February 27, 2004

Mr. Thomas Coutu
Site Vice President
Kewaunee Nuclear Plant
Nuclear Management Company, LLC
N490 Hwy 42
Kewaunee, WI 54216-9511

SUBJECT: KEWAUNEE NUCLEAR POWER PLANT
NRC SPECIAL INSPECTION REPORT 05000305/2004003

Dear Mr. Coutu:

On January 28, 2004, the NRC completed a Special Inspection at your Kewaunee Nuclear Power Plant to evaluate the facts and circumstances surrounding an event that occurred on January 16, 2004, in which both high pressure safety injection trains were declared inoperable due to degraded service water flow conditions in the lubricating oil coolers for each safety injection pump. The enclosed report documents the inspection findings which were discussed on January 28, 2004, with you and members of your staff.

The inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. The inspectors reviewed selected procedures and records, observed activities, and interviewed plant personnel.

On January 15, 2004, during a routine quarterly maintenance inspection of the 'A' safety injection pump lubricating oil cooler, visual examination revealed silt and biological fouling at 17 of 20 inlet tubes. A further evaluation into the condition of the 'B' safety injection pump lubricating oil cooler identified similar inlet tube blockage. Although flow rates through both heat exchangers were within your past acceptance criteria, recent revisions to heat exchanger performance calculations developed by your staff raised operability concerns for the safety injection pumps. After further reviewing the matter, plant operators declared both trains of the high pressure safety injection system inoperable at 12:20 a.m. on January 16 and a plant shutdown was commenced 1 hour later in accordance with Technical Specifications.

Based on the risk and deterministic criteria specified in Management Directive 8.3, "NRC Incident Investigation Program," and Inspection Procedure 71153, "Event Followup," and due to the equipment performance problems which occurred, a Special Inspection was initiated in accordance with Inspection Procedure 93812, "Special Inspection," to evaluate the facts and circumstances surrounding the event, as well as the actions taken by your staff in response to the unexpected system condition. Inspection focus areas are detailed in the Special Inspection Charter (Attachment 2). At the conclusion of the inspection, several questions remained regarding the past operability of the safety injection pumps when the lubricating oil cooler inlet tube blockage was present. The outcome of these operability questions will directly affect the significance characterization of this event and any further enforcement action taken by the NRC. Therefore, an Unresolved Item was opened to monitor your resolution of the past operability questions pertaining to the safety injection pumps.

In addition, one finding of very low safety significance was identified associated with your failure to appropriately evaluate for potential bypass flow on the service water pump discharge strainers by measuring a critical gap dimension at the bottom of the strainer basket-to-housing interface. This finding did not constitute a violation of NRC requirements because the strainers (aside from the pressure boundary) did not fulfill a safety-related function.

During our review of your corrective actions and extent of condition evaluation for the event, significant inspector involvement was necessary to fully understand the potential impact and safety significance of the degraded condition on other service water cooled safety-related equipment as well as the adequacy of your corrective actions associated with the restoration of the high pressure safety injection system and other service water cooled safety-related equipment.

Immediate corrective actions were taken to prevent recurrence. Those actions included replacing the coolers with a different design which is expected to be less susceptible to fouling. Other actions planned include an internal review of your heat exchanger inspection and testing program to ensure that it is adequately implemented and verification that the replacement coolers will perform their design function under all operating conditions.

If you contest the finding, you should provide a response with the basis for your denial, within 30 days of the date of this inspection report, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001; with copies to the Regional Administrator, U.S. Nuclear Regulatory Commission, Region III, 801 Warrenville Road, Lisle, IL 60532-4351; the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC Resident Inspector at the Kewaunee Nuclear Power Plant.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system (ADAMS). ADAMS is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html (the Public Electronic Reading Room).

Sincerely,

/ RA by P. Hiland acting for /

Steven A. Reynolds, Acting Director
Division of Reactor Projects

Docket No. 50-305
License No. DPR-43

Enclosure: Inspection Report 05000305/2004003
w/Attachments: 1. Supplemental Information
2. Special Inspection Charter

See Attached Distribution

***See Previous Concurrence**

DOCUMENT NAME: C:\ORPCheckout\FileNET\ML040610784.wpd

To receive a copy of this document, indicate in the box: "C" = Copy without attachment/enclosure "E" = Copy with attachment/enclosure "N" = No copy

OFFICE	**RIII ***		**RIII ***		RIII		RIII	
NAME	**PLouden for BKemker:dtp**		**PLouden**		PHiland		PHiland for SReynolds	
DATE	**02/26/04**		**02/26/04**		02/27/04		02/27/04	

OFFICIAL RECORD COPY

cc w/encl: D. Graham, Director, Bureau of Field Operations
Chairman, Wisconsin Public Service Commission
State Liaison Officer

ADAMS Distribution:
WDR
DFT
JGL1
RidsNrrDipmIipb
GEG
HBC
JFL
C. Ariano (hard copy)
C. Pederson, DRS (hard copy - IR's only)
DRPIII
DRSIII
PLB1
JRK1

U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Docket No:	50-305
License No:	DPR-43
Report No:	05000305/2004003
Licensee:	Nuclear Management Company, LLC
Facility:	Kewaunee Nuclear Power Plant
Location:	N 490 Highway 42 Kewaunee, WI 54216
Dates:	January 20 through 28, 2004
Inspectors:	B. Kemker, Senior Resident Inspector, D. C. Cook A. Dunlop, Senior Reactor Engineer, Region III S. Unikewicz, Mechanical Engineer, NRR, DE
Approved By:	Patrick Louden, Chief Reactor Projects Branch 5

Enclosure

SUMMARY OF FINDINGS

IR 05000305/2004003; 01/20/2004 - 01/28/2004; Kewaunee Nuclear Power Plant; Special Inspection to review circumstances surrounding the declaration of both safety injection system trains being inoperable due to lubricating oil cooler blockage.

This report covers a 2-week period of special inspection by NRC resident and region-based inspectors. The inspection identified one Green finding. The significance of most findings is indicated by their color (Green, White, Yellow, Red) using Inspection Manual Chapter (IMC) 0609, "Significance Determination Process" (SDP). Findings for which the SDP does not apply may be "Green" or be assigned a severity level after NRC management review. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 3, dated July 2000.

A. Inspector-Identified and Self-Revealed Findings

Cornerstone: Mitigating Systems

- Green. The inspectors identified a finding of very low safety significance associated with the licensee's failure to appropriately evaluate for potential bypass flow on the service water pump discharge strainers by measuring a critical gap dimension at the bottom of the basket-to-housing interface. This finding did not constitute a violation of NRC requirements because the strainers (aside from the pressure boundary) did not fulfill a safety-related function.

  The inspectors determined that the finding was of more than minor significance because it would become a more significant safety concern if left uncorrected. Specifically, the failure to appropriately evaluate for potential bypass flow on the service water pump discharge strainers could reasonably result in debris fouling of service water cooled components and degraded or inoperable safety-related equipment. The inspectors concluded that this finding was a licensee performance deficiency of very low safety significance because it did not result in loss of safety function for a service water system train for greater than its Technical Specification allowed outage time. To address this issue, the licensee opened each strainer and measured the gap at the bottom of the basket-to-housing interface. (Section 4OA3.6)

B. Licensee-Identified Violations

No findings of significance were identified.

REPORT DETAILS

Summary of Plant Event

On January 15, 2004, during a routine quarterly maintenance inspection of the 'A' safety injection pump lubricating (lube) oil cooler, visual examination revealed silt and lake grass[1] accumulation at 17 of 20 inlet tubes. Investigation into the condition of the 'B' safety injection pump lube oil cooler identified similar blockage of the inlet tubes. Although flow rates through both heat exchangers were within the licensee's established acceptance criteria, the licensee was concerned that the remaining unblocked tubes may not be able to provide the required cooling. Therefore, on January 16, 2004, at 12:20 a.m., the licensee declared both trains of the high pressure safety injection system inoperable due to degraded service water flow conditions found in both trains of the safety injection pump lubricating lube oil coolers and initiated a Technical Specification required plant shutdown one hour later.

Inspection Scope

Based on the probabilistic risk and deterministic criteria specified in Management Directive 8.3, "NRC Incident Investigation Program," and Inspection Procedure 71153, "Event Followup," and due to the equipment performance problems which occurred, a Special Inspection was initiated in accordance with Inspection Procedure 93812, "Special Inspection."

The inspection focus areas included the following charter items:

- the sequence of events related to the degraded condition found in the safety injection pump lube oil coolers, including an historical time line and the licensee's response to previous indications of cooler fouling;
- the adequacy of the licensee's response to the degraded condition including the operability determination and subsequent plant shutdown;
- the adequacy of the licensee's approach to evaluate the root cause for the degraded condition;
- the impact and safety significance of the degraded condition on the safety injection system and other service water cooled safety-related equipment;
- the adequacy of the licensee's corrective actions associated with the restoration of the safety injection system and other service water cooled safety-related equipment;
- the adequacy of service water system strainer performance;
- the adequacy of the licensee's initial plans for long-term corrective actions to prevent recurrence of the degraded condition (if available); and
- the adequacy of the licensee's response to Significant Operating Event Report (SOER) 02-04, "Reactor Pressure Vessel Head Degradation at Davis-Besse Nuclear Power Station," November 11, 2002, relative to this event, including the effectiveness of any corrective actions implemented following the licensee's review of the SOER.

[1]Throughout this report, "lake grass" is considered a mixture of plant fiber, diatom, algae filament, fungi, protozoa, and bacteria.

4. OTHER ACTIVITIES (OA)

4OA3 Special Inspection (93812)

.1 Sequence of Events Related to the Degraded Condition Found in the Safety Injection Pump Lube Oil Coolers

a. Inspection Scope

The inspectors reviewed selected documents and conducted interviews to determine the sequence of events associated with an event that occurred on January 16, 2004, in which both trains of the high pressure safety injection system were declared inoperable due to fouling of the service water side of the lube oil coolers for both pumps. The inspectors also reviewed work request history and corrective action program documents to evaluate the licensee's response to previous indications of cooler fouling.

b. Findings and Observations

Introduction

Based upon a review of the licensee's corrective action program documents, work order history, control room logs, and personnel interviews, the inspectors developed the following sequence of events associated with the fouling of the safety injection pump lube oil coolers and subsequent plant shutdown.

Discussion

Inspection of the 'A' safety injection pump lube oil cooler during a scheduled quarterly inspection on January 15, 2004, revealed silt and lake grass accumulation at the tube pass inlets. The safety injection pump lube oil coolers were two pass heat exchangers with twenty 0.375" (outer diameter) tubes per pass. The licensee identified that 17 of 20 tubes in each pass were blocked. The "as-found" flow was measured between 3.0 and 3.8 gallons-per-minute (gpm), and after cleaning flow was measured between 5.95 and 6.05 gpm. This concern prompted an investigation into the condition of the 'B' safety injection pump lube oil cooler. During a visual inspection, the licensee identified that 17 of 20 tubes in each pass of this cooler were also blocked. The results of a flow test conducted with the cooler's end bell removed revealed that there was no flow from 17 of the 20 tubes as seen from the outlet of the cooler and an "as-found" flow rate similar to the 'A' safety injection pump lube oil cooler was measured. The licensee determined that this condition had potentially rendered both safety injection pump trains inoperable and the discovery raised doubts regarding future operability of the safety injection pumps. After discussing these results with senior plant managers, the licensee declared both safety injection pumps inoperable and initiated a plant shutdown on January 16, 2004, at 1:20 a.m.

The licensee's engineering staff had recently performed a calculation (C11423, Revision 0, Addendum A, dated January 12, 2004) to determine service water flow and temperature requirements for the safety injection pump lube oil coolers. The calculation provided the required service water flow rate based on the number of tubes blocked and the service water temperature. The calculation used data that were contradictory to previous preventive maintenance procedure acceptance criteria and provided the basis

for declaring the safety injection pumps inoperable on January 16th. The licensee's engineering staff recognized that a previous calculation from 1997, which provided a 1.5 gpm minimum flow criteria, was not appropriate to base an operability determination on because it did not consider service water temperature and the minimum number of un-fouled tubes needed to provide an adequate heat transfer surface area.

b.1 Historical Repeat Fouling of the Safety Injection Pump Lube Oil Coolers

Introduction

The inspectors identified an Unresolved Item associated with the circumstances surrounding the repetitive fouling of the high pressure safety injection pump lube oil coolers. The Unresolved Item will remain open pending additional licensee engineering evaluation to conclude the overall operability impacts the lube oil cooler blockage may have had on the safety injection pumps.

Discussion

The inspectors interviewed personnel and reviewed work request history and corrective action program documents to understand the sequence of events leading up to this event. Significant fouling of the safety injection pump lube oil coolers with lake grass was identified as early as 1992 when the coolers were first opened and inspected following implementation of the licensee's NRC Generic Letter (GL) 89-13, "Service Water System Problems Affecting Safety-Related Equipment" program. The licensee continued to identify the same problem during subsequent cooler inspections on roughly an 18-month frequency. In October 2001, both coolers were inspected. About 80 percent of the tubes on both passes were found blocked with lake grass and silt on the 'B' safety injection pump lube oil cooler. About 100 percent of the tubes on both passes were found blocked on the 'A' safety injection pump lube oil cooler. In addition, part of a fish (approximately 0.375" x 0.125" x 0.750") was found plugging one of the tubes. A potential concern for bypass flow around the service water pump discharge strainers was identified in condition report CAP 001096; however, an associated corrective action (CA 003111) was closed with no action taken to resolve the issue. The inspectors noted that the comments in that corrective action essentially dismissed the potential strainer bypass concern. In addition, the inspectors noted that an associated condition evaluation (CE 000901) did not appropriately evaluate the condition. The evaluation stated that maintenance personnel had found that the cooler fouling issue was a routine situation every outage when the coolers were opened and cleaned. The condition evaluation discussed five possible corrective actions; however, no corrective action was implemented. The condition evaluation was categorized as "broke/fix". In May 2002, the licensee wrote an engineering work request to evaluate a modification to replace the existing coolers with a different design having larger diameter tubes to minimize lake grass fouling. In July 2002, the licensee increased the safety injection pump lube oil cooler inspection frequency to every 9 months. Similar fouling was identified in both coolers during inspections in July 2002, May 2003 and October 2003. Still, no positive action was taken to correct this problem, due in part, to the fact that the licensee's operability criteria (i.e., observed flow through the pump's lube oil sight glass and the absence of temperature alarms) at the time were met.

An assessment of the licensee's GL 89-13 program performed by a vendor in December 2002, noted that the safety injection pump lube oil coolers were a "weak

spot" in the licensee's component inspection program. The assessment highlighted the history of fouling, noted a strength in the licensee's decision to increase the inspection frequency from every 18 months to every 9 months, and suggested that even a shorter inspection interval was warranted based on inspection results at the 9-month frequency. The assessment, however, also noted that the licensee's practice of verifying the absence of alarms and observing flow through a sight glass would not ensure operability of the coolers under design basis accident conditions. The assessment noted other conditions that should be considered in evaluating the operability of the coolers would include: delivered flow with the service water system in accident alignment, service water temperature at its design limit, and the safety injection pump moving fluid at accident temperatures for a prolonged period of time (i.e, for the duration of the post-accident function). The inspectors noted that the assessment did not mention any consideration of the actual amount of tube plugging (i.e., available heat transfer area), which would also affect the heat removal capability of the coolers.

In May 2003, the licensee completed a review of abnormal plant conditions or indications that could not be easily explained in response to Recommendation 3 of SOER 02-04, "Reactor Pressure Vessel Head Degradation at Davis-Besse Nuclear Power Station," November 11, 2002. The licensee identified that the fouling of the safety injection pump lube oil coolers was a widely known issue which had not been aggressively pursued, had existed for a long period of time, and had the potential to affect an important piece of safety-related equipment. The licensee determined that this issue had many characteristics in common with the Davis-Besse vessel head corrosion issue. The inspectors noted that a corrective action to complete an engineering work request to find a solution to the safety injection pump lube oil cooler fouling problem was deferred multiple times and had not been completed at the time of the event. The inspectors also noted that the only two corrective actions completed in response to this SOER, changing the inspection frequency to every 3 months and performing ultrasonic flow testing, were not effective at preventing the event.

Although the cooler inspection history existed in the licensee's work request database, the inspectors noted that the results of many of these individual inspections where significant fouling was identified, were absent from the corrective action program documents that were reviewed. In other words, it did not appear that the licensee had identified the fouling as a significant condition adverse to quality and did not routinely document the results in the corrective action program for evaluation, trending and early identification of problems. In particular, the inspectors noted that there were no condition reports specifically associated with the results of recent safety injection pump lube oil cooler inspections in May 2003 and October 2003. The inspectors considered this to be indicative of current licensee performance and affected the cross-cutting area of problem identification and resolution (see Section 4OA4.)

The inspectors concluded that the licensee's response to multiple previously identified degraded conditions that have potentially affected the operability of both safety injection pumps since 1992 was not appropriate. The inspectors were concerned that the licensee had missed many opportunities to correct this problem sooner because the licensee had not correctly evaluated the longstanding degraded condition. Because several outstanding questions remained at the conclusion of the inspection regarding the safety injection system pump past operability, the issue will be treated as an Unresolved Item (URI 05000305/2004003-01).

.2 Adequacy of Licensee’s Response to the Degraded Condition

a. Inspection Scope

The inspectors evaluated the licensee’s identification of and initial response to the event. This evaluation included a review of the licensee's identification of the degraded condition, initial actions to mitigate the event, and initial actions to restore the safety injection pump lube oil coolers. The inspectors interviewed plant personnel and reviewed the plant's Technical Specifications, operator logs, maintenance procedures, and corrective action program documents.

b. Findings and Observations

Introduction

No findings of significance were identified.

Discussion

The inspectors determined that the licensee's response to the degraded condition identified in the safety injection pump lube oil coolers on January 15th was appropriate. Recognizing that the condition potentially affected the continued operability of both safety injection pumps and that the extent of condition with respect to other risk significant service water cooled components was unknown, the licensee chose to shut down the plant pending completion of a thorough evaluation and the implementation of corrective actions.

To further mitigate the event, the licensee cleaned each cooler and returned it to service until the plant was in an operational mode that no longer required operable safety injection pumps.

.3 Adequacy of the Licensee's Approach to Evaluate the Root Cause for the Degraded Condition

a. Inspection Scope

The inspectors evaluated the licensee's initial approach to determine the root cause for the recurring fouling of the safety injection pump lube oil coolers. The inspectors interviewed plant personnel, attended meetings, and reviewed relevant corrective action program documents.

b. Findings and Observations

Introduction

No findings of significance were identified.

Discussion

The licensee concluded that the safety injection pump lube oil coolers were fouled by

lake grass and silt accumulation at the tube pass inlets. The licensee's final root cause evaluation was not completed at the conclusion of the inspection; however, the licensee's initial cause determination was completed. The inspectors concluded that the licensee's initial cause determination and approach for further evaluating the root cause appeared to be adequate.

.4 Impact and Safety Significance of the Degraded Condition on the Safety Injection System and Other Service Water Cooled Safety-Related Equipment

a. Inspection Scope

The inspectors evaluated the impact and safety significance of the degraded condition (i.e., lake grass intrusion into the service water system) on the high pressure safety injection system and other service water cooled equipment by performing the following:

- interviewed plant personnel;
- attended licensee meetings evaluating the extent of condition;
- observed inspections performed by the licensee on several heat exchangers;
- observed inspections performed by the licensee on the service water pump discharge strainers;
- reviewed system design descriptions and drawings;
- reviewed heat exchanger inspection and performance data;
- reviewed the licensee's extent of condition evaluation; and
- reviewed relevant corrective action program documents.

b. Findings and Observations

Introduction

No findings of significance were identified.

Discussion

The safety significance of the degraded condition on the high pressure safety injection system was treated as an Unresolved Item as discussed above in Section 4OA3.1

The potential impact and safety significance of the degraded condition on other service water cooled components was of paramount concern to the inspectors during this inspection. Soon after the start of the special inspection, the inspectors became concerned that the licensee had not aggressively pursued a more thorough evaluation of the extent of condition. It appeared to the inspectors that the licensee was principally focused on restoring the safety injection pumps to an operable status in support of a plant restart and was not rigorously examining the potential impact of debris fouling on other service water cooled components. By questioning the licensee's staff, the inspectors prompted the licensee to further consider the potential for debris fouling of other service water coolers and service water cooled components with potential flow restrictions (e.g., auxiliary feedwater system recirculating line orifices, safety injection pump stuffing boxes, and service water pump bearing lubricating water filters). The inspectors also prompted the licensee to evaluate the potential for debris, including lake grass, to bypass the service water pump discharge strainers.

The inspectors reviewed the licensee's completed extent of condition evaluation and concluded that it adequately examined the extent of condition. The inspectors concluded that reasonable measures were taken by the licensee to review heat exchanger inspection and performance data and to open and examine several service water coolers. The licensee concluded that the extent of condition was, with the exception of one non-safety related heat exchanger, limited to the safety injection pump lube oil coolers. The non-safety related heat exchanger was the boric acid evaporator cooler, which like the safety injection pump lube oil coolers also has small diameter tubes (0.250" outer diameter tubes), has relatively low service water flow, and is located in the lowest elevation of the Auxiliary Building.

.5 Adequacy of Licensee Corrective Actions Associated with Restoration of the Safety Injection System and Other Service Water Cooled Safety-related Equipment

a. Inspection Scope

The inspectors attended licensee meetings, interviewed plant personnel, observed maintenance and testing activities, reviewed testing plans and design packages, and performed system walkdowns to assess the adequacy of the licensee's corrective actions for the restoration of the safety injection system and other service water cooled safety-related equipment.

b. Findings and Observations

No findings of significance were identified.

b.1 Safety Injection Pump Lube Oil Cooler Modification

The basic corrective action to address fouling of the safety injection pump lube oil coolers was a modification to install replacement coolers. This modification was performed at risk since preparation of the design change documents was not completed prior to work commencing in the field. The licensee implemented Design Change Request 003518, "Replace Safety Injection Pump Lube Oil Coolers," Revisions 0, to replace the shell and tube type heat exchanger with a dual coil heat exchanger that contained a single 0.750" (outer tube diameter), Type 304 stainless steel tube that matched up with the 0.750" service water pipe supply to the cooler. This design was chosen since it did not have a tube sheet with multiple tubes in order to prevent the accumulation of lake grass at the tube pass inlets, which was the problem with the original heat exchangers. Service water flows through the tube coil removing the heat from the lube oil that flows over the coil. With the inlets and outlets at the same end of the cooler, a coil separator channels flow the length of the cooler. The lube oil flows along the inside coil and then reverses past the end of the coil separator to flow around the outside coil to the cooler outlet.

This modification appeared to be a minor change of one heat exchanger design for another to address the fouling issue. However, several problems were encountered during the implementation of the modification. As work on the design was progressing, a number of issues arose that the licensee needed to address. The new cooler was sized to remove more heat than the original cooler. The inspectors identified this as a possible concern for overcooling of the organic lube oil used in the safety injection pumps and questioned the licensee's engineering staff. The licensee determined that

this would result in an overcooling problem, which led to the use of a synthetic oil. The use of a synthetic oil then led to a review of the elastomer seals in the pump's lube oil system to ensure compatibility.

The licensee's receipt inspection for the replacement cooler initially installed on the 'A' safety injection pump did not identify a defect/damage to the coil separator. This defect provided a path for lube oil to bypass the coils such that the cooler would not perform as designed. The licensee's receipt inspection guidance did not specifically address inspection of the coil separator or measurement of the coil separator dimensions.

During initial testing of the new cooler using a temporary lube oil pump, the licensee was unable to obtain a significant differential temperature across the cooler. The temporary lube oil pump was only able to heat the oil to about 70°F and with a service water temperature of about 33°F, there was not a significant heat load on the cooler. The licensee decided to inspect the cooler's internals to determine if any concerns could be identified. This subsequent inspection of the cooler identified the following problems: (1) the coil separator was not flush with the cooler head; (2) the coil separator spanned the inlet oil line opening in the cooler head; and (3) the coil separator was buckled, which caused separation on a portion of the longitudinal seam. These defects/damage to the coil separator would allow lube oil flow to bypass the coils in the cooler, which would prevent the cooler from performing as designed. The licensee initiated condition report CAP 019716 to evaluate the "as-found" condition as a potential 10 CFR Part 21 issue. As a result of identifying the damage to the cooler, the licensee decided to disassemble the other cooler to inspect for similar damage. That inspection did not identify any damage to the coil separator. Another internal coil assembly was procured to replace the one that was defective/damaged. The licensee initiated condition report CAP 019736 to address the receipt inspection.

Although the licensee determined the new coolers would not be susceptible to plugging with lake grass like the original coolers, the inspectors noted that neither the design description in the modification package nor 10 CFR 50.59 evaluation discussed the potential for fouling of the flapper in the sight glasses downstream of the coolers. These sight glasses with flappers were installed in the return lines for many of the service water cooled components, including the safety injection pump lube oil coolers and stuffing boxes, to provide operators with a qualitative indication of flow through the components. Prior to the installation of the modification, the inspectors noted some accumulation of lake grass on one flapper in the system, which at that time did not appear to adversely affect flow through the piping. However, since the original coolers effectively acted like filters for the system by collecting lake grass and those coolers were now removed from the system, there would be more lake grass passing through the sight glasses, increasing the potential for lake grass accumulation on the flapper and blocking service water flow in the return lines. Although this issue should have been addressed in the appropriate design documents, the licensee indicated that based on previous experience with the sight glasses, the likelihood of substantial fouling without it being identified was minimal. Operators were required to monitor flow through the coolers by looking through the sight glasses four times a day, such that if the sight glasses were plugging with lake grass, the condition should be identified by the operators on their normal rounds prior to any significant flow blockage. The licensee initiated condition report CAP 019866 to address the incomplete documentation.

Due to the higher heat removal capacity of the new coolers, the licensee identified a

concern with the viscosity of the organic lube oil used since it would have to function at a lower temperature. This led the licensee to use a synthetic oil with better viscosity properties at lower temperatures. The use of a synthetic oil, however, also will require the replacement of a number of elastomer seals on the pump which are not compatible with the new oil. These issues were appropriately addressed by the licensee in the design change.

The inspectors questioned the methodology used to qualify the new heat exchangers. The heat exchangers were qualified using the Seismic Qualification Utility Group (SQUG) Generic Implementation Procedure (GIP) methodology. However, the Updated Final Safety Analysis Report (UFSAR) Section 4.8 and plant procedure NEP 15.32, "Seismic Design and Analysis of Modified, New, and Replacement Equipment and Parts/Sub-components Using the GIP Methodology," Revision 0, did not allow use of this methodology for new heat exchangers. The licensee initiated condition report CAP 019725 to address this concern. Based on the licensee's subsequent review, it was verified that the NRC has accepted the use of the GIP methodology for heat exchangers. As a result, the licensee initiated a temporary change to NEP 15.32 and will update the UFSAR to allow the use of this methodology.

The licensee's testing and analysis performed on the replacement coolers verified that the coolers would have sufficient flow rates to prevent debris, such as silt and sand from settling out in the tube (3 feet-per-second minimum flow rate) under both normal and design basis conditions. The guidance for the velocity of water through a heat exchanger tube was obtained from NUREG/CR-5210, "Technical Findings Document for Generic Issue 51: Improving the Reliability of Open-Cycle Service-Water Systems," August 1988. During testing, service water flow rates through the cooler were approximately 4.4 gpm as measured by a temporarily installed ultrasonic flow meter. Based on these flow rates and the lack of obstructions to catch lake grass, there should not be a concern with plugging of the single tube in the heat exchanger.

The licensee was unable to demonstrate that the new heat exchanger would perform its design function of removing heat from the safety injection pump lube oil over the entire range of lake water temperatures for which the plant was licensed (32°F to 80°F). The calculations performed by the cooler vendor predicted a heat transfer coefficient for the cooler of 60 Btu/hr-ft^2-°F. The testing of the cooler conducted by the licensee with a service water temperature of about 35°F and subsequent analysis, showed an effective heat transfer coefficient for the cooler of 15 Btu/hr-ft^2-°F. The factor of four difference between predicted and demonstrated performance was not readily explained. The licensee believed it was likely due to the large difference in oil viscosity between the predicted conditions in the vendor's calculation and those observed during the test. The licensee performed operability determination OBD 000066 and established a conservative administrative limit for service water temperature of 55.5°F to ensure that the coolers would remove the required heat load.

b.2 Other Service Water Cooled Safety-Related Equipment

There were no specific corrective actions required for other safety-related heat exchangers cooled by service water. It was determined, based on a review of the results of previous heat exchanger inspections and performance tests, that the larger

tubes and higher flow rates for those heat exchangers did not result in significant fouling of tubes by silt and lake grass as was seen on the smaller tubed safety injection pump lube oil coolers. As previously discussed in Section 4OA3.4 of this report, several coolers were inspected during this outage to verify this position was representative of what was seen in previous heat exchanger inspections.

Based on the inspectors' concern for potential bypass flow on the service water pump discharge strainers, the licensee opened and examined all four strainers. One strainer was adjusted to reduce the bypass at the bottom of the basket-to-housing interface. This issue is further discussed below in Section 4OA3.6 of this report.

.6 Adequacy of Service Water System Strainer Performance

a. Inspection Scope

The inspectors attended licensee meetings, interviewed plant personnel, observed maintenance activities, and reviewed applicable procedures and corrective action program documents.

b. Findings and Observations

b.1 Failure to Appropriately Evaluate for Potential Bypass Flow on Service Water Strainers

Introduction

The inspectors identified a finding of very low safety significance (Green) associated with the licensee's failure to appropriately evaluate for potential bypass flow on the service water pump discharge strainers by measuring a critical gap dimension at the bottom of the basket-to-housing interface. This finding did not constitute a violation of NRC requirements because the strainers (aside from the pressure boundary) did not fulfill a safety-related function.

Discussion

During the inspectors' review of the circumstances leading up to the event, a potential concern for bypass flow around one or more of the service water pump discharge strainers was identified. The strainers were built with a mesh that had 0.125" diameter holes to prevent larger debris from entering the service water system and potentially fouling components. The inspectors questioned the licensee's identification of part of a fish (approximately 0.375" x 0.125" x 0.750") that was found plugging one of the tubes in the 'A' safety injection pump lube oil cooler in October 2001. As discussed above in Section 4OA3.1, the licensee did not appropriately evaluate the potential bypass issue at the time. When the inspectors examined the "as-found" condition of the boric acid evaporator cooler (0.250" outer diameter tubes), they also noted what appeared to be shells that were larger than 0.125" diameter along with a significant amount of lake grass and silt. The licensee subsequently identified zebra mussel shells and fish parts in the Auxiliary Building Mezzanine 'A' fan cooling unit. The largest zebra mussel shell measured 0.690" x 0.298" and the largest fish part measured 1.750" x 0.375" x 0.130". Although the licensee could reasonably explain the presence of the zebra mussel shells as a result of their growth in the service water system between chemical treatments, the licensee could not account for the fish fragments without opening and inspecting the

strainer baskets for possible bypass flow.

In response to the inspectors' questions, the licensee identified that a critical gap dimension at the bottom of the basket-to-housing interface was not routinely verified during preventive maintenance inspections of the strainer baskets. The licensee was not able to locate any record of this gap being measured. As a result, the licensee opened each one of the four service water pump discharge strainers to verify the gap. Per the strainer manufacturer, the nominal gap between the bottom of the rotating drum and the drum body for a new strainer was 0.020". This gap may enlarge due to abrasives (i.e., sand) passing between the drum and the body during normal strainer operation. The manufacturer did not specify a tolerance for this gap in its vendor manual. The licensee determined that an appropriate criteria would be 0.125", such that the gap would not exceed the size of the 0.125" diameter holes in the strainer mesh.

The licensee completed an inspection of the strainers for bypass flow. The 'A2', 'B1', and 'B2' service water pump discharge strainer baskets were found with measured gaps (maximum) on the order of 0.042" to 0.055". The 'A1' service water pump discharge strainer basket was found with a localized gap of about 0.130". Measurements varied from 0.087" to 0.130" around the circumference of the basket as it was rotated and measured from an inspection access panel on the side of the strainer. The licensee concluded in its extent of condition evaluation that the fish fragments found in the service water system downstream of the basket strainers were likely a result of this gap, in that the fish parts found could easily slide through an opening of 0.130" that existed in the 'A1' strainer. The licensee subsequently adjusted the drum to minimize this gap. Final "as-left" measured gaps for the 'A1' strainer were between 0.066" and 0.093".

The inspectors determined that the licensee's failure to appropriately evaluate for potential bypass flow on the service water pump discharge strainers by measuring a critical gap dimension at the bottom of the basket-to-housing interface with a procedure appropriate to the circumstances was a licensee performance deficiency warranting a significance evaluation.

Analysis

The inspectors assessed this finding using the Significance Determination Process (SDP). The inspectors reviewed the samples of minor issues in NRC Inspection Manual Chapter (IMC) 0612, "Power Reactor Inspection Reports," Appendix E, "Examples of Minor Issues," and determined that there were no examples related to this issue. Consistent with the guidance in IMC 0612, "Power Reactor Inspection Reports," Appendix B, "Issue Disposition Screening," the inspectors determined that this finding would become a more significant safety concern if left uncorrected and was therefore more than a minor concern. Specifically, the failure to appropriately evaluate for potential bypass flow on the service water pump discharge strainers could reasonably result in debris fouling of service water cooled components and degraded or inoperable safety-related equipment. Because the service water system provided cooling to systems primarily associated with decay heat removal following certain design basis accidents, the inspectors concluded that this issue was associated with the Mitigating Systems cornerstone. The inspectors performed a Phase 1 SDP review of this finding using the guidance provided in IMC 0609, Appendix A, "Significance Determination of Reactor Inspection Findings for At-Power Situations," and determined that this finding was a licensee performance deficiency of very low safety significance because the

finding: (1) was not a design or qualification deficiency; (2) did not represent an actual loss of safety function of a system; (3) did not represent an actual loss of safety function of a single train for greater than its TS allowed outage time; (4) did not represent an actual loss of safety function of one or more non-TS trains of equipment designated as risk significant; and (5) did not screen as potentially risk significant due to a seismic, flooding, or severe weather initiating event.

Enforcement

No violation of regulatory requirements was identified. This issue is considered to be a finding (FIN 05000305/2004003-02). The licensee entered this finding into its corrective action program as condition report CAP 019684.

.7 Adequacy of the Licensee's Initial Plans for Long-term Corrective Actions to Prevent Recurrence of the Degraded Condition (if available)

a. Inspection Scope

The inspectors attended licensee meetings, interviewed plant personnel, and reviewed testing plans and design packages to determine what additional long-term actions the licensee had planned to address the safety injection pump lube oil cooler plugging concern.

b. Findings and Observations

Introduction

No findings of significance were identified.

Discussion

The licensee had not yet completed its root cause evaluation at the conclusion of this inspection and had not yet formulated other corrective actions in response to this event. Some of the longer term actions that were discussed include the following:

- Verification that the safety injection pump lube oil cooler modification will perform its design function under all operating conditions by testing and analysis. The licensee intends to conduct laboratory testing of a spare cooler under 80°F service water temperatures. This testing will be conducted to verify whether the new heat exchanger will perform acceptably under design basis accident conditions. In parallel to this effort, the licensee is initiating contingency plans for

  a new heat exchanger design if the testing is unsuccessful in establishing the full qualification of the installed coolers. These actions will be needed to resolve operability determination OBD 000066.

- The licensee will conduct a review of its Generic Letter 89-13 program to ensure that it is adequately implemented. As part of this review, the licensee indicated they would establish and incorporate acceptance criteria within the heat exchanger inspection procedure to ensure that future inspection results are

appropriately addressed.

- The licensee will evaluate the effect of micro-biologically induced corrosion (MIC) on the stainless steel tubing in the cooler. The stainless steel tubing in the new coolers, which is more susceptible to MIC than the tube material in the original coolers, was only evaluated for 1 year of service before additional actions are needed to assess the effects of MIC. The licensee initiated condition report CAP 019683 to track this concern.

The licensee sent samples of the lake grass to a laboratory for analysis. Preliminary results indicated that it was primarily an algae called Cladophora. This algae grows on the rocky shoals of lakes. Several factors may be the cause for increased amount of algae seen at the plant. First, the water levels in Lake Michigan have decreased in recent years, which exposes more rocky areas where the algae can grow. Second, the introduction of zebra mussels have cleaned up the clarity of the lake water, such that the algae can establish itself at deeper lake depths. Third, the zebra mussels also provide nutrients necessary for the algae to flourish. These causes have expanded the algae habitat by providing needed sunlight and nutrients.

.8 Adequacy of the Licensee's Response to SOER 02-04, "Reactor Pressure Vessel Head Degradation at Davis-Besse Nuclear Power Station"

a. Inspection Scope

The inspectors interviewed plant personnel, reviewed applicable corrective action program documents, and reviewed the licensee's response to Recommendation 3 of SOER 02-04, "Reactor Pressure Vessel Head Degradation at Davis-Besse Nuclear Power Station," dated November 11, 2002.

b. Findings and Observations

Introduction

No findings of significance were identified.

Discussion

As discussed above in Section 4OA3.1, the licensee completed its review in May 2003 of abnormal plant conditions or indications that could not be easily explained in response to Recommendation 3 of SOER 02-04. The licensee identified that repetitive fouling of the high pressure safety injection pump lube oil coolers was a longstanding, widely known issue, which had not been aggressively pursued.

4OA4 Cross-Cutting Aspects of Findings

Section 4OA3.1 of this report describes an Unresolved Item in which the licensee had missed multiple opportunities to identify and correct repetitive fouling of the high pressure safety injection pump lube oil coolers. The inspectors concluded that many elements of this problem affected the cross-cutting area of problem identification and resolution.

4OA6 Meetings

Exit Meetings

On January 28, 2004, the inspectors presented the preliminary inspection results to Mr. T. Coutu and other members of Kewaunee plant management and staff. The licensee acknowledged the information presented. The inspectors asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

On February 25, 2004, the inspectors and Mr. P. Louden re-exited with Mr. K. Hoops and other licensee staff by telephone to discuss changes in the characterization of the issues since the previous exit meeting. The licensee acknowledged the information discussed.

ATTACHMENT: SUPPLEMENTAL INFORMATION
SPECIAL INSPECTION TEAM CHARTER

SUPPLEMENTAL INFORMATION

KEY POINTS OF CONTACT

Nuclear Management Company, LLC

L. Armstrong, Engineering Director
T. Coutu, Site Vice President
K. Davison, Plant Manager
L. Gerner, Acting Regulatory Affairs Manager
G. Harrington, Regulatory Affairs
K. Hoops, Site Operations Director
D. Lohman, Operations Manager
K. McCann, Engineering Systems Manager
C. Neuser, Engineering Supervisor Mechanical Maintenance Engineering
K. Peveler, Engineering Programs Manager
J. Pollock, Engineering Design Manager
S. Putman, Maintenance Manager

Nuclear Regulatory Commission

P. Hiland, Acting Deputy Director, Division of Reactor Projects
R. Krsek, Senior Resident Inspector, Kewaunee
P. Louden, Chief, Reactor Projects Branch 5
W. Schmidt, Senior Reactor Analyst, Region I

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

05000305/2004003-01	URI	Followup on open questions regarding past operability of the safety injection pumps commensurate with the identification of lube oil cooler fouling.
05000305/2004003-02	FIN	Failure to appropriately evaluate for potential bypass flow on service water strainers

Closed

05000305/2004003-02	FIN	Failure to appropriately evaluate for potential bypass flow on service water strainers

Discussed

None

LIST OF DOCUMENTS REVIEWED

The following is a list of documents reviewed during the inspection. Inclusion on this list does not imply that the NRC inspectors reviewed the documents in their entirety but rather that selected sections of portions of the documents were evaluated as part of the overall inspection effort. Inclusion of a document on this list does not imply NRC acceptance of the document or any part of it, unless this is stated in the body of the inspection report.

Corrective Action Program Documents

- CAP 001096, "Safety Injection Pump Oil Coolers Plugged: GL 89-13 Problems," October 20, 2001
- CAP 006187, "Service Water System Pressure Went to 150 Pounds Upstream of SW-903C - GL 96-06 Issue," November 30, 1999
- CAP 006195, "GL 96-06 Over-pressure Protection Check Valves Associated With Chiller Units," December 3, 1999
- CAP 006853, "Perform Service Water Flow Test," April 23, 1997
- CAP 011748, "Auxiliary Building Mezzanine Fan Coil Unit 'A' Failed Its Performance Monitoring," May 30, 2002
- CAP 011913, "Local Semi-Monthly Check of Backup Bearing Lube Water for Service Water Pump 'A1' Unsuccessful," June 16, 2002
- CAP 012296, "Safety Injection Pump Oil Cooler Pluggage - GL 89-13," July 18, 2002
- CAP 012388, "'B' Safety Injection Pump Oil Cooler Pluggage - GL 89-13," July 26, 2002
- CAP 012756, "Unable to Complete Performance Monitoring on Auxiliary Building Mezzanine Fan Coil Unit 'A'", August 28, 2002
- CAP 013391, "Zebra Mussels Were Found in Valve SW-2301," October 22, 2002
- CAP 015197, "SOER 02-04 Recommendation 2, Area for Improvement #5," March 12, 2003
- CAP 015479, "SOER 02-04 Recommendation 3 - Safety Injection Pump Lube Oil Coolers - Biofouling," April 3, 2003
- CAP 016225, "Design Discrepancy Between Safety Injection Pump Lube Oil Cooler's Spares and As-Built," May 1, 2003
- CAP 016659, "SOER 02-04 Recommendation 3 - Plugging of Service Water Piping, Valves, and Heat Exchangers," May 27, 2003
- CAP 016670, "SOER 02-04 Recommendation 3 - Service Water Pump Rotating Strainer Problems," May 27, 2003
- CAP 017771, "GL 89-13 Test Methodology Questioned by NRC," August 21, 2003
- CAP 019545, "Safety Injection Pump 'A' Lube Oil Cooler Service Water Flow Test and GL 89-13 Cooler Inspection," January 15, 2004
- CAP 019557, "'B' Safety Injection Pump Lube Oil Heat Exchanger Concerns," January 16, 2004
- CAP 019574, "Safety Injection Pump Stuffing Box Questions," January 18, 2004
- CAP 019585, "Service Water Review - Auxiliary Feedwater and Safety Injection Lube Oil," January 19, 2004
- CAP 019586, "Adequacy of Acceptance Criteria for Safety Injection Lube Oil Inspections," January 19, 2004
- CAP 019617, "NRC Questions Fire Protection System Operability," January 21, 2004
- CAP 019640, "Inspection Record Could Not Be Located," January 2, 2004

- CAP 019684, "Inadequate Service Water Strainer Preventive Maintenance," January 24, 2004
- CAP 019707, "Zebra Mussel Shell of 0.690" Long by 0.298" Wide in Auxiliary Mezzanine 'A'", January 26, 2004
- CAP 019709, "Discrepancy Between Predicted and Observed Performance of New Safety Injection Pump Oil Coolers, " January 26, 2004
- CAP 019716, "Defective Safety Injection Lube Oil Cooler Installed - Potential Part 21 Reportable, " January 27, 2004
- CAP 019719, "CAP Notes Added After Initiation Missed During CAP Evaluation," January 27, 2004
- CAP 019721, "50.59 Review Inconsistent with Procedural Requirements and Guidance," January 27, 2004
- CAP 019722, "Continued Reliance on Manual Action for Replacement of Service Water Cuno Filter," January 27, 2004
- CAP 019725, "NEP 15.32, Seismic Analysis Guidance Deviation - Procedure Not Followed," January 27, 2004
- CAP 019736, "Receipt Inspection of Heat Exchanger Did Not Identify Damaged Separator Plate," January 28, 2004
- CAP 019738, "Auxiliary Feedwater Recirculation Orifices," January 28, 2004
- CAP 019747, "Safety Classification of Service Water Strainers," January 28, 2004
- CAP 019866, "Safety Injection Pump Lube Oil Cooler and Stuffing Box Service Water Sight Glasses," February 5, 2004
- CA 003008, "Initiate a Physical Change to Install a Duplex Filter/Strainer Upstream of the Safety Injection Pump Lube Oil Coolers," April 1, 2002
- CA 003100, "Increase the Inspect and Clean Frequency of the Safety Injection Pump Lube Oil Coolers from 18 Months to 9 Months," April 11, 2003
- CA 003111, "Determine If There Is a Bypass or Other Means That Could Allow Something Larger Than 1/8" to Enter the Service Water System," April 12, 2002
- CA 011488, "Safety Injection Pump Lube Oil Coolers - Biofouling," May 1, 2003
- CA 011508, "Design Discrepancy Between Safety Injection Pump Lube Oil Cooler Spares and As-Built," May 2, 2003
- CA 012671, "Reduce Safety Injection Lube Oil Cooler Fouling," July 17, 2003
- CE 000901, "Safety Injection Pump Oil Coolers Plugged: GL 89-13 Problems," October 20, 2001
- CE 009920, "Auxiliary Building Mezzanine Fan Coil Unit 'A' Failed Its Performance Monitoring," May 31, 2002
- CE 006067, "Service Water Flow Measurement on 'B' Safety Injection Pump Lube Oil Heat Exchanger," April 23, 1997
- CE 010331, "Safety Injection Pump Oil Cooler Pluggage - GL 89-13," July 22, 2002
- CE 010383, "'B' Safety Injection Pump Oil Cooler Pluggage - GL 89-13," July 30, 2002
- CE 010639, "Unable to Complete Performance Monitoring on Auxiliary Building Mezzanine Fan Coil Unit 'A'", August 30, 2002
- CE 012729, "Design Discrepancy Between Safety Injection Pump Lube Oil Cooler's Spares and As-Built," May 4, 2003
- CE 012730, "Design Discrepancy Between Safety Injection Pump Lube Oil Cooler's Spares and As-Built," May 4, 2003
- ACE 002012, "Zebra Mussels Were Found in Valve SW-2301," October 24, 2002
- ACE 002198, "SOER 02-04 Recommendation 2, Area for Improvement #5," March 14, 2003

- ACE 002217, "SOER 02-04 Recommendation 3 - Safety Injection Pump Lube Oil Coolers - Bio-fouling," April 5, 2003
- MRE 001515, "Local Semi-Monthly Check of Backup Bearing Lube Water for Service Water Pump 'A1' Unsuccessful," June 18, 2002
- RCE 000617, "SOER Recommendation 3 - Plugging of Service Water Piping, Valves, and Heat Exchangers," May 29, 2003
- Root Cause Investigation Charter CAP 019545, RCE 000637

Calculations

- Calculation No. C11423, "Service Water Flow to the Safety Injection Lube Oil Coolers," Revision 0, Addendum A
- Calculation No. C11556, "Service Water Flow to Safety Injection Pump 1A/1B Lube Oil Coolers," Revision 0
- Calculation No. C11558, "Structural Evaluation of Piping and Tubing Changes Associated With the Safety Injection Pump Lube Oil Heat Exchanger Replacement per Design Change Request 003518," Revision 0
- Calculation No. C11183, "Auxiliary Feedwater Pump Suction Strainer Operability Determination," Revision 1

Drawings

- "Technical Data Sheet - Lubricating Oil Heat Exchanger - Safety Injection Pumps," March 10, 1992
- Thermxchanger, Incorporated Drawing B-4817, "No. 315 Type BF 2-Pass Liquid Cooler," March 5, 1966
- S. P. Kinney Engineers, Incorporated Drawing 12545, "16 Inch x 20 Inch Model 'A' Automatic Self-Cleaning Strainer," November 2, 1965
- Flour Engineers, Incorporated Drawing OPERM-202, "Flow Diagram Service Water System," Revision CW

Procedures

- Corrective Maintenance Procedure CMP-02-02, "Service Water Strainer Straining Media Replacement," Revision F
- Corrective Maintenance Procedure CMP-02-04, "Service Water System Strainer Inspection, Lubrication and Packing Replacement," Revision 0
- Corrective Maintenance Procedure CMP-02-06, "Service Water Strainer Overhaul," Revision A
- FP-SC-RSI-02, "Quality Receipt," Revision 3
- GMP-137, "Brush/Tube Scrubber Cleaning Heat Exchanger Tubes and Inspection," Revision G
- N-SW-02, "Service Water System," Revision Y
- Engineering Procedure NEP 15.32, "Seismic Design and Analysis of Modified, New, and Replacement Equipment and Parts/Sub-components Using the GIP Methodology," Revision 0
- Preventive Maintenance Procedure PMP-02-04, "Service Water System Strainer Inspection, Lubrication and Packing Replacement (QA-1)," Revision 0
- Preventive Maintenance Procedure PMP-33-01, "Safety Injection (QA-1) Pump Maintenance," Revision 0
- Surveillance Test Procedure SP-33-098B, "Train B Safety Injection Pump and Valve

Test," Revision A

Purchase Orders

- P200427, "Model NX0750FW Heat Exchanger," January 17, 2004
- P200545, "Coil Assembly for Model NX0750FW Heat Exchanger," January 25, 2004

10 CFR 50.59 Screenings/Evaluations

- Evaluation #04-01, "Replace Safety Injection Pump Lube Oil Coolers," Revisions 0 and 1
- Evaluation #04-02, "NEP 15.32, 'Seismic Design and Analysis of Modified, New, and Replacement Equipment and Parts/Sub-components Using the GIP Methodology,' Revision 1," Revision 0
- Screening #04-12, "Replace Safety Injection Pump Lube Oil Coolers," Revisions 0 and 1
- Screening #04-16, "Temporary Change to SP-33-098A and SP-33-098B," Revision 0
- Screening #04-18, "NEP 15.32, 'Seismic Design and Analysis of Modified, New, and Replacement Equipment and Parts/Sub-components Using the GIP Methodology,' Revision 1," Revision 0

Work Requests/Work Orders

- Engineering Work Request EWR 000555, "Perform Review of Service Water Issues Identified in ACE 002319," July 29, 2003
- Engineering Work Request EWR 007688, "Find a Solution to the Plugging of Safety Injection Lube Oil Coolers," May 20, 2002
- Work Order WO-01-008451, "Measure Perforation Size of Service Water Pump Strainer 1A2," January 21, 2004
- Work Order 02-008750-00, "Fan Coil Unit Auxiliary Building Mezzanine '1A' - Zebra Mussel Shells, Lake Weeds, and Mud Had Several Tubes Blocked Preventing Flow Through Tubes," August 28, 2002
- Work Order 02-009746-00, "SW-43-A1 Failed to Regulate to 10 Pounds During N-SW-02," June 17, 2002
- Work Order WO 04-000346, "Measure '1A1' Strainer Gap," January 24, 2004
- Work Order WO 04-000347, "Measure '1A2' Strainer Gap," January 24, 2004
- Work Order WO 04-000348, "Measure '1B1' Strainer Gap," January 23, 2004
- Work Order WO 04-000349, "Measure '1B2' Strainer Gap," January 23, 2004
- Work Order WO 04-000361, "Adjust '1A1' Strainer Gap," January 25, 2004
- Work Order WO 04-000364, "Perform Post Modification Testing for SI Pump 'A', January 27, 2004
- Work Order WO 04-000365, "Perform Post Modification Testing for Safety Injection Pump 'B'," January 25, 2004
- Work Request WR 206791, "Service Water Strainer '1A2' Operating Clearance Was Not Proper Distance," December 15, 1994
- Work Request WR 35614, "Service Water Strainer '1A1' Packing Leak," October 27, 1989

Other Documents

- Kewaunee Nuclear Power Plant Updated Final Safety Analysis Report, Revision 18
- Kewaunee Nuclear Power Plant System Description, "Service Water System," Revision 2
- Risk Informed Inspection Notebook for Kewaunee Nuclear Power Plant, Revision 1
- "Service Water System Extent of Condition for the Kewaunee Nuclear Power Plant Safety Injection Pump Lube Oil Cooler Event," January 27, 2004
- Event Notification 40452, "Technical Specification Required Shutdown Due to Both Trains of Safety Injection Declared Inoperable," January 16, 2004
- Licensee Event Report 95-006-00, "Recent Changes in Pump Operating Practice Resulted in Inadequate Thrust Bearing Lubrication and Failure of the B Safety Injection Pump," November 1, 1995
- Proto-Power Corporation Assessment, "Generic Letter 89-13 Program Assessment for Kewaunee Nuclear Power Plant," December 6, 2002
- Kewaunee Nuclear Power Plant Significant Operation Experience Report (SOER) 02-0004, Recommendation No. 3 - Equipment Screening Report, May 2003
- NRC Information Notice 2004-01, "Auxiliary Feedwater Pump Recirculation Line Orifice Fouling - Potential Common Cause Failure," January 21, 2004
- NRC Generic Letter 89-13, "Service Water System Problems Affecting Safety-Related Equipment," July 18, 1989
- Shift Manager’s Logs, January 15, 2004 through January 17, 2004
- Control Room Logs, January 15, 2004 through January 17, 2004
- Operability Determination OBD 000066, "Safety Injection Pump Lube Oil Coolers Require Injection Temperature Limit of 55.5°F; January 27, 2004
- Design Change Request DCR 003518, "Replace Safety Injection Pump Lube Oil Coolers," Revisions 0 and 1
- PTE No. 04-0003, "Replacement Safety Injection Pump Lube Oil Coolers," Revisions 0, 1, and 2
- Letter from Sulzer Pumps to Kewaunee Nuclear Plant, "Bingham-Willamette Co. 4X6X9, Type ’CP’ Pumps," January 26, 2004
- Inspection Results for ’A’ and ’B’ Safety Injection Lube Oil Coolers, 1992 through 2004
- Inspection Results for Component Cooling Water, Diesel Generator, and Fan Cooler Unit Heat Exchangers, 1995 through 2003
- Performance Test Results for Diesel Generator and Fan Cooler Unit Heat Exchangers, 1991 through 2003
- Kewaunee Nuclear Power Plant System Description, "Service Water System," Revision 2
- Kewaunee Nuclear Power Plant System Description, "Safety Injection System," Revision 4

LIST OF ACRONYMS USED

ACE	Apparent Cause Evaluation
AV	Apparent Violation
CA	Corrective Action
CAP	Corrective Action Program
CE	Condition Evaluation
CFR	Code of Federal Regulations
DRP	Division of Reactor Projects
FIN	Finding
GIP	Generic Implementation Procedure
GL	Generic Letter
gpm	Gallons-per-minute
IMC	Inspection Manual Chapter
MIC	Micro-biologically Induced Corrosion
MRE	Maintenance Rule Evaluation
NCV	Non-Cited Violation
NRC	Nuclear Regulatory Commission
OA	Other Activities
OBD	Operability Determination
PDR	Public Document Room
RCE	Root Cause Evaluation
SDP	Significance Determination Process
SOER	Significant Operating Event Report
SQUG	Seismic Qualification Utility Group
UFSAR	Updated Final Safety Analysis Report
URI	Unresolved Item