July 3, 2003

Mr. A. C. Bakken III
Senior Vice President
Nuclear Generation Group
American Electric Power Company
500 Circle Drive
Buchanan, MI 49107

SUBJECT: D. C. COOK NUCLEAR POWER PLANT, UNITS 1 AND 2
NRC SPECIAL INSPECTION REPORT 50-315/03-08(DRP);
50-316/03-08(DRP)

Dear Mr. Bakken:

On May 20, 2003, the NRC completed a Special Inspection at your D.C. Cook Nuclear Power Plant to review the circumstances surrounding the fish intrusion event of April 24, 2003. The enclosed report documents the inspection findings which were discussed on May 20, 2003, 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 team reviewed selected procedures and records, observed activities, and interviewed personnel.

On April 24, 2003, with both units operating at full power, the control room operators observed indications of an intrusion of alewives (fish) into the intake structure. The operators responded to the fish intrusion by dispatching auxiliary equipment operators to the screen house forebay to begin removing fish impacting the traveling water screen barrier between Lake Michigan and the circulating water and essential service water pump suction sides of the screen house forebay. Over the next hour, the auxiliary operators continued to remove an increasing quantity of fish from the traveling water screens. Subsequently, the control room operators determined that sufficient fish had entered the circulating water system to require a plant shutdown and tripped both reactors. With indications of degraded essential service water flow to the emergency diesel generators, the shift manager classified the ongoing condition as an Alert in accordance with the site emergency plan. Over the next 24 hours, your staff identified the immediate consequences of the fish intrusion, implemented short-term compensatory measures, and effected necessary corrective actions to cool down and stabilize the reactors in a Hot Shutdown Mode. On April 25, the Alert was exited when both reactors were placed in Hot Shutdown and at least one train of safety-related equipment was verified to be operable for each unit. Unit 1 and Unit 2 were subsequently placed in a Cold Shutdown Mode on April 28 and 29, 2003, respectively.

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 performance issues encountered. The inspection focused on: (1) the sequence of events related to the Essential Service Water (ESW) degraded flow condition; (2) the adequacy of your response to the ESW degraded flow condition including operator actions and Emergency Plan implementation; (3) the adequacy of your approach to the evaluation of the root cause for the ESW degraded flow condition; (4) the impact and safety significance of the ESW degraded flow condition on safety-related equipment; (5) the adequacy of your corrective actions associated with the restoration of safety-related equipment; (6) the adequacy of your plans for long-term corrective actions to prevent recurrence of the ESW degraded flow conditions; and (7) the adequacy of your approach to the assessment of the common causes of this event and a degraded ESW event in August 2001, including the effectiveness of any corrective actions from the previous event.

The NRC Special Inspection team concluded that this event could have been avoided. While the inspection results indicate that your staff effectively responded to the fish intrusion event within the significant limitations imposed by the available procedural guidance and control room indications, the findings clearly indicate that your staff failed to act upon several previous opportunities to be prepared for and minimize the impact of this type of event. The Problem Identification and Resolution area was previously identified as a substantial cross-cutting issue and discussed in our March 4, 2003 annual assessment letter to you. This event indicates that your corrective actions to address this cross-cutting issue have not been fully effective and that further improvements are necessary before this area can no longer be considered a substantial cross-cutting issue. In addition, our review of your root cause evaluation of the event noted that significant management involvement was necessary to compensate for limitations in your staff’s application of root cause techniques to understand the contribution safety-related equipment issues made to the resultant degraded essential service water system flow rates. Your root cause evaluation process also warrants your immediate attention.

Based on the results of this inspection, three findings of very low safety significance were identified which involved violations of NRC requirements. However, because of their very low safety significance and because these issues were entered into your corrective action program, the NRC is treating these violations as Non-Cited Violations in accordance with Section VI.A.1 of the NRC’s Enforcement Policy.

If you contest the subject or severity of a Non-Cited Violation, you should provide a response within 30 days of the date of this inspection report, with the basis for your denial, to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with a copy 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 Resident Inspector Office at the D.C. Cook facility.

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Sincerely,

/RA by S. Reynolds acting for/

Geoffrey E. Grant, Director
Division of Reactor Projects

Docket Nos. 50-315; 50-316
License Nos. DPR-58; DPR-74

Enclosure: Inspection Report 50-315/03-08(DRP);
50-316/03-08(DRP)

cc w/encl: J. Pollock, Site Vice President
M. Finissi, Plant Manager
R. Whale, Michigan Public Service Commission
Michigan Department of Environmental Quality
Emergency Management Division
MI Department of State Police
D. Lochbaum, Union of Concerned Scientists

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REGION III

Docket No:	50-315; 50-316
License Nos:	DPR-58; DPR-74
Report No:	50-315/03-08(DRP); 50-316/03-08(DRP)
Licensee:	American Electric Power Company
Facility:	D.C. Cook Nuclear Power Plant, Units 1 and 2
Location:	1 Cook Place Bridgman, MI 49106
Dates:	April 24 through May 20, 2003
Inspectors:	K. O'Brien, Branch Chief L. Kozak, Project Engineer P. Lougheed, Senior Reactor Inspector I. Netzel, Resident Inspector
Approved by:	Geoffrey E. Grant, Director Division of Reactor Projects

SUMMARY OF FINDINGS

IR 05000315-03-08(DRP), IR 05000316-03-08(DRP); Indiana Michigan Power Company; 04/24/2003 - 5/20/2003; D.C. Cook Nuclear Power Plant, Units 1 and 2; Special Inspection. Violations were identified with the adequacy of licensee response to essential service water degraded flow conditions due to fish intrusion and the adequacy of the common cause assessment approach.

This report covered a 2-week period of special inspection by NRC resident and region-based inspectors. Three Green findings and associated Non-Cited Violations (NCVs) were identified. 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. NRC-Identified and Self-Revealed Findings

Cornerstone: Initiating Events

- Green. A finding of very low safety significance was self-revealed during an event when the licensee failed to develop and implement adequate procedures associated with operator response to off-normal forebay conditions.

  The finding was more than minor because it could be reasonably viewed as a precursor to a significant event. The finding was determined to be of low safety significance because all mitigating systems were available during the event. This issue was determined to be a Non-Cited Violation of 10 CFR 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings." (Section 4OA3.2)

- Green. A finding of very low safety significance was identified by the team regarding the ineffective implementation of a prior corrective action to develop and integrate into plant operations a rapid power reduction procedure for a 1996 fish intrusion event.

  The finding was more than minor because it could be reasonably viewed as a precursor to a significant event. The finding was determined to be of low safety significance because all mitigating systems were available following the event. This issue was determined to be a Non-Cited Violation of 10 CFR 50, Appendix B, Criterion XVI, "Corrective Actions." (Section 4OA3.7)

Cornerstone: Mitigating Systems

- Green. A finding of very low safety significance was self-revealed during an event when the licensee failed to adequately assess the suitability of a vendor's substitution of lighter weight stainless steel mesh in the construction of replacement safety-related essential service water discharge strainers.

The finding was more than minor because it could be reasonably viewed as a precursor to a significant event. The finding was determined to be of low safety significance because all mitigating systems were available following the event. This issue was determined to be a Non-Cited Violation of 10 CFR 50, Appendix B, Criterion III, "Design Control." (Section 4OA3.7)

Licensee-Identified Violations

No findings of significance were identified.

REPORT DETAILS

Summary of Plant Event

On April 24, 2003, at about 2:00 a.m. the licensee experienced a large intrusion of alewives (fish) into the circulating and essential service water forebay. At the time, both units were operating at full power with six of seven circulating water and three of four essential service water pumps in operation.

Within about 1 hour after the initial indications of the fish intrusion, the incoming fish overloaded the traveling water screens (TWSs) and several TWS panels failed. Ongoing operation of the circulating water pumps caused about 1.6 million gallons per minute (gpm) of water and large quantities of fish to be drawn through the intact and failed screens to the pump suction side of the forebay and into the circulating and essential water systems. The control room operators, noticing the degraded circulating water system conditions caused by the fish, initiated a manual trip of both units.

Subsequently, the control room operators observed degraded essential service water system flow to the emergency diesel generator coolers. In an effort to ensure an appropriate and timely response to the apparent consequences of the ongoing fish intrusion event, the shift manager implemented the site emergency plan and classified the ongoing condition as an Alert.

Over the next 24 hours, the licensee staff continued implementation of the emergency plan for the Alert condition, placed both units in a Hot Shutdown condition, and implemented necessary immediate corrective measures to ensure the operability of at least one train of essential service water supported safety-related equipment for each unit. Early on the morning of April 25, 2003, licensee management terminated the Alert condition, exited the emergency plan, and continued efforts to place both units in a Cold Shutdown Mode. In addition, the licensee staff continued efforts to remove the fish remaining in the forebay and in all components served by the circulating water and essential service water systems. Unit 1 and Unit 2 were placed in Cold Shutdown on April 28 and 29, 2003, respectively.

Inspection Scope

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.”

The inspection focused on: (1) the sequence of events related to the Essential Service Water (ESW) degraded flow condition; (2) the adequacy of the licensee’s response to the ESW degraded flow condition including operator actions and Emergency Plan implementation; (3) the adequacy of the licensee’s approach to the evaluation of the root cause for the ESW degraded flow condition; (4) the impact and safety significance of the ESW degraded flow condition on safety-related equipment; (5) the adequacy of the licensee’s corrective actions associated with the restoration of safety-related equipment; (6) the adequacy of the licensee’s plans for long-term corrective actions to prevent recurrence of the ESW degraded flow conditions; and (7) the adequacy of the licensee’s approach to the assessment of the common causes of this event

and a degraded ESW event in August 2001, including the effectiveness of any corrective actions from the previous event.

4. OTHER ACTIVITIES (OA)

4OA3 Special Inspection (93812)

.1 Sequence of Events Related to Degraded Essential Service Water (ESW) Flow

a. Inspection Scope

The team reviewed documentation and conducted interviews to determine the sequence of events associated with an intrusion of a large quantity of fish into the forebay and circulating water and ESW systems, the resultant degraded ESW flow rates to safety-related equipment, and the licensee's declaration and termination of an Alert emergency classification.

b. Findings

No findings of significance were identified.

Based upon a review of control room logs, operator statements, plant process computer data and other instrumentation, the team developed the following sequence of events associated with the fish intrusion and subsequent shutdown and cooldown of both units.

Date and Time	Event Description
April 24, 2003	Initial Conditions:
12:00 a.m.	Unit 1: Mode 1, 100 percent power, all three circulating water (CW) pumps and both ESW pumps in service.
	Unit 2: Mode 1, 100 percent power, three of four CW and one of two ESW pumps in service. The number 24 CW pump was out of service for replacement. The 2W ESW pump was in operation to support scheduled surveillance testing. The 2E ESW pump was in standby. The Unit 2 ESW loads were being supplied by the 1W ESW pump through an open unit cross-tie valve.
2:03 a.m.	Unit 2: The control room operators received a traveling water screen (TWS) high differential pressure (d/p) alarm (setpoint of 4.5 inches of water). The operators reviewed the associated alarm response procedure, requested local auxiliary equipment operators (AEOs) and a field supervisor investigate the alarm, and notified the Unit 1 control room staff of the alarm.

Date and Time	Event Description
2:10 a.m.	Unit 1: The TWSs were in operation with an indicated d/p of 2.5 inches of water.
	Unit 2: The control room operators received a TWS high-high d/p alarm (setpoint of 5.0 inches of water), started the south screen wash pump, and placed the TWSs in service. The high-high d/p alarm cleared a few minutes later.
2:11 a.m. to 2:40 a.m.	Auxiliary equipment operators vacuumed fish and other debris from the traveling water screens.
2:40 a.m.	Unit 1: The control room operators received a TWS high d/p alarm.
2:50 a.m.	Unit 1: The control room operators received a TWS high-high d/p alarm, placed the north screen wash pump and all spray wash headers in service.
	Unit 2: The control room operators received TWS high and high-high d/p alarms. At the time, the operators had all TWSs and the south screen wash pump in service. The operators increased the TWS speed to fast and noted that the d/p indicated 4 to 6 inches of water.
2:51 a.m. to 2:55 a.m.	Unit 1: The control room operators noted that the TWS high-high d/p alarm was cleared and received several times.
	The AEOs, working to clean the TWSs, reported to the control room operators the presence of large quantities of fish on the TWSs. The AEOs noted limited fish carryover; however, the influx of fish was sufficient to fill the fish baskets in only about 10 minutes.
3:00 a.m.	Unit 1: The control operators observed that the TWS high-high d/p alarm cleared with the TWS controls set to fast speed.
	The AEOs, working to clean the TWSs, reported to the control room operators that there was no decrease in the influx of fish. Noises could be heard as some TWSs (numbers 2 and 6) stopped on thermal overload or failure of the motor to shaft shear pin.
3:05 a.m.	Unit 2: The control room operators received a 2W ESW pump discharge strainer high d/p alarm (setpoint of 95 inches of water). The operators placed a parallel ESW strainer in service and the alarm cleared. The shift manager directed the Unit 2 staff to abort a 2W ESW pump surveillance which was in progress.

Date and Time	Event Description
3:19 a.m.	Unit 2: The control room operators observed the TWS d/p to be steady at 5 inches of water.
3:20 a.m.	Unit 1: The staff secured TWS Number 6 due to excessive carryover of fish. The AEOs reported to the control room operators that the fish influx was continuing. The fish influx rate had increased to the point that it was no longer possible to empty one fish basket before the other basket was filled.
3:24 a.m.	The shift manager directed both unit control room staffs to review Procedure 01/02-OHP-4022-001-006, "Rapid Power Reduction Response," in anticipation of securing some CW pumps. The control room operators observed that the TWS d/p indications for both units was pegged high (greater than 30 inches of water) for the past few minutes.
3:25 a.m.	Unit 1: The control room operators received the 1E and 1W ESW strainer high d/p alarms, the non-essential service water (NESW) strainer high d/p alarms, and the NESW header low pressure alarm (setpoint of 80 pounds per square inch gauge (psig)).
3:27 a.m.	Unit 1: The control room operators initiated a manual trip of the reactor following a loss of the 1W main feedwater pump, due to low feed water pump condenser vacuum, and degraded CW system conditions. The TWS d/p indication was pegged high and main condenser vacuum was decreasing. The control room operators entered Emergency Operating Procedure 01-OHP-4023-E-0, "Reactor Trip or Safety Injection." The reactor was placed in Mode 3 (Hot Standby).
3:30 a.m.	Unit 2: The control room operators performed a manual trip of the reactor based upon degrading circulating water system conditions, i.e. loss of all TWSs and decreasing main condenser vacuum. The control room operators entered Emergency Operating Procedure 02-OHP-4023-E-0, "Reactor Trip or Safety Injection." The reactor was placed in Mode 3.
3:45 a.m.	Unit 2: The control room operators secured one of three operating Unit 2 CW pumps (Number 23).

Date and Time	Event Description
3:48 a.m.	The Unit 1 and Unit 2 control room operators declared the emergency diesel generators (EDGs) for both units inoperable due to ESW flow rates trending to or less than the minimum required flow rate of 590 gallons per minute (gpm). The ESW flow rate to EDG 1-AB was 350 gpm and to EDG 1-CD was 600 gpm. The operators entered Technical Specification (TS) 3.8.1.1, Action E for each unit. The shift manager, using the site emergency plan and exercising management discretion, classified the ongoing fish intrusion and degraded ESW flow to the four EDGs event as an Alert condition.
3:50 a.m.	Unit 1: The control room operators secured one of three operating CW pumps (Number 13). Unit 2: The control room operators secured a second operating CW pump (Number 22).
3:53 a.m. to 5:10 a.m.	Unit 2: The control room operators initiated cycling of the ESW supply valves to the Unit 2 EDGs in an effort to restore acceptable ESW flow rates through the EDG coolers. Repeated cycling of the ESW supply valves was required to maintain adequate flow rates.
4:00 a.m.	Unit 1: The control room operators secured a second operating CW pump (Number 12).
5:05 a.m.	Unit 1: The control room operators secured the last operating CW pump (Number 11).
5:10 a.m.	Unit 1: The control room operators initiated cycling of the ESW supply valves to the Unit 1 EDGs in an effort to improve ESW flow rates through the EDG coolers.
7:52 a.m.	Unit 2: The control room operators declared the 2W component cooling water (CCW) train inoperable due to insufficient ESW flow to the 2W CCW heat exchanger. The operators entered TS 3.7.3.1, Action A, and TS 3.0.5 for both EDGs and one train of CCW inoperable.

Date and Time	Event Description
8:28 a.m.	The Technical Support Center (TSC) staff recommended that the operations staff close the ESW unit cross-tie valves to facilitate ESW pump discharge strainer integrity testing. The engineering staff recommended that the operations staff perform Procedure 01/02-OHP-5030-019-002E/W, "Essential Service Water Flow Test," to verify ESW pump and strainer performance.
8:30 a.m.	Unit 2: The control room operators, in an attempt to clear fish from the system, initiated cycling of valves in the ESW line supplying cooling water to the 2W CCW heat exchanger. During the cycling efforts, the operators noticed decreasing ESW flow rate (less than 590 gpm) to the Unit 2 AB EDG coolers.
9:48 a.m.	Unit 2: The control room operators started the 2E ESW pump in order to permit closing of unit cross-tie valves and integrity testing of the individual ESW pump strainer baskets. Upon pump startup, the operators received a 2E ESW pump discharge strainer high d/p alarm. The operators observed that the system attempted to automatically switch strainer baskets and to backwash the basket initially in service; however, a second high d/p alarm was received shortly after the system attempted to realign from the inservice basket. The ESW flow to the associated Unit 2 CD EDG coolers also decreased shortly after the pump was started.
10:46 a.m.	Divers reported the presence of fish outside the lake water intake cribs, the intake tunnels filled with fish, and the presence of large numbers of fish on both sides of the TWSs in the forebay. The divers also observed a 3 foot tear in a screen panel associated with TWS 1-3.
10:52 a.m.	Unit 2: The control room operators cycled valves in the ESW supply line to the 2W CCW heat exchanger. During a 3 hour period the valves were cycled eight times and the observed ESW flow rates increased from 2100 gpm to 8350 gpm.
11:50 a.m.	Unit 2: The control room operators secured the last operating CW system pump (Number 21).
12:08 p.m.	Unit 1: During flow testing of the 1E ESW train, the control room operators observed an initial flow rate of 6000 gpm which subsequently decreased to 3000 gpm. Additional immediate operator efforts to increase the flow rate were unsuccessful.

Date and Time	Event Description
12:16 p.m.	Unit 1: The control room operators declared the 1E CCW train inoperable due to low ESW flow rates through the 1E CCW heat exchanger. The operators entered TS 3.7.3.1, Action A, and TS 3.0.5 due to both units EDGs and one CCW header being declared inoperable.
12:30 p.m.	The shift manager halted all further ESW system flow testing until an integrated recovery plan could be developed.
3:03 p.m.	Unit 2: The control room operators completed flow and strainer integrity testing of the 2W ESW supply to the 2W CCW heat exchanger. The operators declared the 2W CCW train operable based upon the ability to maintain 9200 gpm of ESW supply flow to the CCW heat exchanger (minimum 5000 gpm flow rate required for operability). The operators exited TS 3.0.5 and TS 3.7.3.1, Action A.
3:52 p.m.	Unit 2: The control room operators completed a cooldown of the unit to Mode 4 (Hot Shutdown).
4:58 p.m.	Unit 1: The control room operators completed a cooldown of the unit to Mode 4 (Hot Shutdown).
5:00 p.m.	The operations and engineering staff completed development of a plan to restore ESW system operability one train at a time. The plan prioritized recovery efforts first on the Unit 1, A and B and then Unit 2, B and A trains of equipment The recovery plan anticipated that operators would use Procedure OHP-5030-019-002 to demonstrate acceptable ESW pump and strainer performance and an acceptable CCW flowpath and flow rates. Subsequently, the operators would use Procedure OHP-4030-119-22 to flush the containment spray systems and would direct maintenance staff to fail open the ESW flow control valves associated with the EDG turbo-charger aftercoolers. Once a train of ESW-supplied components was declared operable, the operators would complete the same sequence for the other train of components.
8:00 p.m.	Unit 1: Following ESW flow testing with acceptable results, the control room operators declared the 1E CCW train operable and exited TS 3.0.5 and TS 3.7.3.1, Action A.

Date and Time	Event Description
10:55 p.m.	Unit 2: Following ESW flow testing with acceptable results, the control room operators declared the 2AB EDG operable and exited TS 3.8.1.1, Action E. The operators entered TS 3.8.1.1, Action B, due to the 2CD EDG remaining inoperable.
April 25, 2003	
3:00 a.m.	Unit 1: Following ESW flow testing with acceptable results, the control room operators declared the 1CD EDG operable and exited TS 3.8.1.1, Action E. The operators entered TS 3.8.1.1, Action B, due to the 1AB EDG remaining inoperable.
4:30 a.m.	Unit 2: Following flow testing with unacceptable results, the control room operators declared the 2E CCW train inoperable due to low ESW flow to the CCW heat exchanger and entered TS 3.7.3.1, Action A.
5:12 a.m.	Unit 2: The control room operators cycled valves in the ESW supply line to the 2E CCW heat exchanger four times over 20 minutes and restored the ESW flow rate to greater than 5000 gpm. The operators declared the 2E CCW train operable and exited TS 3.7.3.1, Action A.
5:21 a.m.	Based upon the availability of a single train of operable ESW and CCW equipment for each unit, the site emergency director terminated the Alert classification of the event, deactivated emergency operating facilities and exited the emergency plan.
3:53 p.m.	Unit 2: The control room operators flushed the ESW supply to the 2CD EDG after-coolers during the performance of Procedure 02-OHP-4030-219-0-22E, "East Essential Service Water System Test," without any indications of restricted flow. As a result, the operators declared the 2CD EDG operable and exited TS 3.8.1.1, Action B.
4:35 p.m.	Unit 1: Following flushing of the ESW supply to the 1AB EDG with satisfactory results, the control room operators declared the 1AB EDG operable and exited TS 3.8.1.1, Action B, for both units.

.2 Adequacy of Licensee Response to ESW Degraded Flow Conditions

a. Inspection Scope

The team evaluated the licensee's response to the ESW fish intrusion event. This evaluation included a review of the control room operators' identification of the event,

initial actions to mitigate the event, long-term operator response to the event including system restoration, and the implementation of the site emergency plan.

b. Findings

Introduction

One Green finding in the Initiating Events Cornerstone and an associated Non-Cited Violation (NCV) of 10 CFR 50, Appendix B, Criterion V, "Instructions, Procedures, and Drawings," was identified regarding the licensee's failure to develop and implement adequate procedures for operator response to off-normal forebay conditions.

Description

Identification of and Initial Response to the Fish Intrusion Event

The team determined that the control room operators' first indication of the fish intrusion was a TWS high d/p alarm. The expected operator response to this alarm was indicated in Procedure 01(02)-OHP-4024-123(223), Drops 18 and 19.

The team reviewed these procedures and determined the following:

- The guidance provided in Drop 18, "Traveling Screen Differential Pressure High," for both procedures, permitted the operators to start a second screen wash pump, to operate the TWSs at high speed, and to run the TWSs continuously and start the de-icing system.

- The guidance provided in Drop 19, "Traveling Screen Differential Pressure High-High," for both procedures, directed the operators to start a second screen wash pump, to operate the TWSs at high speed and to monitor for trash carryover.

- Drop 19 did not require or direct the control room operators to take any further action as long as a single screen wash pump was operating, irrespective of how high TWS d/p reached or how much carryover occurred.

- Neither of the procedures included a reference to the licensee's rapid power reduction procedure.

The team also determined that the procedures did not direct the operators to monitor screen wash pump performance. During the fish intrusion event, the screen wash pump strainers became clogged. As a result, although the operators may have had an indication that the pumps were operating, the pump discharge pressure was too low to effectively clear the screens of debris.

Based upon the existing control room instrumentation and information included in operator statements obtained following the event, the team concluded that the limited control room indications of forebay conditions and limited communications between the AEOs and the control room operators further hampered the operators' response to the event. At about 2:50 a.m., the control room operators increased the TWS speed to fast

in an effort to keep up with the influx of fish. At 2:55 a.m., AEOs working in the forebay area identified an increased fish influx into the forebay. At 3:00 a.m., an AEO observed that an inservice TWS had stopped due to broken shear pins and the activation of thermal overload protection systems. However, operators did not begin reviewing the rapid power reduction procedure until almost 25 minutes later. Because the forebay and CW systems continued to degrade, the operators were unable to implement the rapid power reduction procedure. Instead, the operators appropriately took action to manually trip the reactors at 3:27 a.m. and 3:30 a.m. for Units 1 and 2, respectively.

Post Trip Response and System Recovery

Shortly after the control room operators tripped each of the reactors, the operators began a methodical shutdown of the operating CW pumps. The operators shut down five of the six operating CW pumps between 3:45 a.m. and 5:05 a.m.. The sixth CW pump was shut down at 11:50 a.m.. The team determined that the operators shut down the Unit 1 CW pumps in the order and manner specified in Procedure 01(02)-OHP-4021-057-001, "Circulating Water Pumps." However, the operators did not shut down the Unit 2 CW pumps in the order or the manner specified in the governing procedure. Specifically, the procedure directed the operators to shutdown the CW pumps beginning with the pump closest to the center of the forebay and to wait 15 minutes between pump shutdowns. For Unit 2, the operators began to shut down the CW pumps with the pump located furthest from the center of the forebay and did not shut down the last pump until about 8½ hours after the reactor was tripped.

Because the TWSs failed as a result of tears in the screen material, the team determined that the order and timing of the operators' shut down of the CW pumps contributed to a continued movement of fish from the Lake Michigan side of the TWSs to the pump suction side of the TWSs. In addition, the team determined that the procedural guidance used by the operators to shut down the CW pumps was not appropriate for the circumstances of this event. Specifically, the control room operators shutdown the CW pumps using procedural guidance developed as a corrective action for the August 2001 sand, silt, and zebra mussel ESW intrusion event. This guidance was intended to minimize the re-entrainment of sand, silt, and zebra mussels, located in low flow areas of the forebay due to changing water currents caused by the starting or stopping of CW pumps. However, due to TWS failures caused by the fish intrusion, the control room operators should have shut down the CW pumps as quickly as possible after the reactor trips in order to minimize flow and passage of fish through the damaged TWSs. The team noted that a single operating CW pump drew about 25 times more water through the TWSs than a single operating ESW pump. Therefore, the prompt shut down of all CW pumps would have likely reduced the magnitude and duration of the required recovery actions.

About 15 minutes after the control room operators tripped the reactors, the operators noted significantly decreased ESW flows through the EDG coolers. Because the observed ESW flow rates were less than that required for the EDGs to be considered operable, the operators declared all four of the EDGs inoperable and initiated efforts to clear the assumed blockage by cycling system valves. The operators had previously used this technique to clear ESW system flow blockages. The team noted that the control room operators' actions to cycle the ESW system valves in an effort to flush

debris out of the system were effective in ensuring the continued availability of the ultimate heat sink. Equipment affected by the fish intrusion and subsequently cleared of fish debris through valve cycling included heat exchangers associated with both the EDG and the CCW systems.

Later on the morning of April 24, the control room operators, in an effort to assess the impact of the fish intrusion on each of the ESW trains and on the advice and guidance of the Technical Support Center staff, started the previously idle and unaffected 2E ESW pump. At the time the 2E ESW pump was started, the forebay contained a substantial amount of fish, many TWS panels had significant tears in the screen mesh, and one of the CW pumps was still operating. As a result, shortly after placing the 2E ESW pump in service, the operators received a 2E ESW pump discharge strainer high d/p alarm. Immediately after the alarm was received, the operators noted that an automatic backwash of the 2E ESW pump discharge strainer began. However, before the process could be fully initiated, the operators observed that the system began an automatic backwash of the alternate discharge strainer. At this point, the operators took manual control of the backwash function and performed several manual backwashes of both strainers. During these activities, the operators noted that ESW flow rate to the 2CD EDG, the EDG associated with the 2E ESW pump, decreased from 740 gpm to 440 gpm. This change in the ESW flow rate indicated that operation of the 2E ESW pump caused debris to be swept into the system and partially plugged the 2CD EDG coolers.

Based upon the relatively stable plant conditions at the time and the unexpected results observed during flow testing for the 1E ESW train and on startup of the 2E ESW pump, the Shift Manager appropriately halted all further actions pending the staff's development of an integrated recovery and restoration plan.

The control room staff began recovery efforts, using the integrated recovery plan at about 5:00 p.m., with both units in a Hot Shutdown condition. Over the next 12 hours, the operations staff effectively restored a single train of ESW-related equipment for each unit to an operable condition and the shift manager terminated the Alert emergency classification. Subsequently, the operators cooled down Unit 1 and Unit 2 to a Cold Shutdown Mode on April 28 and 29, respectively.

Emergency Plan Implementation

Shortly after the control room operators tripped the reactors, the operators identified low ESW flow rates to all four EDGs. Given the safety importance of the EDGs, the lessons learned from the August 2001 ESW debris intrusion event, and the operations staff current lack of understanding of the full impact of the fish intrusion, the shift manager classified the ongoing condition as an Alert, in accordance with criteria included in the emergency plan. This criteria provided the shift manager with discretionary authority to classify an ongoing condition as an Alert in order to ensure that appropriate personnel and equipment were made available in a timely manner to address plant conditions. Based upon a review of the information provided in the emergency plan and discussions with the shift manager of the decision-making considerations, the team determined that the Alert classification was timely, appropriate, and consistent with the emergency plan.

Subsequent to the shift manager's classification of the ongoing condition as an Alert, additional licensee management and staff were made available to support the operating crew. A part of this additional support was the personnel and resources of the licensee's Technical Support Center (TSC) and Emergency Operations Facility.

Based upon a review of operator logs, communication logs, and discussions with licensee and NRC individuals involved in the response and monitoring efforts, the team determined that the licensee's overall implementation of the emergency plan was effective and appropriately supported the operating staffs' response to the event, with two exceptions. First, during the early stages of the event response, the TSC staff did not identify, communicate, or ensure that the operations staff quickly shut down the operating CW pumps. As a result, the control room operators left a single CW pump running for about 8½ hours after the reactors were tripped. Secondly, the TSC staff incorrectly recommended that the control room operators start the idle 2E ESW pump as a first step in a process to separate each of the ESW trains and test the integrity of the ESW discharge strainers. At the time of this recommendation, the team determined sufficient information existed to conclude that debris had bypassed the in-service ESW discharge strainers, as demonstrated by the previous low ESW flow rates to the EDGs, and that starting the idle 2E ESW pump would potentially damage the pump discharge strainers, as demonstrated by the reports of large numbers of fish in the forebay.

Following the event, the licensee conducted a critique of their implementation of the emergency plan. The team reviewed the initial results of the critique process and noted that the evaluation focused almost exclusively on administrative and equipment problems experienced during the response. The critique failed to identify the issues discussed above. Independent of the team's review of the critique results, the operations staff concurrently determined that the critique results did not capture the issues discussed above and immediately initiated a follow-up review of the technical decision-making effectiveness of the control room, TSC, and Emergency Operations Facility staff. This review identified the issues discussed above as well as several other issues which the licensee entered into their corrective action program.

Analysis

The team determined that the licensee failed to develop and implement adequate procedures associated with the operators' response to off-normal forebay conditions since the control room operators had insufficient instructions to respond to the increasing TWS d/p; and also failed to shut down operating circulating water pumps in a timely manner and in the proper order specified in an existing procedure. Both of these performance deficiencies contributed to the observed ESW system damage and to the overall significance of the event. The Initiating Events cornerstone was impacted by this performance deficiency.

The team concluded that the finding had more than minor risk significance in accordance with Inspection Manual Chapter (IMC) 0612, "Power Reactor Inspection Reports," Appendix B, "Issue Disposition Screening," because inadequate procedures contributed to a dual unit reactor trip which could be reasonably viewed as a precursor to a significant event.

In accordance with Inspection Manual Chapter 0605, “Significance Determination Process [SDP],” Appendix A, “Significance Determination of Reactor Inspection Findings for At-Power Situations,” a Phase 1 SDP was initiated to address the findings contained in this report. That review determined that the finding affected the Initiating Events cornerstone since the likelihood of a reactor trip was increased as a result of the finding. Therefore, in accordance with the “SDP Phase 1 Screening Worksheet for IE [Initiating Events], MS [Mitigating Systems], and B [Barrier Integrity] Cornerstones,” since the finding did contribute to both the likelihood of a reactor trip and the likelihood that mitigation equipment or functions would not be available, a Phase 2 SDP analysis was warranted.

For the Phase 2 SDP review, to address the increased plant vulnerability during the season of increased alewife population, the likelihood of a transient (reactor trip) and the loss of the power conversion system (main condenser and feed pumps) was increased by one order of magnitude for a period of greater than 30 days. The team concluded that while ESW flow rates through the EDG heat exchangers and the CCW heat exchanger were degraded, the safety functions remained available. As a result, the Phase 2 SDP analysis determined that the finding was of very low safety significance (Green).

Enforcement

10 CFR 50, Appendix B, Criterion V, “Instructions, Procedures, and Drawings” requires, in part, that activities affecting quality shall be prescribed by documented instructions or procedures of a type appropriate to the circumstances and shall be accomplished in accordance with the instructions or procedures.

Contrary to the above, on April 24, 2003, the licensee failed to ensure that activities affecting quality were described by procedures, appropriate to the circumstances; and failed to accomplish activities affecting quality in accordance with prescribed procedures. Specifically, on April 24, 2003, the licensee failed to describe in Procedure 01(02)-OHP-4024-123(223), Drop 18, “Traveling Water Screen Differential Pressure High,” and Drop 19, “Traveling Water Screen Differential Pressure High-High,” appropriate operator actions to identify and respond to increasing TWS d/p; and failed to include in Procedure 01(02)-OHP-4021-057-001, "Circulating Water Pumps," appropriate operator actions to promptly shut down the circulating water pumps following indications of significant TWS differential pressure or a failure of the TWSs. In addition, on April 24, 2003, the licensee failed to accomplish a shutdown of the circulating water pumps in the order and manner described in Procedure 02-OHP-4021-057-001, “Circulating Water Pumps.”

However, because no actual loss of safety function of any safety-related equipment occurred, the violation was of only very low safety significance. Therefore, because this issue was entered in the corrective action program, it is being treated as a Non-Cited Violation (NCV), consistent with Section VI.A.1 of the Enforcement Policy (NCV 50-315/0308-01; 50-316/0308-01). This issue was entered into the licensee’s corrective action program as Condition Report 03055133.

.3 Adequacy of the Root Cause Evaluation of the ESW System Degraded Flow Condition

a. Inspection Scope

The team reviewed the as-found condition of components of the TWS, ESW, and CCW systems, including each of the ESW pump discharge strainers. This review included the observation of heat exchanger end bell removal, pump discharge strainer inspections, and flushing activities. The team also interviewed individuals involved with these activities and reviewed the licensee's root cause report for the fish intrusion event.

b. Findings

No findings of significance were identified.

The licensee used a causal analysis methodology to assess the root and contributing causes for the observed failure of the debris removal capability that resulted in degradation of all cooling water systems taking a suction from the forebay. This approach began with the identification of barriers between the debris (fish) and the systems that take a suction from the forebay. For each of the identified barriers, the licensee developed a failure mode chart to document how each barrier may fail, and then applied documented observations, data, and/or evaluations to either support or refute the postulated failure mode. Causes for the observed failures were then linked and evaluated to determine root and contributing causes. The licensee staff considered four criteria to determine if an identified cause was a root cause. The criteria were: 1) the cause could be eliminated to prevent recurrence; 2) the cause was under management's control; 3) the cause could be prevented cost-effectively; and, 4) the cause was sub-standard.

As a result of this evaluation, the licensee identified three root and five contributing causes for the failure of the debris removal capability to preclude a degradation of all cooling water systems taking a suction from the forebay. The identified root and contributing causes were as follows:

Root Causes

- A failure to resolve long standing or repetitive equipment problems associated with the TWSs.
- The lack of a fully developed operational response to debris intrusion into the forebay.
- A failure to adequately maintain the TWS panels.

Contributing Causes

- The lack of robust designs for the TWS system, forebay, and ESW strainers.
- Inadequate awareness of the consequences resulting from a loss of the TWS system.

- Inadequate response to previous operating experience and corrective actions.
- The absence of a debris monitoring methodology.
- The absence of a fish deterrent methodology.

The team assessed the licensee's root cause methodology and determined that the licensee's root cause evaluation methodology and the developed results were reasonable for the problem statement evaluated. However, the team determined that the root cause evaluation did not fully investigate the performance issues and failure modes applicable to the safety-related ESW system. Specifically, the team noted that the licensee's root cause analysis problem statement only addressed debris transport from the lake to the suction of the forebay pumps. As a result, potential performance issues associated with the ESW system, including the design and operation of the discharge strainer, may not be identified and could not be determined to be either a root or contributing cause. As such, these type of performance failures would not require corrective actions under the licensee's root cause analysis process.

In spite of the inadequate problem statement defined by the licensee's root cause team, the team noted that the senior management review of the root cause report resulted in an ESW-related issue being classified as a contributing cause. Specifically, the management review team directed that the non-robust ESW discharge strainer design should be identified as a contributing cause. Management's review of the root cause report further resulted in the licensee staff evaluating the current ESW discharge strainer backwash system design and installation of a modification to ensure proper operation during a similar fish intrusion event.

Licensee management acknowledged the team observations and concluded that a more complete root cause analysis, properly balanced to consider both nonsafety-related and safety-related equipment performance issues, would likely have resulted in a more thorough evaluation of this event. The team concluded that the management-compensated root cause results adequately identified the issues and corrective actions necessary to preclude the potential adverse consequences of a similar fish intrusion event.

.4 Impact and Safety Significance of the Fish Intrusion Event on Safety-Related Systems

a. Inspection Scope

The team reviewed the as-found condition of components potentially impacted by the fish intrusion event. The review included observations of heat exchanger end bell inspections, pump discharge strainer inspections, and flushing activities. The team also interviewed individuals involved in these activities and reviewed the licensee's root cause report for the ESW degraded flow condition.

b. Findings

No findings of significance were identified.

Results of Traveling Water Screen and Essential Service Water System Inspections

Following the event, licensee personnel performed inspections of the TWS and ESW systems to determine the extent of damage to the systems and impacts of the degraded ESW system performance. The results of these inspections and the licensee's immediate corrective actions are summarized below:

Traveling Water Screens

The TWSs provided a barrier to the transport of large debris between the ultimate heat sink and the ESW and CW pump suctions.

Shortly after the reactors were tripped and most of the CW pumps were shut down, the licensee dispatched divers into the intake tunnels and forebay to assess the impact of the fish intrusion on the TWSs. The licensee identified significant damage to the TWSs including torn panel screens, bowed panel frames, and broken motor-to-shaft shear pins. The team reviewed the as-found condition of the TWS panels with torn screens and the bowed panels and noted a trend in the failed panels. Specifically, the team determined that all of the TWS panels with torn screens employed a carbon steel screen mesh that exhibited significant corrosion. In general, the team determined that the bowed panels were either panels with relatively new carbon steel screen mesh or panels with stainless steel mesh. The team also observed that the number of damaged panels per TWS system was notably higher for those TWS systems in the major intake water flow paths. Through discussions with the system engineer, the team determined that the licensee normally replaced panels with degraded screens only when a failure occurred or was imminent.

The team determined that the fish intrusion event had a significant impact on the TWS system, essentially rendering the system unable to perform its intended function. The significance of this failure was minimized as a result of the control room operators' actions to shut down the reactors and maintain the minimum-required ESW flow rates through safety-related systems by cycling the ESW supply valves.

ESW Pump Discharge Strainers

The ESW pump discharge strainers were designed to provide a barrier to the transport into the ESW system of significant amounts of debris from the forebay.

During the event, operators began cycling the ESW supply valves in an effort to restore nominal ESW flow rates to safety-related equipment. Degraded ESW flow rates to the EDG heat exchanges was a first indication to the operators that one or more of the ESW pump discharge strainers had been damaged. Beginning at about 5:00 a.m. on April 24 and throughout the day on April 25, control room operators performed flow testing for each of the four ESW trains of equipment. Based, in part, on these test results, the licensee staff incorrectly concluded that the ESW discharge strainers were not bypassing a significant amount of the fish and debris present in the forebay.

Following cooldown of the reactors to a Cold Shutdown Mode, licensee personnel initiated an effort to open and inspect each of the ESW pump discharge strainer housings. The team observed the as-found conditions and noted significant damage to each of the discharge strainers. The damage included buckling of the lower section of the strainer immediately adjacent to the incoming flow path and general crushing of the strainer around its circumference. In each case, the team noted that the strainers appeared to have shifted within the strainer housing such that the top edge of the strainer no longer appeared to have been in close contact with the strainer housing cover. As a result of the buckling, shifting, and crushing of the strainers, the team observed clear indications that fish and other debris had bypassed the discharge strainers. The team also determined that the discharge strainers neither catastrophically failed nor plugged during the fish intrusion event.

The team determined that the fish intrusion event had a significant impact on the ESW pump discharge strainers as demonstrated by the observed buckling, crushing and distortion of the strainers. As a result, fish and other debris bypassed the strainers during ESW pump operations. However, the safety impact of the damaged strainers was minimized as a result of the control room operators shut down of the reactors and their timely cycling of the ESW supply valves such that minimum flows to safety-related equipment were maintained.

Emergency Diesel Generator Heat Exchangers

The ESW system provided essential cooling for the EDG turbo-charger air aftercoolers, and the lubricating oil and jacket water heat exchangers.

Consistent with the degraded flow conditions observed during the August 2001 debris intrusion event and about 15 minutes after the reactors were tripped, the control room operators identified low ESW flow rates to the EDG heat exchangers. As a result, the shift manager declared all four EDGs inoperable. Subsequent to this action, the control room operators periodically cycled the ESW supply valves to the EDG heat exchangers in an effort to clear a recurring debris buildup on the heat exchanger tube sheets. The team noted that these efforts were generally successful. In addition, the team noted that during the fish intrusion event, the ESW flow rates to the EDG heat exchangers were sufficient to allow the EDGs to be considered available for emergency use.

The team reviewed computer data of ESW flow rates to the EDG coolers at the onset of the fish intrusion event and noted that flow rates had degraded to a level below the “operability” threshold nearly 15 minutes prior to the operators observing the condition. At that time, the operators had just initiated a trip of the reactors and were involved in implementing the steps of applicable emergency procedures. However, the team also noted that, similar to the August 2001 event, the licensee’s control room design did not include an audible or visible alarm to warn the control room operators of a decreasing trend in ESW flows to the EDGs.

Subsequent to placing the units in a Cold Shutdown Mode, the licensee staff opened and inspected each of the EDG heat exchangers. The inspection results were characterized by limited amounts of visible fish remains in either the entrance or exit bells or in the flow-reversing end bell. However, the licensee staff did identify the

presence of small amounts of water in the EDG lubricating oil for two of the four EDGs. A further licensee investigation of these findings resulted in the licensee staff finding a few small pinhole leaks in some of the tubes. The licensee staff indicated that the involved heat exchanger tube bundles dated to the plant's initial startup. The licensee staff concluded that the small amounts of water would not have prevented the EDGs from being able to perform their intended function. The licensee replaced the heat exchanger tube bundles in each of the lubricating oil and jacket water heat exchangers.

The team determined that the overall impact of the fish intrusion into the EDG heat exchangers was significant; however, the safety impact was minimal, in part, due to operator actions to clear debris from the system and maintain an adequate level of ESW flow to the heat exchangers.

Component Cooling Water System

The CCW system provided cooling to heat exchangers in the residual heat removal, Emergency Core Cooling System (ECCS), spent fuel pool cooling, reactor coolant pump thermal barrier, and containment air recirculating systems. Each unit's CCW system was arranged in three flow circuits; two parallel safeguards equipment trains, and one miscellaneous services train which could be served by either safeguards train. The ESW system provided cooling to the CCW heat exchangers.

Similar to the August 2001 debris intrusion event, during the April 2003 fish intrusion event, ESW flow to the CCW heat exchangers became degraded. As before, limitations in the licensee's computer system prevented a complete analysis of the event, because many of the data points were marked as "bad data." While the actual minimum flow rates experienced did not indicate marked decreases from prior to the event, there were a number of items of interest:

- During recovery from the event, the operators cycled the ESW supply valves to the 1E CCW heat exchanger. While the ESW flow rate would increase sharply for a short period of time, it would soon return to a lower degraded flow rate. Repeated cycling of the supply valves was necessary before the blockage was finally cleared. When opened, the licensee staff discovered the heat exchanger divider plate was intact, with minimal blockage of the tubesheet.

- During examination of the 1W CCW heat exchanger, the licensee staff discovered that the heat exchanger divider plate was torn and displaced, such that it blocked a number of tubes and allowed bypass of the ESW flow (i.e., some essential service water could go in and directly out without going through the heat exchanger). Through a review of the computer data, the team noted that the heat exchanger maintained a fairly constant delta between inlet and outlet temperatures until about 5:00 a.m. on April 24. At this time, the difference between the inlet and outlet temperatures began to decrease, and became negative for about 30 minutes, until control room operators increased the ESW flow rate. The team postulated that damage to the divider plate first occurred around this time, because prior to 5:00 a.m., the delta between inlet and outlet temperatures did not appear to be sensitive to ESW flow rate.

However, after 5:00 a.m., the heat exchanger inlet to outlet temperature difference appeared to have a definite correlation to the ESW flow rate.

The licensee did not appear to have noted the inlet and outlet temperature delta discrepancies, as only the outlet temperature had an alarm function in the control room. The team noted that during the 1W ESW system flow test using Procedure 01-OHP05030-019-002W, the inlet to outlet temperature difference again went negative; however, this was not one of the parameters monitored during the test. When the licensee started the shutdown cooling system, the operators used the 1W CCW heat exchanger. Although the operators noticed an initial increase in outlet temperature, and increased the ESW flow rate, the operators did not question if the heat exchanger was functioning as expected.

The team reviewed the available data and performed limited calculations to determine the heat transfer capability of the damaged heat exchanger. Even with the limitations imposed by the bypassed flow, the team determined that the 1W CCW heat exchanger was capable of removing the heat loads necessary under the required conditions.

In Inspection Report 50-315/01-04;50-316/01-04, the inspector noted that in 1989 weld cracks were observed in the 1W CCW heat exchanger divider plate and a weld repair was performed at that time. In contrast, the licensee staff did not observe weld cracks in the other three heat exchanger divider plates until 1999. The inspector, at that time, noted that the licensee postulated varying root causes for the cracks. The licensee later determined that the cracks and divider plate bowing were most likely caused by water hammer (pressure pulses) as discussed in Inspection Report 50-315/03-02;50-316/03-02. The team determined that the current tear in the 1W CCW divider plate was likely the result of the combination of a higher quality stiff weld and the flexible quarter-inch steel plate. This combination of weld strength and material likely resulted in the plate experiencing metal fatigue as a result of repeated "pressure pulses" over the last 14 years.

- During the fish intrusion event, the 2E CCW heat exchanger required repeated valve cycling in order to clear the heat exchanger of debris. When opened, the licensee staff observed that the divider plate was intact, but bowed. This was similar to the divider plate condition observed in 1999.

- The 2W CCW heat exchanger also required repeated valve cycling during the fish intrusion event in order to clear the heat exchanger of debris. The licensee staff did not identify any problems with its divider plate when the heat exchanger was opened.

The team determined that the fish intrusion into the ESW system had a significant impact on the CCW heat exchangers, particularly the 1W and 2E CCW heat exchangers. Although the licensee staff identified a failed weld associated with the 1W CCW heat exchanger and movement or bowing associated with the 1W and 2E CCW heat exchangers, respectively, the team concluded that the CCW heat exchangers would have been able to perform their intended safety functions following

the fish intrusion event. Therefore, the team concluded that the risk significance of the degraded ESW flow rates through the CCW heat exchangers was very low.

Auxiliary Feedwater Pump Room Cooling and Emergency Water Supply

The ESW system provided the safety-related water source to each auxiliary feed water (AFW) pump and support cooling to the AFW pump room coolers. Following the fish intrusion event, the licensee inspected and cleaned the room coolers. The licensee did not initially inspect the ESW lines to the AFW pumps because the condensate storage tank was available and the operators promptly took action to ensure makeup to the tanks.

- The condensate storage tank provided the normal suction supply to the AFW pumps and remained available during the event. Consequently, the team concluded that the potential loss of the emergency AFW pump suction water supply from the ESW system did not significantly impact the ability of the AFW system to perform its safety function.

- The turbine-driven auxiliary feedwater pump (TDAFWP) rooms were cooled by two 100 percent capacity coolers. Although all the TDAFWP room coolers had some blockage, the team deemed sufficient capacity would remain to maintain TDAFWP room temperatures. Therefore, the room cooler degradation did not adversely impact the ability of the TDAFWPs to perform their safety functions.

- Although all of the motor-driven auxiliary feedwater pump (MDAFWP) room coolers experienced some blockage, the team noted that the AFW system was able to operate without the rooms being overheated. Additionally, the annunciator response procedures for high MDAFWP room temperature included compensatory actions for degraded room cooling. Therefore, the team concluded that the blockage was not sufficient to degrade the coolers to the point where they could not perform their safety function when required to operate.

Control Room Air Conditioning System (CRAC)

The CRAC units provided cooling to maintain temperatures at which control room equipment was qualified for the life of the plant. As stated in the bases for TS 3.7.5.1, "Control Room Emergency Ventilation System," at control room temperatures less than or equal to 102°F, vital control room equipment remained within the manufacturers' recommended operating range. The team reviewed control room logs and determined that control room temperatures did not exceed 80°F during and immediately following the fish intrusion event. Based on the ability of the CRAC units to adequately maintain control room temperatures, the team determined that the impact of this event on the control room ventilation system was minimal.

Containment Spray System

The primary purpose of the containment spray (CTS) system is to spray cool water into the containment atmosphere in the event of a loss of coolant accident to prevent

containment pressure from exceeding the design value. With the exception of some leakby of the 1E CTS heat exchanger, the ESW supplies to the CTS heat exchangers were isolated during the event. Subsequent inspections and engineering evaluations of the CTS system identified no significant fouling or obstructions of flow. The team concluded that the fish intrusion event had minimal safety impact on the CTS system.

.5 Adequacy of Licensee Corrective Actions Associated with Equipment Restoration

a. Inspection Scope

The team attended licensee meetings, interviewed personnel, observed maintenance activities, reviewed testing plans, and performed system walkdowns to assess the adequacy of the licensee's corrective actions for the restoration of the Traveling Water Screens, Essential Service Water System, Emergency Diesel Generators, Component Cooling Water System, and other safety-related components served by ESW.

b. Findings

No findings of significance were identified.

The licensee established a series of recovery and support teams in order to identify equipment, procedural, and personnel performance issues that needed to be addressed before the equipment could be restored to full service. The licensee developed an overall restoration plan that focused on creating a barrier between the lake and the pump suctions in the forebay, and then inspecting, cleaning and repairing equipment receiving water from the forebay through the ESW system. The team determined that the licensee's corrective actions, overall, were prompt, thorough, and effective.

Traveling Water Screens

Early during the recovery process, the licensee staff focused their efforts on restoring a viable debris barrier between the ultimate heat sink and the pump suction side of the forebay. Prior to the restart of Unit 1, the licensee staff installed stainless steel mesh panels for each of the TWS sections associated with Unit 1 and either new carbon steel or stainless steel mesh panels for Unit 2. The licensee further planned to replace the new carbon steel mesh panels, installed in the Unit 2 TWS sections, with stainless steel mesh panels prior to restart of Unit 2.

In addition to returning the TWS system to near new condition, the licensee staff conducted extensive cleaning of the forebay and planned to install a temporary fish sonar system to deter fish from entering the intake tunnels. A more permanent fish deterrent system was planned for installation prior to the April 2004 alewife spawning season.

Essential Service Water Strainers

The licensee staff implemented three significant corrective actions relative to restoration of the ESW system. First, the licensee staff replaced each of the damaged discharge strainers with a strainer constructed of a heavier stainless steel mesh, 14 gage vice 20

gage. Second, the licensee staff modified the discharge strainer design to include a nearly fully enclosed top. The revised design was originally developed in response to the August 2001 ESW debris intrusion event; however, the licensee staff chose not to install the design modification after inadequate maintenance instructions were identified as the root cause for that event. Finally, the licensee staff revised the logic circuitry employed to control back washing of a discharge strainer with an indicated high differential pressure. During a review of statements made by the operators following the fish intrusion event and following discussions with other operations staff, the team concluded that the discharge strainer automatic back wash function may not have operated as intended during the event. Specifically, the team noted that the control room operators had to manually back wash the strainers in order to restore normal ESW flow rates during the fish intrusion event. The licensee's root cause evaluation also identified this issue for further future review; however, the licensee staff determined that corrective measures were necessary prior to a restart of either reactor to ensure that the system would be able to perform its intended safety function in both the automatic and manual modes.

Emergency Diesel Generators

The licensee staff inspected the cooling systems of all EDGs immediately following the event. For each EDG, the licensee staff inspected and cleaned (as necessary) the ESW sides of the air after-coolers, the lubricating oil heat exchangers, and the jacket water heat exchangers. Additionally, due to the licensee-identified indications of small amounts of water in the lubricating oil systems for some EDGs, the licensee staff replaced the heat exchanger tube bundles in all four of the EDG lubricating oil and jacket water heat exchangers. The previously installed tube bundles were original equipment installed during initial plant startup.

Component Cooling Water System

The licensee staff removed the end bells of the each of the CCW heat exchangers and performed visual inspections and cleaning, as necessary. In the case of the 1W CCW heat exchanger, the licensee identified that the divider plate was torn and had shifted such that it was blocking tubes and allowing bypass flow. The licensee staff did not identify a broken divider plate in any of the other CCW heat exchangers. The licensee staff also identified numerous tubes blocked with fish, silt, or other debris despite numerous pre-inspection flushes of the CCW heat exchangers.

As part of their corrective actions for a previous violation documented in NRC Inspection Report 50-315/01-04;50-316/01-04, the licensee planned to replace the CCW heat exchanger ½-inch thick divider plates with 1-inch thick plates during the next outages (May 2003 for Unit 2 and September 2003 for Unit 1). Based on the observed damage to the 1W CCW heat exchanger divider plate, the licensee chose to replace the Unit 1 divider plates prior to Unit 1 restart. The licensee staff also planned to replace the Unit 2 CCW heat exchanger divider plates during the May 2003 refueling outage and prior to restart.

Other Safety-Related Components Served by ESW

The licensee staff also inspected and cleaned, as necessary, the CRAC heat exchangers and the AFW pump room coolers and returned this equipment to service. The team observed an initial inspection of one of the CRAC heat exchangers and did not identify any intrusion of fish or any other debris into the heat exchanger.

.6 Adequacy of Long-Term Corrective Actions to Prevent ESW Degraded Flow Conditions

a. Inspection Scope

The team attended licensee meetings, interviewed personnel, observed maintenance activities, reviewed testing plans, and performed system walkdowns as part of the assessment of the licensee's corrective actions to prevent recurrence.

b. Findings

No findings of significance were identified.

The team reviewed the licensee's long-term corrective actions which included the following:

- Installation of a permanent fish deterrent and monitoring system;
- Installation of an enhanced traveling water screen design, including the development of an appropriate preventive maintenance program for the traveling water screens and associated screen wash system;
- Development and implementation of an Abnormal Operating Procedure addressing the control room operators' response to degraded forebay conditions;
- Development and implementation of a more comprehensive rapid power reduction procedure to better guide the control room operators' identification of entry conditions for and response actions to off-normal conditions that may require a rapid downpower;
- Revision of existing control room alarm response procedures to ensure appropriate reference to new or revised procedures for responding to degrading forebay conditions or the need for a rapid power reduction, and;
- Require Corrective Action Review Board (CARB) oversight and review of significant operating experience evaluations.

The team concluded that the licensee's actions appeared reasonable to prevent a recurrence of the significant negative impact of a fish intrusion event on both the safety-related and nonsafety-related systems affected by this event.

.7 Adequacy of Common Cause Assessment Approach

a. Inspection Scope

The team compared the April 2003 fish intrusion event with an August 2001 silt intrusion event and an April and May 1996 fish intrusion event. Since each of the events resulted in degraded ESW flows, the team evaluated the potential for common causes and the effectiveness of the licensee's previous corrective actions.

b. Findings

.1 August 2001 ESW Debris Intrusion Event

Introduction

One Green finding in the Mitigating Systems cornerstone and an associated Non-Cited Violation of 10 CFR 50, Appendix B, Criterion III, "Design Control," was identified for the failure to adequately evaluate the potential impact of changes in the material strength of the safety-related ESW discharge strainers as a result of a vendor change in the material used to construct the strainers.

Description

In August 2001, the plant experienced an ESW debris intrusion event based upon observed low ESW flow to the EDGs. This event was a slowly evolving condition which affected all four EDGs, although the condition was caused by the failure of a single ESW discharge strainer. By coincidence, the initial plant lineup during the April 2003 event and the August 2001 event was nearly identical, including the performance of an ESW surveillance on the 2W ESW system train.

The team determined that a design change, implemented as a part of a corrective action from the August 2001 event had an adverse impact on the August 2003 event. Specifically, following the August 2001 silt intrusion event, the licensee staff replaced each of the ESW discharge strainers with a new vendor-supplied model. The licensee determined that a change to all of the discharge strainers was necessary to address design weaknesses identified in the strainer mounting configuration. Upon receipt of the replacement discharge strainers from the vendor, the licensee staff noted that the new strainers were constructed with a lighter weight stainless steel mesh material. As a result, the licensee performed an initial evaluation of the non-conforming condition which was documented in Condition Report (CR) 01253026, dated September 17, 2001. Subsequently, the engineering staff performed an equivalency evaluation of the new strainer design which was documented in EE-2001-0269, dated September 20, 2001. The team reviewed the two documents and noted that the CR 0125026 identified that the replacement strainers, constructed with the lighter weight material, would be more likely to deform or rip in a manner that would allow debris to bypass the strainer. The CR further documented that other modifications were planned to the strainer design which would compensate for this increased vulnerability. The team noted that the equivalency evaluation documented the engineering staff's conclusion of little or no significant difference in response to system parameters between the new and the old

strainer designs. The equivalency evaluation also documented a perception by some of the engineering staff that the failure modes of the new and original equipment strainers were identical. However, these statements were not supported. The team noted that the equivalency evaluation also did not identify or include an assessment of the increased buckling probability created by the vendor's use of the lighter weight mesh material. Finally, although the CR documented a new failure mode of displacement of the strainer within the strainer housing allowing unanticipated bypass of debris between the strainer top and the strainer housing, the team noted that the equivalency evaluation did not identify any new or different failure modes with the newer design.

The team noted that buckling of the lower portion of the strainer during the April 2003 fish intrusion event permitted displacement of the strainer within the strainer housing and the bypass of fish debris which impacted ESW flow to safety-related components. The team also estimated that the lighter weight mesh used to construct the newer strainer caused a factor of four reduction in the strainer's resistance to buckling.

Analysis

The team determined that the licensee failed to adequately assess the suitability of the vendor's substitution of lighter weight stainless steel mesh in the construction of replacement safety-related essential service water discharge strainers which resulted in damage to the strainers. This performance deficiency contributed to the ESW system damage and to the overall significance of the event. The Mitigating Systems cornerstone was impacted by this performance deficiency.

The team compared this finding to the examples in Appendix E, "Examples of Minor Issues," of Inspection Manual Chapter 0612, "Power Reactor Inspection Reports," Appendix B, "Issue Disposition Screening," and determined it was similar to Example "c." of Section 5, "Work in Progress Findings," at the "not minor" level since the licensee installed a component that was not equivalent to the original equipment, returned the system to service, and the equipment was subsequently adversely impacted in a manner not previously evaluated. In addition, the team concluded that the finding had more than minor risk significance in accordance with Inspection Manual Chapter 0612, "Power Reactor Inspection Reports," Appendix B, "Issue Disposition Screening," because the inadequate suitability review contributed to ESW system damage which could be reasonably viewed as a precursor to a significant event.

In accordance with Inspection Manual Chapter 0605, "Significance Determination Process [SDP]," Appendix A, "Significance Determination of Reactor Inspection Findings for At-Power Situations," a Phase 1 SDP was initiated to address the finding. That review determined that the finding affected the Mitigating Systems cornerstones since mitigating systems were degraded as a result of the finding in accordance with the "SDP Phase 1 Screening Worksheet for IE [Initiating Events], MS [Mitigating Systems], and B [Barrier Integrity] Cornerstones," the team determined that since the finding resulted in only the degradation of the function of safety-related systems and did not represent an actual loss of safety function of a system; an actual loss of safety function of a single train greater than the TS Allowed Outage Time; or screen as potentially risk significant due to a seismic, fire flooding, or severe weather event, the finding screened out as Green.

Enforcement

10 CFR Part 50, Appendix B, Criterion III, "Design Control," requires, in part, that measures shall be established and implemented for the selection and review for suitability of materials, parts, and equipment that are important to the safety-related functions of structures, systems, and components.

Contrary to the above, on September 20, 2001, during a suitability review of a vendor's substitution of a lighter weight stainless steel mesh in the design and construction of replacement ESW discharge strainers, the licensee failed to implement measures to ensure that review was adequate. This contributed to the buckling of those strainers which allowed fish to bypass the strainers and degraded the safety-related functions of the ESW, EDG, and CCW systems.

However, because no actual loss of safety function of any safety-related equipment occurred, the violation was of only very low safety significance. Therefore, because this issue was entered in the corrective action program, it is being treated as a Non-Cited Violation (NCV), consistent with Section VI.A.1 of the Enforcement Policy (NCV 50-315/0308-02;50-316/0308-02). This issue was entered into the licensee's corrective action program as Condition Report 03055133.

.2 April and May 1996 Fish Intrusion Event

Introduction

One Green finding in the Initiating Events cornerstone and an associated Non-Cited Violation of 10 CFR 50, Appendix B, Criterion XVI, "Corrective Actions," was identified for the failure to effectively develop and integrate into plant operations a rapid power reduction procedure as a corrective action to a 1996 fish intrusion event.

Description

In April and May 1996, the plant experienced a series of alewife (fish) intrusions into the screen house forebay over a 3-week period. The team concluded that the following corrective actions from the 1996 event were not effectively implemented:

- Rapid Power Reduction Procedure

  Although the licensee staff generated Procedure 01(02)-OHP-4022.001.006, "Rapid Power Reduction Procedure," in response to the 1996 fish intrusion event and the procedure was revised in response to the Salem Nuclear Power Plant sea grass intrusion event, the team identified that the control room staff did not consider entering the procedure until well into the event, and then only at the shift manager's suggestion.

Additionally, the team determined that the procedure entry conditions were insufficient to ensure its use during an event that was similar to the event which caused the procedure to be generated. Specifically, the procedure required the control room operators to obtain information on condenser and main feed pump differential pressures, which were not available in the main control room, and diverted an auxiliary operator from addressing the fish intrusion to collect the condenser differential pressure data. The necessity to have someone dispatched to obtain the information and report back to the control room operators was contrary to the decision process to rapidly reduce power.

- Preplanned Response Strategy

  Although a Preplanned Response Strategy was identified as a corrective action for the previous events, the licensee was unable to provide a copy to the team, and did not believe that the corrective action had been implemented. According to the apparent cause analysis for the 1996 event, this preplanned response strategy was intended to provide guidance to the operations staff on how to address a fish intrusion event, including ensuring that the operators had sufficient information to make decisions; and was intended to provide additional support for the operators so they would not be overwhelmed. Based on the review of operator logs and the developed timeline for the April 2003 event, the team noted that the lack of a Preplanned Response Strategy contributed to the 2003 fish intrusion event.

  For example, the control room operators initially directed the AEOs to the screen house at about 2:00 a.m.. However, information reviewed by the team did not indicate that any clear instructions or lines of communication were established once the personnel arrived in the area. Additionally, none of the workers gave any indication in their statements that they had any guidance which would have required a call to the control room. The workers apparently focused on emptying the TWS trash baskets and providing additional spray to maintain the TWSs clear of debris. Additionally, the control room operators did not appear to have any expectations that the personnel in the area of the TWSs would provide any feedback of the as-found conditions.

  The shift manager indicated in his post-event written statement that he called the Work-It-Now supervisor at about 3:00 a.m.. Although the shift manager's narrative appeared to echo the words from the preplanned response strategy, the Work-It-Now supervisor evidently did not understand the need and did not respond. The team determined that even though the shift manager was aware of the preplanned response strategy, other departments were not, which defeated the purpose of having such a strategy.

- Recognition of Expected Occurrences (Just In Time Training)

  The root cause analysis for the 1996 fish intrusion event identified that the licensee staff understood that a fish influx was expected during the months of April through June and that the staff had failed to appropriately plan for the occurrence. The root cause analysis also noted that the critical variable to a

successful response to a fish intrusion was the control room operators' response.

The team also determined that the rapid power reduction was only routinely trained upon as part of initial license training. The team determined that the most recent initial license class was conducted in 2001. While not specifically trained upon during re-qualification training, the procedure was referenced during a training class in the last quarter of 2002 during a discussion of steam generator tube ruptures. A training coordinator informed the team that the emphasis during this training was appropriately placed on ensuring conservative decision-making, and that the operators tripped the reactor if required.

The licensee provided a list of all the times briefings were held during the past 2 years that also involved the rapid power reduction procedure. The team determined that since the August 2001 debris intrusion event, four crews used the procedure - several times in October 2001, once in May 2002 and once in December 2002.

The team concluded that the corrective actions to the 1996 alewife intrusion event were ineffective as: 1) the rapid power reduction procedure, written as a result of the event, did not contain appropriate entry conditions and the entry conditions could not be monitored by the operators from the control room; 2) there was insufficient guidance both for auxiliary personnel assigned to the screen house as to what information about changing conditions needed to be conveyed to the control room operators and to control room operators about what feedback they should expect from the personnel directed to the screen house; 3) other departments appeared to be unaware of their need to respond to this type of expected occurrence, and 4) the operators did not receive seasonal training on this expected occurrence.

Analysis

The team determined that the ineffective implementation of a corrective action to develop and integrate into plant operations a rapid power reduction procedure for a 1996 fish intrusion event was a performance deficiency that contributed to the ESW system damage and to the overall significance of the event. The Initiating Events cornerstone was impacted by this performance deficiency.

The team compared this finding to the examples in Appendix E, "Examples of Minor Issues," of Inspection Manual Chapter 0612, "Power Reactor Inspection Reports," Appendix B, "Issue Disposition Screening," and determined it was similar to Example "d." of Section 4, "Insignificant Procedure Errors," at the "not minor" level since corrective actions had not been implemented and increased the severity of the 2003 fish intrusion event. As a result, this finding was determined to be more than minor. In addition, the team concluded that the finding had more than minor risk significance in accordance with Inspection Manual Chapter (IMC) 0612, "Power Reactor Inspection Reports," Appendix B, "Issue Disposition Screening," because the ineffective corrective actions contributed to a dual unit reactor trip which could be reasonably viewed as a precursor to a significant event.

In accordance with Inspection Manual Chapter 0605, “Significance Determination Process [SDP],” Appendix A, “Significance Determination of Reactor Inspection Findings for At-Power Situations,” a Phase 1 SDP was initiated to address the findings contained in this report. That review determined that the finding affected the Initiating Events cornerstone since the likelihood of a reactor trip was increased as a result of the finding. Therefore, in accordance with the “SDP Phase 1 Screening Worksheet for IE [Initiating Events], MS [Mitigating Systems], and B [Barrier Integrity] Cornerstones,” since the finding did contribute to both the likelihood of a reactor trip and the likelihood that mitigation equipment or functions would not be available, a Phase 2 SDP analysis was warranted.

For the Phase 2 SDP review, to address the increased plant vulnerability during the season of increased alewife population, the likelihood of a transient (reactor trip) and the loss of the power conversion system (main condenser and feed pumps) was increased by one order of magnitude for a period of greater than 30 days. The team concluded that while ESW flow rates through the EDG heat exchangers and the CCW heat exchanger were degraded, the safety functions remained available. As a result, the Phase 2 SDP analysis determined that the findings were of very low safety significance (Green).

Enforcement

10 CFR Part 50, Appendix B, Criterion XVI, "Corrective Action," requires in part, that measures shall be established to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, and non-conformances are promptly identified and corrected.

Contrary to the above, following the April and May 1996 fish intrusion events, the licensee failed to take adequate corrective actions to address the identification that the plant was subject to seasonal fish intrusion events and needed to take actions to effectively respond to these events. As a result, on April 24, 2003, a fish intrusion event occurred which adversely impacted safety-related equipment.

However, because no actual loss of safety function of any safety-related equipment occurred, the violation was of only very low safety significance. Therefore, because this issue was entered in the corrective action program, it is being treated as a Non-Cited Violation (NCV), consistent with Section VI.A.1 of the Enforcement Policy (NCV 50-315/0308-03;50-316/0308-03). This issue was entered into the licensee’s corrective action program as Condition Report 03057040.

.8 Additional Risk Assessment Reviews

The licensee performed an independent risk analysis by modeling the likelihood of a fish intrusion event combined with the loss of the power conversion system and some degradation of the ESW system. The licensee’s risk analysis also concluded that the findings were of very low safety significance.

The significance assessment of the findings associated with this event was also compared to the significance assessment of the findings associated with the August

2001 debris intrusion event which also resulted in degradation of the ESW system and resulted in a White inspection finding. Although the effect on the ESW system was similar during the two events, there were several important differences that resulted in different conclusions regarding the risk assessment.

The initiating event evaluated for the findings from the August 2001 event was a loss of offsite power because that event would result in the tripping of the circulating water pumps, debris entrainment, and the subsequent ESW flow degradation. Additionally, the ESW flow to the EDGs was more severely degraded during the August 2001 event, such that the function of the EDGs was determined to be affected. The scenario of interest to evaluate the current findings does not include loss of offsite power because there was no causal relationship between a loss of offsite power and the likelihood of a fish intrusion event. Therefore, the initiating event of interest was a reactor trip with loss of the main condenser due to clogging.

4OA6 Meeting

Exit Meeting

On May 20, 2003, the team presented the preliminary inspection results to Mr. C. Bakken and other members of D.C. Cook plant management and staff. The licensee acknowledged the information presented. The team asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

KEY POINTS OF CONTACT

Licensee

C. Bakken, Senior Vice President, Nuclear Generation
P. Cowan, Manager, Engineering Systems
M. Finissi, Plant Manager
J. Giessner, Director, Design Engineering and Regulatory Affairs
E. Larson, Director, Operations
B. McIntyre, Manager, Regulatory Affairs
R. Meister, Regulatory Affairs
J. Pollock, Site Vice President
S. Simpson, Assistant Director, Operations

NRC

E. Duncan, Chief, Reactor Projects Branch 6
G. Grant, Director, Division of Reactor Projects
B. Kemker, Senior Resident Inspector, D.C. Cook

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

50-315/03-08-01; 50-316/03-08-01	NCV	Inadequate Procedure For Off-Normal Forebay Conditions
50-315/03-08-02; 50-316/03-08-02	NCV	Inadequate Strainer Material Review
50-315/03-08-03; 50-316/03-08-03	NCV	Inadequate Corrective Actions to Address 1996 Fish Intrusion Event

Closed

50-315/03-08-01; 50-316/03-08-01	NCV	Inadequate Procedure For Off-Normal Forebay Conditions
50-315/03-08-02; 50-316/03-08-02	NCV	Inadequate Strainer Material Review
50-315/03-08-03; 50-316/03-08-03	NCV	Inadequate Corrective Actions to Address 1996 Fish Intrusion Event

Discussed

None.

LIST OF ACRONYMS USED

AEO	Auxiliary Equipment Operator
AEP	American Electric Power
AFW	Auxiliary Feedwater System
CCW	Component Cooling Water
CFR	Code of Federal Regulations
CR	Condition Report
CRAC	Control Room Air Conditioning
CTS	Containment Spray System
CW	Circulating Water
d/p	Differential Pressure
EDG	Emergency Diesel Generator
EE	Engineering Evaluation
EOF	Emergency Operations Facility
ESW	Essential Service Water
DRP	Division of Reactor Projects
EOP	Emergency Operating Procedure
ESW	Essential Service Water
gpm	Gallons Per Minute
MDAFW	Motor Driven Auxiliary Feedwater
NCV	Non-Cited Violation
NRC	Nuclear Regulatory Commission
NESW	Non-Essential Service Water
OA	Other Activities
OHI	Operations Head Instruction
OHP	Operations Head Procedure
PDR	Public Document Room
psig	Pounds Per Square Inch Gauge
SDP	Significance Determination Process
TDAFW	Turbine Driven Auxiliary Feedwater
TS	Technical Specification
TSC	Technical Support Center
TWS	Traveling Water Screen

LIST OF DOCUMENTS REVIEWED

Condition Reports (CRs)

P-96-00695	Unit 1 Power Reduction after Large Influx of Alewives into Forebay from Lake Michigan, 4/25/96
P-96-01878	Review of Operating Experience Report 8106 on Point Beach Alewife Kill Due to Chlorination, 11/14/96
CR 01045048	Evaluation of Bowed Divider Plate Was Not Adequate, 2/14/01
CR 01046029	NRC Identified Problems with CCW Heat Exchanger Baffle Plate Welds, 2/15/01
CR 01242013	Dual Unit Plant Trip Due to Silt Accumulation in Essential Service Water System, 8/30/01
CR 01253035	Strainer Baskets in the Quarantine Area Removed from the ESW Strainers Have a Higher Hole Density per Square Inch than the Baskets Staged on Hold Tags in the Same Maintenance Shop
CR 01253036	Replacement Strainer Baskets in the South Shop are Observed to be Constructed of 20 Gage Mesh, as Opposed to 14 Gage Mesh on the Baskets Removed From Service Thus Far
CR 01268045	Dedication Plan HP-1015 Is Inconsistent with Requirements of 12 EHP-5043-CGD-001 and 12-EHP-5043-CGD-001 Is Inconsistent with Source Document EPRI NP-5652, 9/25/0
CR 03114044	Root Cause Analysis Report of April 24, 2003 Fish Intrusion Event
CR 03118028	During the Alert declared on 4/24/03, there was an about 22 minute delay between the declaration of the Alert and activation of the ERO pagers
CR 03121074	There is no guidance in the Emergency Termination and Recovery procedure to notify the NRC via the ENS system (red phone) upon termination of the event
CR 03121068	Evaluate OHI-2080, Conduct of Operations procedure, to determine if more guidance is necessary to clarify when, and under what conditions, AEOs are released to the OSC during an emergency
CR 03119078	Tracking problems with some damage control teams dispatched during the Alert declaration of 4/24/03
CR 03119074	The final (Termination) EMD-32 form was not faxed to the state of Michigan following termination of the Alert event on 4/25
CR 03119070	The 'Broadcast' feature on the Unit 1 Control Room FAX and the EOF FAX machines did not function correctly during the 4./24-4/25 Alert event
CR 03118030	Tracking CR for assessing Emergency Response from Alert declaration of 4/24/03
CR 03133047	Clarification of Corrective Actions 57 and 58 for 2001 Silting Event Condition Report, 5/13/03

Drawings

INT-SK-1-5141-01	24" Duplex Strainer Basket, 9/10/01
OP-12-5119-64	Circulating Water System, Priming System, Screen Wash Flow Diagram, Revision 64
SOD-01900-001	Essential Service Water System Operation Diagram, Sheet 1, Revision 3
SOD-05700-001	Circulating Water System Operation Diagram, Sheet 1, Revision 1

SOD-05700-002 Screen Wash System Operation Diagram, Sheet 1, Revision 1

Plant Operating Experience Reports

99-006706	Plant Operating Experience Report 8106, Point Beach Alewife Kill Due to Chlorination, 11/11/96
01-001238	Plant Operating Experience Report 12437, Point Beach Alewife Intrusion Event Causing Manual Reactor Trip, 7/17/01

Procedures

01-OHP-4021-057-001	Circulating Water System Operation, Revision 22.
02-OHP-4021-057-001	Circulating Water System Operation, Revision 23
12-OHP-4021.057-005	Operation of Screen Wash and Traveling Screens, Revision 12
01-OHP-4022.001.006	Rapid Power Reduction Procedure, Revision 2
02-OHP-4022.001.006	Rapid Power Reduction Procedure, Revision 2
01-OHP-4024-123	Annunciator #123 Response: Circulating Water, Drop 18 – Traveling Water Screen Differential Pressure High, Revision 9
01-OHP-4024-123	Annunciator #123 Response: Circulating Water, Drop 19 – Traveling Water Screen Differential Pressure High-high, Revision 9
02-OHP-4024-223	Annunciator #223 Response: Circulating Water, Drop 18 – Traveling Water Screen Differential Pressure High, Revision 7
02-OHP-4024-223	Annunciator #223 Response: Circulating Water, Drop 19 – Traveling Water Screen Differential Pressure High-high, Revision 7
02-OHP-4030-022W	West Essential Service Water Test, Revision 2
01-OHP-5030-019-02E	East Essential Service Water Flow Test, Revision 2
RO-C-AOP-3	Abnormal Operating Procedures – Day 3, Revision 1 (Page 32: Training on Rapid Power Reduction Procedure)

Work Requests/Job Orders

R0230617-01	1-HV-AFP-EAC, Several Tubes Were Blocked with Silt/Sand/Zebra Mussels, dated April 22003
03114085-01	2-HV-645, Control Room Air Condition Heat Exchanger Examination, dated April 29, 2003
03114004-017	Dive Inspection Map of the Unit 2 Forebay East of the Traveling Water Screens, dated April 26, 2003

Other Documents

Unit 1 Control Room and Shift Manager Logs, from 06:30 on April 23, 2002 to 06:30 on April 26, 2003.

Unit 2 Control Room and Shift Manager Logs, from 06:30 on April 23, 2002 to 06:30 on April 26, 2003.

Unit 1 Operator Rounds, CRIT M1-3/PWR Gen, April 23, 2003 through April 24, 2003

Unit 1 Operator Rounds, DR M1-4 Daily Chks, April 23, 2003 through April 24, 2003.

Unit 1 Operator Rounds, CR M12 Shift Chks, April 23, 2003 through April 24, 2003.

Unit 1 Operator Rounds, CR M34 Shift Chks, April 23, 2003 through April 24, 2003.

Unit 1 Operator Rounds, Critical Modes 4-6, April 23, 2003 through April 24, 2003.

Unit 1 Operator Rounds, Turbine Tour, April 23, 2003 through April 24, 2003.

Unit 1 Operator Rounds, Auxiliary Tour, April 2,3 2003 through April 24, 2003.

Unit 2 Operator Rounds, CRIT M1-3/PWR Gen, April 23, 2003 through April 24, 2003.

Unit 2 Operator Rounds, DR M1-4 Daily Chks, April 23, 2003 through April 24, 2003.

Unit 2 Operator Rounds, CR M12 Shift Chks, April 23, 2003 through April 24, 2003.

Unit 2 Operator Rounds, CR M34 Shift Chks, April 23, 2003 through April 24, 2003.

Unit 2 Operator Rounds, Critical Modes 4-6, April 23, 2003 through April 24, 2003.

Unit 2 Operator Rounds, Turbine Tour, April 23, 2003 through April 24, 2003.

Unit 2 Operator Rounds, Auxiliary Tour, April 2,3 2003 through April 24, 2003.

Operator Rounds, Waste Disposal System, April 23 2003 through April 24, 2003.

Operator Rounds, Outside Tour, April 23, 2003 through April 24, 2003.

Operator Rounds, MUP Tour, April 23, 2003 through April 24, 2003.

Unit 1 and Unit 2 Post Reactor Trip Operator Event Narratives

Timeline of Events Associated with Influx of Fish on April 24, 2003 at D.C. Cook, Revision 1, April 28, 2003

Summary of the Operations Department Performance - Dual Unit Manual Reactor Trips, April 24, 2003.

Technical Support Center Logs, April 24, 2003 through April 25, 2003.

Operational Support Center Logs, April 24, 2003 through April 25, 2003.

Emergency Operations Facility Logs, April 24, 2003 through April 25, 2003.

Electronic Mail, Training on Rapid Power Reduction Procedure 01(02)-OHP-4022.001.006, 5/2/03

HP-0128, Dedication Plan for Essential Service Water Strainer Basket, Revisions 0 and 1

HP-1015, Dedication Plan for Essential Service Water Strainer Parts, Revisions 0 Through 5

Maintenance Listing, Listing of Maintenance Work History on Traveling Water Screens and Essential Service Water Strainers, 4/25/03

Engineering Evaluation EE-2001-0269, Baskets Manufactured to the Original Basket Configuration Were Not Available from the Original Equipment Manufacturer, 09/20/01

LDCP 2-LDCP-5147, Revision 0, "Essential Service Water Strainer Structural Reinforcement Modification," dated September 12, 2001

LDCP 2-LDCP-5147, Revision 1, "Essential Service Water Strainer Structural Reinforcement Modification," dated May 9, 2003

DIT-B-2180-00, "ESW Strainers Differential Pressure and Flow," dated May 14, 2001

DIT-B-2180-01, "ESW Strainers Differential Pressure and Flow," dated November 28, 2001

Power Log Report, Listing of Occasions Where Operators Briefed on Use of Rapid Power Reduction Procedure in Last Two Years, Printed on 5/12/03

Power Log Report, Time Line of Event, 4/28/03

RCE 01-041, Point Beach Root Cause Report: Unit 2 Manual Trip Due to Decreasing Pump Bay Level, 7/27/01

RPA005191, Traveling Water Screen Carryover Project Status Update, Printed on 5/13/03

12-RPA-5191, Traveling Water Screen Carryover Project Charter, 4/11/03

Unit 1 Forebay Level Stripchart Recorder 1-MR-27, April 24, 2003

Corrective Action Review Board Meeting Minutes for May 15, 2003

VTM-TATE-0001, Vendor Technical Manual, Tate Andale Strainers, dated May 2, 2002