heat exchangers, which transfer heat to the SW System, are performance tested as required by GL 89-13 Action Item II.

A single active failure analysis of the SW System was conducted on a component level in 1993 by Pacific Nuclear, WEP-013-10. The safety-related components subject to an active failure were determined and the failure modes identified. The failures were analyzed and determined that the single failure criterion was satisfied. The results of the analysis verified that the SW System can perform its safety-related function during a design basis event given a single active component failure. The 1993 SWSOPI team reviewed the single failure analysis and concurred with the reports conclusions in the SWSOPI Report, NPC 93-02873.

A SW flow and pressure data collection procedure was created to validate the model in 1992, SMP-1092. The procedure recorded flow rates and pressure indication on various SW components. The flow rates were then review against the model for validation. The results of the procedure were favorable when compared to the SW hydraulic model. The 1993 SWSOPI team concurred that results from the model compared well with actual measurements of flow and pressure drops in the SWSOPI Report, NPC 93-02873. The results were superceded by Calculation N-92-087. The revision documented various deficiencies with the data collected using SMP-1092.

Walk downs of the SW system were performed as part of the IEB 79-14 review. IEB 79-14 is currently open and awaiting completion. However, the as built walk downs performed on SW for model validation were in general accurate. The SWSOPI team agreed that the hydraulic circuits agreed with the plant P&ID's in limited walk downs in the SWSOPI Report, NPC 93-02873.

A review of the modeling methodology was performed in 1997 due to questions raised by the NRC. A review of the model methodology was performed by Sargent and Lundy (S&L), SL-WE-97-142. The review verified the models assumptions that a Loss of Coolant Accident during the recirculation phase requiring both containment and heat decay removal was more challenging to the SW System than other design basis accidents.

Currently the model is used to verify changes to the SW System. The modification process at PBNP requires that all modifications that affect SW be evaluated for any possible impact the modification may have on the SW System. These processes are part of the modification design package.

APPENDIX D

Implementation:
Design Input Checklist, PBF-1584, requires that any modification, including temporary modifications, which require service water be evaluated for any changes which would impact both essential and nonessential service water loads. Modification Request Checklist, PBF-1606, requires that all modifications be reviewed for impact they may have on governing calculations and models. Specifically listed is the SW model.

References:
Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment"
PBNP Letter, VPNPD-90-027, "Response to GL 89-13"
Service Water System Operational Performance Inspection (SWSOPI), NPC 93-02873
SMP-1092
Pacific Nuclear Single Failure Analysis, WEP-013-10
Sargent and Lundy Letter, SL-WE-97-142
PBF 1584
PBF-1606

APPENDIX E

Unit: 0/1/2 **Equipment ID:** N/A **System:** SW
Description: **Required Review of SW System for GL 89-13 Action Item V**

Safety-Related Function:
The Service Water (SW) System shall provide sufficient flow to support the heat removal requirements of components required to mitigate the consequences of a Loss of Coolant Accident (LOCA) in one unit, while supporting the normal flow of the unaffected unit. Although SW is required to mitigate other plant accidents as well, a LOCA combined with normal operation of the unaffected unit is the most limiting event for the heat load imposed on the SW System.

Basis:
PBNP's response to GL 89-13 required that all procedures and training relating to the service water be reviewed for accuracy and applicable experiences described in NUREG-1725 Vol. 3. A review of applicable procedures determined that PBNP conformed to NUREG-1725 Vol. 3. The 1993 SWSOPI team's review of maintenance practices, operating and emergency procedures, and training documentation concluded that Action V was appropriately accomplished.

Implementation:
A review of procedures and training related to SW was performed.

References:
Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment"
PBNP Letter, VPNPD-90-027, "Response to GL 89-13"
Service Water System Operational Performance Inspection (SWSOPI), NPC 93-02873