Indiana Michigan
Power Company
500 Circle Drive
Buchanan, MI 49107 1395

INDIANA MICHIGAN POWER

June 23, 2003

AEP:NRC:2573-08

Docket No. 50-315

U. S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Mail Stop O-P1-17
Washington, DC 20555-0001

Donald C. Cook Nuclear Plant Unit 1
DUAL UNIT MANUAL TRIP DUE TO THE FAILURE OF
THE INTAKE TRAVELING SCREENS AND FAILURE TO COMPLY
WITH TECHNICAL SPECIFICATION 3.8.1.1

In accordance with the criteria established by 10 CFR 50.73, entitled Licensee Event Report System, the following report is being submitted:

LER 315/2003-003-00: "Dual Unit Manual Trip Due to the Failure of the Intake Traveling Screens and Failure to Comply With Technical Specification 3.8.1.1."

No commitments are included in this submittal.

Should you have any questions regarding this correspondence, please contact Mr. Brian A. McIntyre, Regulatory Affairs Manager, at (269) 697-5806.

Sincerely,

Joseph E. Pollock

Joseph E. Pollock
Site Vice President

RAM/jen

Attachment

c: L. Brandon – Michigan Department of Health
K. D. Curry – AEP Ft. Wayne
J. E. Dyer – NRC Region III
J. T. King - MPSC
MDEQ – DW & RPD
NRC Resident Inspector
Records Center - INPO
J. F. Stang, Jr. – NRC Washington DC

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NRC Form 366 (7-2001) U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB NO. 3150-0104 EXPIRES 7-31-2004

Estimated burden per response to comply with this mandatory information collection request: 50 hours. Reported lessons learned are incorporated into the licensing process and fed back to industry. Send comments regarding burden estimate to the Records Management Branch (T-6 E6), U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001, or by internet e-mail to bjs1@nrc.gov, and to the Desk Officer, Office of Information and Regulatory Affairs, NEOB-10202 (3150-0104), Office of Management and Budget, Washington, DC 20503. If a means used to impose information collection does not display a currently valid OMB control number, the NRC may not conduct or sponsor, and a person is not required to respond to, the information collection.

# LICENSEE EVENT REPORT (LER)

(See reverse for required number of digits/characters for each block)

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**4. TITLE**

Dual Unit Manual Trip Due to the Failure of the Intake Traveling Screens and Failure to Comply With Technical Specification 3.8.1.1

| 5. EVENT DATE | | | 6. LER NUMBER | | | | 7. REPORT DATE | | | 8. OTHER FACILITIES INVOLVED | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MONTH | DAY | YEAR | YEAR | SEQUENTIAL NUMBER | | REVISION NUMBER | MONTH | DAY | YEAR | FACILITY NAME | DOCKET NUMBER |
| 04 | 24 | 2003 | 2003 | – 003 | – | 00 | 06 | 24 | 2003 | Unit 2 | 50-316 |
| | | | | | | | | | | FACILITY NAME | DOCKET NUMBER |

| 9. OPERATING MODE | 1 |
|---|---|
| 10. POWER LEVEL | 100 |

11. THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR §: (Check all that apply)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 20.2201(b) | | 20.2203(a)(3)(ii) | | 50.73(a)(2)(ii)(B) | | 50.73(a)(2)(ix)(A) |
| | 20.2201(d) | | 20.2203(a)(4) | X | 50.73(a)(2)(iii) | | 50.73(a)(2)(x) |
| | 20.2203(a)(1) | | 50.36(c)(1)(i)(A) | X | 50.73(a)(2)(iv)(A) | | 73.71(a)(4) |
| | 20.2203(a)(2)(i) | | 50.36(c)(1)(ii)(A) | | 50.73(a)(2)(v)(A) | | 73.71(a)(5) |
| | 20.2203(a)(2)(ii) | | 50.36(c)(2) | | 50.73(a)(2)(v)(B) | | OTHER Specify in Abstract below or in NRC Form 366A |
| | 20.2203(a)(2)(iii) | | 50.46(a)(3)(ii) | | 50.73(a)(2)(v)(C) | | |
| | 20.2203(a)(2)(iv) | | 50.73(a)(2)(i)(A) | | 50.73(a)(2)(v)(D) | | |
| | 20.2203(a)(2)(v) | | 50.73(a)(2)(i)(B) | | 50.73(a)(2)(vii) | | |
| | 20.2203(a)(2)(vi) | | 50.73(a)(2)(i)(C) | | 50.73(a)(2)(viii)(A) | | |
| | 20.2203(a)(3)(i) | | 50.73(a)(2)(ii)(A) | | 50.73(a)(2)(viii)(B) | | |

**12. LICENSEE CONTACT FOR THIS LER**

| NAME | TELEPHONE NUMBER (Include Area Code) |
|---|---|
| Michael Scarpello, Regulatory Compliance | (269) 466-2430 |

**13. COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT**

| CAUSE | SYSTEM | COMPONENT | MANUFACTURER | REPORTABLE TO EPIX | CAUSE | SYSTEM | COMPONENT | MANUFACTURER | REPORTABLE TO EPIX |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | |
| | | | | | | | | | |

| 14. SUPPLEMENTAL REPORT EXPECTED | | | | 15. EXPECTED SUBMISSION DATE | MONTH | DAY | YEAR |
|---|---|---|---|---|---|---|---|
| | YES (If Yes, complete EXPECTED SUBMISSION DATE). | X | NO | | | | |


16. Abstract (Limit to 1400 spaces, i.e., approximately 15 single-spaced typewritten lines)

On April 24, 2003, between 0255 and 0305 hours, a large school of alewives began impinging on the traveling water screens (TWS) located upstream of the common forebay of the circulating water (CW) and the essential service water (ESW) systems. As the volume of fish impinging on the TWS increased, the TWS system was overwhelmed. Differential pressure across the screens increased rapidly, resulting in most of the screens stopping due to either shear pin failure or tripping of breaker thermal overloads, and the eventual failure of multiple screen panels within the TWS system. As a result of the screen panel failures, the fish subsequently entered the suction of the CW and ESW pumps. Components serviced by the CW and ESW pumps began fouling. At approximately 0327 hours, Unit 1 was manually tripped due to fouling of the main feed pump condensers and at approximately 0330 hours Unit 2 was tripped due to degraded forebay conditions. The root cause of the event included the lack of a fully-developed operational response to debris intrusion, the failure to maintain the TWS system, and the failure of Donald C. Cook Nuclear Plant (CNP) to address long-standing or repetitive equipment problems. Corrective actions include flushing and inspection of affected components, repair of the damaged TWS components, improvements in CNP's debris intrusion mitigation strategy, enhanced maintenance program for the TWS, and the development of action plans to address the top equipment reliability concerns. This condition is reportable in accordance with the reporting criteria established in 10 CFR 50.73(a)(2)(iii) and 10 CFR 50.73(a)(2)(iv)(A) for the manual trip of both Unit 1 and Unit 2 reactors.

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17. TEXT *(If more space is required, use additional copies of NRC Form (366A)*

**Conditions Prior to Event**

Unit 1 = MODE 1 - 100% reactor power
Unit 2 = MODE 1 - 100% reactor power

**Description of Event**

Early in the morning on April 24, 2003, Donald C. Cook Nuclear Plant (CNP) Unit 1 and Unit 2 were operating at 100 percent power. CNP had been experiencing a controllable influx of alewives, within the capacity of the traveling water screens (TWS) for the common forebay of circulating water (CW) and the essential service water (ESW) systems, for a number of days. The following pumps and screens within the forebay were in service:

- Six CW pumps were in service (three per unit). Unit 2 CW pump #24 was out of service for replacement.
- All TWS, with the exception of TWS #2-7, were in service. TWS #2-7 had been removed from service to facilitate maintenance on its screen wash system.
- The Unit 1 West ESW pump was in service and was supplying the Unit 1 West ESW header. The Unit 1 West ESW header was supplying the Unit 1 AB emergency diesel generator (EDG), the Unit 1 West Component Cooling Water (CCW) heat exchanger, the Unit 1 South control room air conditioning (CRAC) unit.
- The Unit 1 West ESW header was also cross-tied to the Unit 2 East ESW header. Therefore, the Unit 1 West ESW header was supplying the Unit 2 CD EDG, the Unit 2 East CCW heat exchanger, and the Unit 2 North CRAC unit.
- The Unit 1 East pump was in service and was supplying the Unit 1 East ESW header. The Unit 1 East ESW header was supplying the Unit 1 CD EDG, the Unit 1 East CCW heat exchanger, and the Unit 1 North CRAC Unit.
- The Unit 2 West ESW pump was in service and was supplying the Unit 2 West ESW header. The Unit 2 West header was supplying the Unit 2 West CCW heat exchanger, the Unit 2 AB EDG, and the Unit 2 South CRAC unit.
- The Unit 2 East ESW pump was in standby.

At approximately 0203 hours on April 24, 2003, Unit 2 received a TWS high differential pressure (Hi-DP) alarm. The Unit 1 control room was notified of the alarm, and personnel were dispatched to evaluate its cause. This marked the beginning of the acute intrusion of alewives into the common forebay. Over the subsequent hour, both Unit 1 and Unit 2 received periodic TWS Hi-DP and Hi/Hi-DP alarms with all of the traveling screens operating in fast speed with their debris removal systems in operation.

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17. TEXT *(If more space is required, use additional copies of NRC Form (366A)*

Between 0255 and 0305 hours, a large school of alewives began impinging on the TWS located upstream of the common forebay of the CW and the ESW systems. As the volume of fish impinging on the TWS increased, the TWS system was overwhelmed. Differential pressure across the screens increased rapidly, resulting in most of the screens stopping due to either shear pin failure or tripping of breaker thermal overloads, and the eventual failure of multiple screen panels within the TWS system. As a result of the screen panel failures, the fish subsequently entered the suction of the CW and ESW pumps. Components serviced by the CW and ESW pumps began fouling. At approximately 0327 hours, Unit 1 was manually tripped due to fouling of the main feed pump condensers and at approximately 0330 hours Unit 2 was tripped due to degraded forebay conditions.

Additionally, the ESW pump discharge strainer baskets began fouling. The acute amount of debris impingement on the ESW pump discharge strainer baskets deformed the baskets and allowed bypass flow to occur. This bypass flow resulted in fouling and degraded flow to a number of the downstream components. Components adversely impacted by the degraded flow included:

- All four EDGs (two per Unit). Although flow to the EDGs was reduced to the point the EDGs were declared inoperable, the EDGs were available. One EDG per unit was restored to full OPERABLE status within 24 hours of being declared inoperable.
- Unit 1 East CCW heat exchanger.
- Unit 1 West CCW heat exchanger. The amount of fouling caused increased differential pressure across the inlet/discharge divider plate. Increased differential pressure, coupled with the design and condition of the divider plate resulted in the plate being damaged.
- Unit 2 West CCW heat exchanger.

At approximately 0327 hours, Unit 1 West main feedwater pump tripped on low vacuum, and in accordance with plant operating procedures, Unit 1 was manually tripped. At approximately 0330 hours, Unit 2 was manually tripped due to the degraded forebay conditions. The shift manager declared an ALERT based on Site Emergency Coordinator (SEC) judgment that plant safety systems may be degraded due to reduced ESW flow to the EDGs and that additional assistance was required.

This licensee event report is being submitted to report the manual scram of both CNP Unit 1 and Unit 2 on April 24, 2003. Reporting criteria:

- 10 CFR 50.73(a)(2)(iv)(A) for the manual trip of both Unit 1 and Unit 2.
- 10 CFR 50.73(a)(2)(iii) as a natural phenomenon that hampered site personnel in the performance of duties necessary for the safe operation of the nuclear power plant.

Root Cause of Event

The following root causes were identified:

- Lack of a fully-developed operational response to debris intrusion. The lack of operational guidance to rapidly remove CW pumps from service resulted in the breach of the TWS.
- Failure to maintain the TWS system. Material analysis of the failed carbon steel TWS screen panels indicated significant degradation of the screens by surface corrosion and oxidation. Additionally, CNP had not established an integrated preventive maintenance program for the TWS.
- Failure of the organization to resolve long-standing or repetitive equipment problems. Reliability of the TWS system had been a long-standing issue at CNP. Although improvements to the TWS system had been planned, CNP failed to implement these improvements in a timely manner.

Analysis of Event

The safety significance of the April 24, 2003, alewives intrusion into the CNP forebay has been shown to be minimal. Although the level of challenge to the intake structure and downstream systems from this event is unprecedented in plant history, the safety functions required to respond to this event were maintained throughout the event. The safety margin and redundancy inherent in the design and operation of both the ESW and EDG systems minimized the plant risk from this event.

The probabilistic risk assessment scenarios demonstrated the risk of core damage associated with this event was low (Conditional Core Damage Probability (CCDP) < 1E-06, Conditional Large Early Release Probability (CLERP) < 1E-07).

In this type of event, the AFW pumps, in conjunction with the steam generators, can be used for extended periods of heat removal until CCW heat removal capabilities are satisfactory for shutdown cooling operation.

Corrective Actions

Corrective Actions For Damaged Equipment:

- All existing TWS carbon steel mesh panels were replaced with stainless steel panels.
- The damaged Unit 1 West CCW heat exchanger divider plate was replaced with an improved design in accordance with the CNP plant modification program. In addition, all of the remaining CCW heat exchanger divider plates were replaced with the improved design.

Corrective actions for the lack of a fully-developed operational response to debris intrusion:

- Developed an abnormal operating procedure to address degraded intake conditions. This procedure provides detailed direction and actions to respond to events that have the potential to overload or bypass the traveling water screens.
- Revised (incorporated new actions) the applicable annunciator response procedures that will carry out the new abnormal procedure actions.
- Developed a checklist for evaluating conditions within the intake structure to provide a method to determine if degrading environmental conditions or intake equipment will challenge the plant.
- Provided training to the operators on the abnormal operating procedure for degraded intake conditions.
- Provide training to the operators on potential consequences to the ESW system of a common forebay design and lessons learned from the 2003 alewive intrusion event.

Corrective actions for the failure to maintain the traveling water screen panels:

- Establish an integrated preventive maintenance schedule for the traveling water screens and screen wash system. This schedule will include both predictive and preventive maintenance.
- Establish a process to ensure that previously scheduled work will not be performed during periods when debris intrusion could be significant. This is initiated in the checklist used to evaluate conditions within the intake structure.

Corrective actions for the failure of the organization to resolve long-standing or repetitive equipment problems: These corrective actions will remain in place until CNP management determines they are no longer of substantive value.

- Formalize the Equipment Reliability Steering Committee charter and procedures.
- Develop action plans for the top items on the EQR priority list.
- Designate an intake structure coordinator(s). This position will ensure issues are appropriately prioritized and corrected.

**Previous Similar Events**

- LER 50-316/2001-003-00/01, Degraded ESW Flow Renders Both Unit 2 Emergency Diesel Generators Inoperable

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17. TEXT *(If more space is required, use additional copies of NRC Form (366A)*

The corrective actions resulting from the event associated with LERs 50-316/2001-003-00/01 included recommended upgrades to the TWS. This action would have installed TWSs that would prevent carryover of debris, which was not the failure mode of the screens in this event. However, if replaced, the TWS material condition most likely would not have been significantly degraded. This may have mitigated the significance of this event. Actions have been implemented to improve the TWS and additional actions will be taken, as noted above, to ensure the TWS are adequately maintained.

- 1996 Alewives intrusion event.

The corrective actions associated with the 1996 alewives intrusion event included a recommendation for a high frequency sound system to be installed at the intake structures. CNP has concluded that implementation of this recommendation may have discouraged the alewives schools from accumulating near the intake structures, which could have precluded or significantly mitigated the significance of this event. As a result of the April 2003 fish intrusion event, CNP installed a temporary acoustic fish deterrent system. CNP plans to replace the temporary acoustic fish deterrent system with a permanent system.