June 14, 2006

Mr. David A. Christian
Senior Vice-President and
Chief Nuclear Officer
Innsbrook Technical Center
5000 Dominion Boulevard
Glen Allen, VA 23060-6711

SUBJECT: KEWAUNEE POWER STATION - NRC SPECIAL INSPECTION REPORT 05000305/2006010

Dear Mr. Christian:

On May 10, 2006, the U.S. Nuclear Regulatory Commission (NRC) completed a special inspection at your Kewaunee Power Station. The enclosed inspection report documents the inspection findings, which were discussed at the exit meeting on May 10, with Mr. W. Matthews and other members of your staff.

On April 26, 2006, operators manually tripped the Kewaunee reactor during a controlled shutdown to repair a leaking service water pipe. The trip was initiated when an automatic turbine trip did not occur following the loss of both main feedwater pumps. A malfunction of equipment in the breaker cubicle for one of the feedwater pump motors was identified and the decision was made for the NRC to conduct a special inspection.

Following the criteria (criteria f and g) specified in Management Directive 8.3, and Inspection Procedure 71153, a Special Inspection was initiated in accordance with Inspection Procedure 93812 and Regional Procedure RP-1219. The special inspection team officially commenced on April 27.

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

The report documents two NRC-identified findings of very low safety significance (Green). These findings were determined to involve violations of NRC requirements. However, because of the very low safety significance and because they are entered into your corrective action program, the NRC is treating these two findings as non-cited violations (NCVs), in accordance with Section VI.A.1 of the NRC Enforcement Policy. If you contest any NCV, 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 copies to the Regional Administrator - Region III, 2443 Warrenville Road, Suite 210, Lisle, IL 60532-4352; the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001; and the NRC Resident Inspector at the Kewaunee Power Station.

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

Sincerely,

***/RA/***

Mark A. Satorius, Director
Division of Reactor Projects

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

Enclosure: Inspection Report 05000305/2006010
w/Attachments: Supplemental Information

cc w/encl: L Hartz, Site Vice-President
C. Funderburk, Director, Nuclear Licensing
and Operations Support
T. Breene, Manager, Nuclear Licensing
L. Cuoco, Esq., Senior Counsel
D. Zellner, Chairman, Town of Carlton
J. Kitsembel, Public Service Commission of Wisconsin

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U.S. NUCLEAR REGULATORY COMMISSION

REGION III

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| Docket No: | 50-305 |
| License No: | DPR-43 |
| Report No: | 05000305/2006010 |
| Licensee: | Dominion Energy Kewaunee, Inc. |
| Facility: | Kewaunee Power Station |
| Location: | Kewaunee, Wisconsin |
| Dates: | April 27 through May 10, 2006 |
| Inspectors: | Greg Gibbs, Resident Inspector, Point Beach Nuclear Plant - Team Leader<br>Zelig Falevits, Senior Engineering Inspector<br>Carl Moore, Operations Engineer<br>Steve Burton, Senior Resident Inspector, Kewaunee |
| Approved By: | Patrick Louden, Chief<br>Reactor Projects Branch 5 |

## SUMMARY OF FINDINGS

IR 05000305/2006010; 04/27/06 - 05/10/06; Kewaunee Power Station; Special Inspection for unplanned manual trip of the reactor.

This special inspection examined the facts regarding the need for a manual trip of the Kewaunee reactor on April 26, 2006, during a shutdown to repair an unisolable leak on a service water line to an emergency diesel generator. At 34 percent reactor power and with one main feedwater pump secured, operators secured a condensate pump. The remaining operating feedwater pump then unexpectedly tripped. With both main feedwater pumps not operating, the main turbine should have tripped, followed by a reactor trip. However, neither trip occurred, so operators manually tripped the reactor and declared an Alert. The Alert was subsequently terminated after cooldown of the reactor coolant system. The licensee identified that a misaligned linkage in the breaker cubicle for one of the main feedwater pump motors resulted in false indication that the pump was still running when it was not. This indication prevented the expected turbine trip when the second main feedwater pump tripped. An NRC special inspection was initiated to review these issues and consisted of the resident inspector from the Point Beach Nuclear Plant, the senior resident inspector from Kewaunee, and two region-based inspectors. The inspection identified two Green findings with associated non-cited violations. The significance of most findings is indicated by their color (Green, White, Yellow, Red) using Inspection Manual Chapter (IMC) 0609, "Significance Determination Process" (SDP). Findings for which the SDP does not apply may be "Green" or be assigned a severity level after NRC management review. The NRC's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 3, dated July 2000.

### A. Inspector-Identified and Self-Revealed Findings

**Cornerstone: Initiating Events**

- Green. The inspectors identified a finding associated with a non-cited violation (NCV) of 10 CFR 50.65 (the Maintenance Rule), having very low safety significance for the licensee's failure to incorporate into station procedures available internal and external operating experience pertaining to 4.16-kilovolt (kV) switchgear mechanically operated contact (MOC) switch linkage assemblies. As a result, preventive maintenance procedures for 4.16-kV safety- and nonsafety-related switchgear breaker cubicles were inadequate and had not been upgraded to incorporate important MOC switch linkage measurements and adjustments to be used during periodic breaker/cubicle maintenance. The licensee entered the problem with the procedures into its corrective action program for resolution. Corrective action included the revision of the procedures to incorporate the need to inspect the linkage and adjust it to within specified values.

  The finding is greater than minor because it is associated with the procedure adequacy attribute of the Initiating Events cornerstone and affected the cornerstone objective to limit the likelihood of those events that upset plant stability and challenge critical safety functions during shutdown as well as power

operation. The finding was determined to be of very low safety significance because the transient initiator contributor is a reactor trip that did not contribute to both the likelihood of a reactor trip and the likelihood that mitigation equipment or functions will not be available. The cause of the finding is related to the cross-cutting element of problem identification and resolution. (Section 4OA3.3b.(2))

**Cornerstone: Mitigating Systems**

- Green. The inspectors identified a finding associated with a non-cited violation of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," that pertained to a modification that failed to incorporate applicable design requirements for cable separation. Nonsafety-related cables associated with train 'B' reactor coolant pump (RCP) safety-related cable trays and cables were bundled inside the RCP breaker cubicles with train 'A' RCP safety-related cables feeding the reactor protection system (RPS). Consequently, a fault in the train 'B' cable/cable tray could propagate to train 'A'. The licensee entered the problem into its corrective action program for resolution. Corrective actions included encasing the nonsafety-related cables in flexible metal conduit and confirming that other safety-related cables were not affected.

  The finding is greater than minor because it was associated with the design control attribute of the Mitigating Systems cornerstone and affected the cornerstone objective to ensure the availability, reliability, and capability of systems that respond to initiating events to prevent undesirable consequences (i.e., core damage). The finding was determined to be of very low safety significance **because of the redundancy and coincident logic in the RPS design; and it did not represent a loss of system safety function,** an actual loss of safety function of a single train, an actual loss of safety function of one or more non-technical specification trains of equipment, designated as risk significant per 10 CFR 50.65, for greater than 24 hours, and did not screen as potentially risk significant due to a seismic, flooding, or severe weather initiating event. (Section 4OA3.3b.(3))

## B. Licensee-Identified Violations

None.

## REPORT DETAILS

### Summary of Plant Event

On Wednesday, April 26, 2006, operators were shutting down the Kewaunee Power Station to allow for the repair of an unisolable leak from a service water pipe. At 8:42 p.m. (central daylight time (CDT)), with the reactor at 34 percent power and the 'B' main feedwater pump (MFP) already secured as part of the shutdown, the 'A' MFP unexpectedly tripped when operators secured the 'B' condensate pump. The trip of the second feedwater pump should have caused a main turbine trip, followed by a reactor trip and start of the motor-driven auxiliary feedwater pumps (MDAFWPs). However, the turbine did not trip and the MDAFWPs did not start. Reactor operators recognized the problem and manually tripped the reactor. The MDAFWPs subsequently started, as designed, on low-low steam generator level. A loss of condenser vacuum made the normal heat sink unavailable and operators used the steam generator power-operated relief valves to control reactor temperature during the shutdown and subsequent cooldown.

After the failure of the turbine to trip, operators activated the station's Emergency Plan and declared an "Alert," based on Emergency Plan Table 2-1, EPIP-AD-02, Chart F, "Engineered Safety Feature Anomaly," for what they believed was a failure of both reactor trip breakers to open upon receipt of a valid signal, an anticipated transient without scram (ATWS). The station terminated Emergency Plan actions at 12:24 a.m. on Thursday, April 27. At 12:45 a.m., Kewaunee staff updated its NRC event report (Event Number 42530, made in accordance with 10 CFR 50.72(a)(1)(i)) to reflect that a preliminary investigation of the control room indications and the sequence of events recorder indicated there was no automatic reactor trip signal present before the manual reactor trip and no failure of the reactor trip breakers to open.

The charter for the NRC special inspection team is attached to this inspection report.

## 4. OTHER ACTIVITIES (OA)

4OA3 Special Inspection (93812)

.1 Sequence of Events - (Charter Item 1)

a. Inspection Scope

The inspectors reviewed selected corrective action program documents, work orders, and control room logs, and conducted interviews to determine the sequence of events on April 26, 2006.

b. Findings and Observations

Description and Chronology of the Events

A timeline of the event is attached to the inspection report.

On April 26, 2006, Kewaunee operators were conducting a Technical Specification-required shutdown of the reactor to allow repair of a through-wall leak in an unisolable section of the service water system associated with the 'B' emergency diesel generator. The shutdown was proceeding normally until the operating crew secured the 'B' MFP and two unexpected main control room annunciators were received. The first annunciator was the "Feedwater Pump 'B' Trip" alarm. This alarm was expected to come in and immediately clear, but it did not clear. The second annunciator was the "Feedwater Pump 'B' Abnormal" alarm. In addition to the unexpected annunciators, several of 'B' train main feedwater valves did not function as designed following the shutdown of the 'B' MFP. The 'B' MFP discharge valve (FW-2B), the discharge check valve (FW-1B), and the recirculation valve (FW-101B) should have closed but remained open. In response to these anomalous conditions, the Shift Manager contacted the Outage Control Center (OCC) and requested electrical and instrument and control (I&C) department assistance. Using logic diagrams, the operating crew attempted to determine the cause of the abnormalities but were unsuccessful. During this time, reactor power was reduced to approximately 34 percent.

The operating crew was concerned that with the 'B' MFP recirculation valve open, feedwater was being diverted to the main condenser, away from the running 'A' MFP and, thus, from the steam generators. The crew was also concerned that since the next procedural step was to secure one of the two condensate pumps, flow to the 'A' MFP and the steam generators would be reduced further. The concern was subsequently resolved when manual isolation valves in the 'B' MFP recirculation line were closed.

After the 'B' MFP recirculation flow path was isolated, the 'B' condensate pump was secured. When the 'B' condensate pump was secured, however, the 'A' MFP unexpectedly tripped. With no MFPs running and only one condensate pump running, steam generator levels started to decrease. Operators immediately recognized the 'A' MFP trip and the unit supervisor directed the reactor operator to trip the reactor because no MFPs were running. Furthermore, the crew recognized that with no MFPs running and the reactor at 34 percent power, the turbine should have automatically tripped, which should have caused an automatic reactor trip. Also, with no MFPs running, the MDAFWPs should have started as well, but did not. Approximately 11 seconds after the 'A' MFP tripped, reactor operators manually tripped the reactor and all control rods fully inserted into the core.

The operating crew entered the appropriate Emergency Operating Procedures and Normal Operating Procedures during the event and subsequent reactor cooldown.

Based on plant conditions at the time, the Shift Manager declared an "Alert," in accordance with Emergency Plan Table 2-1, EPIP-AD-02, Chart F, "Engineered Safety Feature Anomaly": Failure of both reactor trip breakers to open upon receipt of a valid signal. The criterion for this determination was "Failure of the RPS to initiate and complete a reactor trip which brings the reactor subcritical."

During the subsequent course of events, the operating crew and the Emergency Response Organization were faced with several challenges. Notifications of state and local officials began within 15 minutes of the Alert declaration, as required by regulations. Completion of the notification of Manitowoc County officials, however, was

delayed slightly because of a problem with the Dial Select phone system. The licensee used the commercial phone system instead, and the notification of Manitowoc County officials was completed about 20 minutes after the declaration.

Another challenge involved the main condenser vacuum degrading to the point that steam generator power-operated relief valves (PORVs) had to be used to maintain reactor coolant system (RCS) temperature. Vacuum was lost because gland steam to train 'B' moisture separator reheater (MSR) relief valve, MS-312B-1, was out-of-service (OOS) which caused air to leak into the main condenser after the main turbine tripped. This failure resulted in the loss of the condenser as a heat sink and the need to cooldown with the PORVs.

On April 27 at 12:24 a.m., the Alert was terminated and cooldown of the RCS was transferred from the PORVs to the residual heat removal system.

.2 Operator Response and Decision-Making - (Charter Item 2)

a. Inspection Scope

The inspectors interviewed operators and other plant staff that were involved in the event to determine the actions taken by the crew, instruments monitored in the control room, procedures used in response to the event, and the decision-making associated with the manual reactor trip and declaration of an "Alert." The inspectors also reviewed the sequence of events recorder output, developed a timeline for the event, reviewed logs and procedures in use in responding to the event, and performed walkdowns of available control room alarms associated with the event, as well as applicable feedwater valve local indications.

b. Findings and Observations.

(1) Proceeding with Plant Shutdown after Unexpected Feedwater System Response

After the 'B' MFP was secured, the two condensate pumps were supplying flow through the open 'B' MFP recirculation valve to the main condenser and to the running 'A' MFP. This additional flow path to the condenser was a concern to the operators because one of the next steps in the shutdown was to secure one of the condensate pumps. The operators were not sure that one condensate pump would be capable of supplying the open recirculation valve of the 'B' MFP and the necessary flow to the running 'A' MFP.

The crew did not associate the available indications (recirculation valve open, discharge check valve open, discharge valve open, 'B' MFP trip alarm, and 'B' MFP abnormal alarm) with a common failure. The annunciator response procedure for "Feedwater Pump 'B' Trip" stated that the alarm was activated by a closed MFP motor breaker and any of eight other conditions. Operators should have recognized that the associated circuits were indicating the 'B' MFP motor breaker was still closed, when it was actually open, and that securing a condensate pump would cause the 'A' MFP to trip because the circuit logic to protect the MFPs requires that the number of running condensate pumps must equal or exceed the number of running MFPs. The sequence of events recorder indicated that 1 hour lapsed between the securing of the 'B' MFP and the

securing of the 'B' condensate pump. It is noteworthy that the operators had not interfaced with the I&C technicians and electricians that the OCC had assigned to the feedwater problem prior to stopping the 'B' condensate pump, thus missed an opportunity to understand the problem with the MFP circuit logic.

Operators investigated the control room indications, but did not adequately pursue all of the ramifications of the failure. The crew only addressed the condition that would affect completion of the reactor shutdown, the open 'B' MFP flow path. Given these indications and the time available, it is a reasonable expectation that the operating crew should have been able to determine the cause of these failures if the appropriate level of troubleshooting had been implemented.

Based on the above, the inspectors concluded that the operators were narrowly focused and did not thoroughly apply a questioning attitude regarding the potential causes of the indications received and the consequences of proceeding without fully understanding them. Operators demonstrated a lack of conservative decision-making as they proceeded with the plant shutdown even though they did not understand the cause of the discrepancy between the train 'B' main feedwater valve positions and the 'B' MFP motor breaker indicated position and did not fully consider the potential consequences of securing the 'B' condensate pump. The crew had also not discussed the status of troubleshooting activities with the OCC before securing the condensate pump.

(2) Decision to Manually Trip the Reactor and Declare an "Alert"

The inspectors concluded that when the operating crew determined the reactor was still at 34 percent power with no feedwater flow, the Shift Manager appropriately ordered a manual reactor trip. Similarly, the inspectors concluded that the declaration of the "Alert," given the operators' understanding of the event at the time the 'A' MFP tripped, was appropriate.

The inspectors reviewed the sequence of events recorder output, event time line, and operator logs, as well as design electrical schematics and licensing documentation to assess the functionality and performance of the RPS, Engineered Safety Features (ESF) system, and ATWS mitigation system. These systems functioned as designed upon receipt of the appropriate actuation signals. The RPS opened both reactor trip breakers following the manually initiated reactor trip signal generated by the reactor operator. The sequence of events recorder print-out indicated that the RPS initiated a reactor trip signal when the steam generators reached the low-low level reactor trip setpoint. Likewise, the ESF system started the AFW pumps at the low-low level setpoint, as designed. The ATWS mitigation system also actuated at its design setpoint, which would have started the AFW pumps if they had not already been running due to the steam generator low-low level actuation signal received.

(3) Decision to Shutdown the Plant Without Thoroughly Evaluating the Effects of Condenser Air-Inleakage

During the shutdown, vacuum was lost earlier than anticipated and the loss of the normal condenser heat sink required cooldown by venting steam to the atmosphere via the steam generator PORVs. Vacuum loss was caused by gland steam to train 'B' MSR

relief valve, MS-312B-1, being OOS, which caused air to leak into the main condenser after the main turbine tripped. The operating crew briefing, prior to the shutdown, addressed the isolation of sealing steam to the MSR relief valve and that the lack of sealing steam would result in air leakage, thereby affecting condenser vacuum.

From interviews and a review of plant records, the inspectors determined that attempts to repair the affected valve about a month prior to the event had not been successful and an appropriate priority had not been established for subsequent repair efforts. The failure to resolve this problem with a nonsafety-related component resulted in a complication to the trip response of the reactor operators.

As a follow up to questions by the inspectors, the licensee commenced a review of outstanding equipment deficiencies for the purpose of identifying other equipment anomalies that may need higher resolution priority. This review considered items individually and in the aggregate with identified operator work arounds and burdens. The purpose of the review was to identify any equipment deficiencies requiring repair prior to startup. This review identified that the consequences of deficient conditions (previously identified) associated with the radioactive gaseous effluent monitoring system were not recognized. Some effluent monitoring system computer points were OOS and, as stated in CAP033459, this would result in operators being unable to diagnose an "Alert" for an Auxiliary Building vent release. The licensee created a mode restraint for the Hot Standby Mode until this equipment was repaired.

.3 Licensee Event Investigation Activities - (Charter Items 3 and 4)

a. Inspection Scope

The inspectors reviewed the licensee's event investigation activities. The review examined the quarantine and troubleshooting procedures, troubleshooting plans used after the event, corrective actions taken to determine the cause of the failure of the 'B' MFP motor breaker MOC switch that was identified to have been responsible for the discrepancy between feedwater valve positions and the MFP motor breaker position, evaluation of the extent-of-condition of the identified deficiencies and cause(s), corrective actions put in place prior to start-up from the event, and the potential vulnerability for a repeat occurrence.

b. Findings and Observations

(1) Troubleshooting Activities

Introduction: Shortly after the operators entered normal operating procedure N–0-04, "35% Power to Hot Shutdown Condition," they quarantined 'B' MFP, 'B' condensate pump, and 4.16-kV bus 2 for investigation. Following the reactor trip, plant management assembled a team to troubleshoot the 'B' MFP motor breaker, MOC switch, and cubicle MOC switch linkage assembly.

Discussion: The troubleshooting team used plant electrical drawings to evaluate expected and actual breaker auxiliary contact positions and the configuration of the associated equipment. The troubleshooting plan identified a list of contacts and their

expected configurations. The licensee identified that the troubleshooting plan would have no adverse effect on plant equipment. The inspectors attended the troubleshooting pre-job brief and asked the licensee what provisions were in place to ensure the MOC switch contacts would not be made up in a manner that could cause an inadvertent start of a MDAFW pump. The licensee had not considered this in the troubleshooting plan and had to revise the plan.

The licensee's troubleshooting procedure included a caution to the troubleshooting team to consider the potential consequence of touching any equipment. However, the inspectors noted that the licensee missed the opportunity to take important measurements of the as-found condition of the breaker/cubicle linkage and associated MOC switch assembly before disconnecting the breaker actuating arm from the upper linkage and subsequently positioning the linkage to evaluate the MOC switch condition. This missed opportunity detracted from the completeness of troubleshooting activities but did not affect the conclusion of the team or the adequacy of proposed corrective actions. The inspectors had previously highlighted to the licensee the importance of taking measurements to establish the as-found condition prior to moving any equipment.

After the initial troubleshooting, which identified the cubicle linkage adjustment as the most probable cause of the MOC switch failure (due to over-travel of the MOC switch, which allowed the auxiliary contacts to misposition), the licensee developed a detailed troubleshooting plan to assess the condition of the 'B' MFP motor breaker MOC switch and linkage assembly and the extent-of-condition for 22 safety-related breakers and 12 balance-of-plant (nonsafety-related) breakers. The inspectors observed the licensee's field troubleshooting activities and noted that the licensee applied internal operating experience (OE) gained during replacement of safety-related breakers in 1996 and 1997 to the troubleshooting effort for the 'B' MFP motor breaker/cubicle and in evaluating the extent-of-condition for both safety- and nonsafety-related 4.16-kV breakers. Detailed troubleshooting plans were developed based on this prior experience. The inspectors observed that the troubleshooting plan (Attachment to Work Order WO 06-005667 and WO 06-005668) took critical breaker/cubicle linkage measurements; inspected the linkage for binding, wear in mating parts, lubricant condition, and critical angles; and observed the MOC switch contact positions in the breaker open and closed position.

Troubleshooting results identified that the cause of the 'A' MFP tripping was the failure of the MOC auxiliary switch linkage in the 'B' MFP motor 4.16-kV switchgear breaker/cubicle to properly reposition the MOC auxiliary switch contacts when the 'B' MFP circuit breaker was opened. This malfunction was classified as a MOC switch actuation arm over-travel. The over-travel prevented the switch from re-obtaining the appropriate OPEN contact when the breaker was opened. The licensee determined that the over-travel was caused by the linkage connecting rod being adjusted 1/4" too short. The over-travel of the MOC switch caused it to bind, resulting in false breaker position indication from the misaligned MOC switch contacts.

(2) Failure to Incorporate OE into Preventive Maintenance Procedures

Introduction: The inspectors identified an NCV of 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," of very low safety significance (Green), for the failure to incorporate available internal and external OE pertaining to 4.16-kV switchgear cubicle MOC switch linkage assemblies. Preventive maintenance procedures for 4.16-kV safety- and nonsafety-related switchgear cubicles had not been revised to incorporate important MOC switch linkage measurements and adjustments.

Discussion: The inspectors reviewed the licensee's preventive maintenance procedures for 4.16-kV safety- and nonsafety-related switchgear and identified that (1) there were no requirements to take and record critical measurements for the breaker/MOC switch linkage assembly of each cubicle, (2) there was no specific guidance for preventive maintenance on MOC switch/linkage setup, and (3) there was no post-maintenance testing specified. The inspectors noted that failure to perform appropriate maintenance activities for the 4.16-kV 'B' MFP motor breaker linkage assembly resulted in failure of the breaker cubicle MOC switch to function as designed and resulted in failure of components to operate on demand.

The inspectors reviewed OE applicable to breaker maintenance. Kewaunee corrective action program documents, OE010039 for Turkey Point Unit 3, "Steam Generator Feedwater Pump Motor Operate Valve Failed to Close," dated July 29, 2005, and OE010295 for Susquehanna, "Deficiencies Identified during Pre-Installation Checks of Areva Eaton Cutler-Hammer Vacuum Circuit Breakers," dated August 9, 2005, discussed concepts that were also applicable to 4.16-kV breaker/cubicle preventive and corrective maintenance at Kewaunee, but were not appropriately evaluated and incorporated into the licensee's preventive maintenance program due to a narrow focus on equipment applicability. The following examples were noted:

OE010039 occurred at Turkey Point in December of 2004. The 'B' steam generator feedwater pump discharge motor-operated valve failed to close. The investigation identified that the motor-operated valve control circuit did not receive a close signal, due to the disengagement of the 4.16-kV breaker MOC actuating fork and the cubicle mounted auxiliary switch for this Siemens breaker. Turkey Point observed that though no dimensional requirements outlined on Siemens drawings could be identified, it was postulated that an adverse combination of tolerances allowed the condition to occur on an intermittent basis.

OE010039 stated that "... the report was distributed with the intent to communicate the subject facility's experience with a topic within the Nuclear Power Industry, but was not intended to identify improper practices, program deficiencies, or human performance issues, as a result no actions in t-Track (the corrective action program) are required."

OE010295 was screened as not applicable to Kewaunee because of equipment differences. Although the specifics of the issue pertained to Cutler Hammer equipment that may not translate directly to the Kewaunee breakers, the inspectors determined that the concepts represented by the OE included the following that were applicable:

- Aging of 4.16-kV switchgear (over 30 years old) can result in some bus/breaker cubicle misalignment indicating that a “one-size-fits-all” approach for measurements of configuration and setup may not be appropriate for all switchgear cubicles.

- Quantitative methods of checking linkage position and adjustment were required for the precision needed.

**In addition to the external OE, the licensee had internal OE that represented previous opportunities to have identified and corrected the MOC switch linkage adjustment problem. This internal OE included CAP0516, Addendum 1; WO 211388 (52SA contacts on 1-506 breaker not directly verified during Design Change Request (DCR) 2618 Vacuum Breaker Replacement Procedure); and WO 211392 (52SA contacts on 1-504 breaker not directly verified during DCR 2618 Vacuum Breaker Replacement Procedure and interlock lever on breaker hangs up slightly when breaker is racked into the connect position). The external and internal OE demonstrated the need to record quantitative measurements for 4.16-kV breaker/cubicle MOC switch linkage set-ups, the need for measurements and setup instructions on each cubicle due to age-related misalignment, and the need for rigorous procedural direction for maintaining 4.16-kV switchgear/breaker linkage setups.**

Analysis: The inspectors determined that the licensee’s failure to incorporate the relevant internal and external OE into its maintenance procedures is a performance deficiency that warranted a significance evaluation.

Consistent with the guidance in IMC 0612, “Power Reactor Inspection Reports,” Appendix B, “Issue Disposition Screening,” the inspectors determined that this finding is associated with the procedure adequacy attribute of the Initiating Events cornerstone and affected the cornerstone objective to limit the likelihood of those events that upset plant stability and challenge critical safety functions during shutdown, as well as power operation, and is therefore greater than minor.

The inspectors assessed this finding using IMC 0609, Significance Determination Process (SDP), Appendix A, “Determining the Significance of Reactor Inspection Findings for At-Power Situation.” The transient initiator contributor was a reactor trip that did not contribute to both the likelihood of a reactor trip AND the likelihood that mitigation equipment or functions will not be available. Consequently, the finding is considered to be of very low safety significance (Green). Additionally, the inspectors determined a contributing cause of the finding is related to the cross-cutting element of Problem Identification and Resolution.

Enforcement: 10 CFR 50.65(a)(3) states, in part, that preventive maintenance activities shall be evaluated at least every refueling cycle and take into account, where practical, industry-wide OE. An adjustment shall then be made where necessary to ensure that the objective of preventing failures of structures, systems, and components through maintenance is appropriately balanced against the objective of minimizing unavailability of structures, systems, and components due to monitoring or preventive maintenance.

**Contrary to this, as of April 26, 2006, the licensee failed to incorporate available internal and external OE into its maintenance procedures and use this important OE information during preventive maintenance activities to ensure the objective of preventing component failures by performing adequate preventive maintenance activities. This failure resulted in the malfunction of the 'B' MFP motor breaker MOC switch, and in combination with the operating crew's response to the anomalous conditions after securing the 'B' MFP, made it necessary to trip the reactor.**

Because this violation is of very low safety significance (Green), and it was entered into the licensee's corrective action program, this violation is being treated as an NCV consistent with Section VI.A of the NRC Enforcement Policy (NCV 05000305/2006010-01). The licensee corrected the identified deficient conditions for the 'B' MFP motor breaker/cubicle; conducted an extent-of-condition for other safety-related breakers/cubicles (12 breakers inspected with no significant findings) and important balance-of-plant breakers/cubicles; corrected deficiencies identified with: the 1-103BKR 'A' RCP motor breaker cubicle linkage, replaced the 1-203BBKR 'B' reactor coolant pump motor breaker engaging bar bushing; the 1-102BKR 'A' MFP motor breaker engaging bar bushing; entered this issue into its corrective action program as CAP033361, "Maintenance for the 4.16-kV breakers and cubicles need improvement," and wrote procedure change request PCR023675 to revise the appropriate procedures. The licensee also planned to re-evaluate existing OE.

(3) Failure to Maintain Cable Separation for Reactor Coolant Pump Breaker Cables

Introduction: The inspectors identified an NCV of 10 CFR 50, Appendix B, Criterion III, "Design Control," for the improper separation of train 'A' and train 'B' safety-related cables routed in the RCP 4.16-kV breaker cubicles.

Discussion: As part of the extent-of-condition review for nonsafety-related aspects of the MFP motor breaker MOC switch design and the interface with safety-related components, the inspectors questioned other similar nonsafety-related applications in protection schemes. In response, the licensee evaluated the electrical nonsafety-related-to-safety-related design and the adequacy of cable separation for the RCP MOC switch auxiliary contact interlocks to the RPS. The inspectors noted that cable separation per Institute of Electrical and Electronics Engineers (IEEE) 308-1971 and Proposed IEEE 279-1968 section on single failure was part of the Kewaunee design basis.

During its evaluation of electrical design drawings, the licensee identified that during installation of design change request DCR 1077 for the reactor vessel level indication system portion of the inadequate core cooling monitoring system (ICCMS), released June 23,1986, cable separation was not maintained for nonsafety-related cables 1NI5010 and 1NI5012, which were associated with train 'B' of ICCMS. These associated nonsafety-related train B cables were also routed to RCP breaker cubicles to pick up the RCP breaker position off the breaker MOC switches and were bundled inside the RCP breaker cubicles with train 'A' safety-related cables.

The potential effect of lack of electrical separation was that electrical faults in the train 'B' cable/cable tray could propagate to the train 'A' "RCP Breaker Position to Reactor Trip." Also affected were "RCP A(B) Breaker Trip on Bus 1(2) Undervoltage," one channel of "RCP A & B Breakers Trip on Bus 2 Underfrequency," and one channel (from each of Bus 1 and Bus 2) of "Reactor Trip Train 'A' on Bus Undervoltage." Following this discovery, the licensee declared the affected RPS channels inoperable.

Analysis: The inspectors determined that the failure to maintain cable separation for DCR 1077 is a performance deficiency that could result in potential electrical faults in the train 'B' cable/cable tray propagating to the train 'A' "RCP Breaker Position to Reactor Trip," resulting in the potential loss of redundant trains, and warranted a significance evaluation.

Consistent with the guidance in IMC 0612, "Power Reactor Inspection Reports," Appendix B, "Issue Disposition Screening," the inspectors determined that this finding is greater than minor because it was associated with the design control attribute of the Mitigating Systems cornerstone and affected the associated cornerstone objective to ensure the availability, reliability, and capability of the RPS to respond to initiating events to prevent undesirable consequences (i.e., core damage).

The inspectors evaluated the finding using IMC 0609, Appendix A, "Determining the Significance of Reactor Inspection Findings for At-Power Situation." The inspectors concluded that the design deficiency affected the Mitigation Systems cornerstone as it resulted in loss of individual channel operability per Part 9900, Technical Guidance, "Operability Determination Process for Operability and Functional Assessment." However, because of the redundancy and coincident logic in the RPS design, it did not represent a loss of safety system function, an actual loss of safety function of a single Train, an actual loss of safety function of one or more non-Technical Specification trains of equipments, designated as risk significant per 10 CFR 50.65, for greater than 24 hours, and did not screen as potentially risk significant due to a seismic, flooding, or severe weather initiating event. Thus the finding screened as very low safety significance (Green).

Enforcement: 10 CFR Part 50, Appendix B, Criterion III, "Design Control," requires, in part, that measures be established to correctly translate the design basis into specifications, drawings, procedures, and instructions. The design basis requirements of IEEE Standard 308-1971, "Criteria for Class 1E Electric Systems for Nuclear Power Generating Stations," and the single failure criterion of "Proposed IEEE Criteria 279-1968" require that cable separation provides sufficient isolation between redundant systems so that no single failure or credible incident can render both systems inoperable or remove them from service. Both IEEE Standard 308-1971 and Proposed IEEE Criteria 279-1968 are part of the Kewaunee design basis.

Contrary to this, cable separation was not maintained when DCR 1077 was installed in 1986. However, because of the low safety significance of this issue and because it was entered in the licensee's corrective action program (CAP033492), the issue is being treated as an NCV, consistent with Section VI.A.1 of the NRC Enforcement Policy (NCV 0500305/2006010-02). To address this issue, the licensee encased the affected

cables in flexible metal conduit and confirmed by extent-of-condition review that other safety-related cables were not so affected. This action was taken prior to the licensee restarting the reactor.

4OA6 Meetings

Exit Meetings

On May 10, 2006, the inspectors presented the preliminary inspection results to Mr. W. Matthews and members of Kewaunee plant management and staff. The licensee acknowledged the information presented. The inspectors asked the licensee whether any materials examined during the inspection should be considered proprietary. No proprietary information was identified.

ATTACHMENTS:
1. SUPPLEMENTAL INFORMATION
2. SPECIAL INSPECTION TEAM CHARTER
3. TIMELINE

## SUPPLEMENTAL INFORMATION

## KEY POINTS OF CONTACT

Dominion Energy Kewaunee, Inc.

W. Matthews, Senior Vice-President - Nuclear Operations
M. Gaffney, Site Vice-President
K. Hoops, Site Director
K. Davison, Plant Manager
L. Armstrong, Engineering Director
T. Webb, Director, Safety and Licensing
T. Breene, Manager, Nuclear Licensing
J. Ruttar, Operations Manager
S. Yuen, Manager, Systems Engineering
P. Snyder, Supervisor, Electrical/I&C Engineering
K. Pedham, Manager, Nuclear Oversight Department

Nuclear Regulatory Commission

P. Louden, Chief, Reactor Projects, Branch 5
P. Higgins, Kewaunee Resident Inspector

## LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened and Closed

| | | |
|---|---|---|
| 05000305/2006010-01 | NCV | Failure to incorporate operating experience into preventive maintenance procedures (Section 4OA3.3b.(2)) |
| 05000305/2006010-02 | NCV | Failure to maintain cable separation for cables 1NI5010 and 1NI5012 associated with train ‘B’ of ICCMS (Section 4OA3.3b.(3)) |

## LIST OF DOCUMENTS REVIEWED

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

| Work Order Number | Title | Revision/Date |
|---|---|---|
| 06-005649-000 | Circuit Breaker - Feedwater Pump 1B (1-202 BKR) | April 29, 2006 |
| 211215 | Circuit Breaker - Diesel General 1B | January 27, 1997 |
| 06-005667-000 | Circuit Breaker-Main Aux Transformer | May 2, 2006 |
| 06-005668-000 | Circuit Breaker - Bus Tie Breaker to 1-510 Breaker | May 2, 2006 |
| 06-005615 | Troubleshooting Plan for Feedwater Pump B Breaker 1-202 BKR MOC Switch Over Travel | April 27, 2006 |
| 211291 | Circuit Breaker - Reserve Aux Transf | April 9, 1997 |
| 211391 | Circuit Breaker - Service Water PP 1B2 | April 9, 1997 |
| 211393 | Circuit Breaker - AFW Pump 1B | April 9, 1997 |
| 211292 | Circuit Breaker - Reserve Aux Transformer | April 9, 1997 |
| 211381 | Circuit Breaker - Safety Injection Pump 1A | April 9, 1997 |
| 211215 | Circuit Breaker - Diesel Gen. 1B | January 23,1997 |
| 211389 | Circuit Breaker - Service water pump 1A2 | April 9, 1997 |
| 211493 | Circuit Breaker - Aux Feedwater Pump 1A | April 9, 1997 |
| 211388 | Circuit Breaker - Service Water pump 1A1 | April 9, 1997 |

Drawings

| Number | Title | Revision/Date |
|---|---|---|
| SGC01649A | Stat SW Mod | Revision B |
| E1022 | Control Schematic 4160kV Breaker 1-102 | Revision M |
| E1027 | Control Schematic 4160kV Breaker 1-404 | Revision Q |
| E1001 | Control Schematic 4160kV Breaker 1-102 | Revision U |
| E1475 | Schematic Diagram Turbine Auto-Stop Trip | Revision N |

| | | |
|---|---|---|
| E2057 | Integrated Logic Diagram Turbine System | Revision S |
| E1624 | Integrated Logic Diagram Feedwater System | Revision Z |
| E1007 | Control Schematic 4160kV Breaker 1-202 | Revision U |
| E1001 | Control Schematic 4160kV Breaker 1-102 | Revision U |
| E1023 | Control Schematic 4160kV Breaker 1-202 | Revision L |
| E1011 | Schematic Diagram Bus 1-2 Undervoltage and Under - Frequent Detection | Revision N |
| E1005 | Schematic Diagram Bus 1-1 Undervoltage and Under - Frequent Detection | Revision P |
| 113E449 Sh. 3 | Reactor Protection System | Revision 4J |
| E3621 | Auxiliary Contacts 4160kV Feeder. for RCP 1A and 1B | Revision B |
| E457 | W/D 4160kV Switch gear Cub 1-103 RCP 1A | Revision AO |
| E456 | W/D 4160kV Switchgear Cub 1-102 FWP A | Revision AE |
| E462 | W/D 4160kV Switchgear Cub 1-203 RCP 1B | Revision AB |
| E798 | W/D Terminal cabinet TC 18S5 | Revision CW |
| E682 | W/D Relay Rack RR131 (Train A) White Reactor Protection System | Revision W |
| E681 | W/D Relay Rack RR130 (Tran A) Red Reactor Protection System | Revision Z |
| E2497 | W/D Auxiliary Relay 4106kV Switchgear Cubicle 1-103 and 1-203 | Revision E |
| E686 | W/D Relay Rack RR125 (Train B) Red Reactor Protection System | Revision U |
| E687 | W/D Relay Rack RR124 (Train B) White Reactor Protection System | Revision S |
| Procedures | | |
| PMP-39-02 | EHV-Supply and Distribution Switchgear Bus 1 and Bus 2 Electrical Maintenance (QA-2) | May 19, 2003 |
| PMP-39-01 | EHV-4160kV McGraw-Edison Circuit Breaker Maintenance | April 28, 2004 |
| GMP-224 | 5kV Air/Magnetic and Vacuum Breaker | September 16, 2004 |

| | | |
|---|---|---|
| PMP-39-15 | EHV-4160kV Vacuum Breaker Maintenance | September 30, 2003 |
| GMP-263 | EHV 4160kV McGraw-Edison Circuit Breaker Electrical Maintenance | February 24, 2005 |
| EPIP-AD-02 | Emergency Class Determination, Chart F | January 20, 2006 |
| N–0-03 | Plant Operation Greater Than 35% Power | April 27, 2006 |
| N–0-04 | 35% Power to Hot Shutdown Condition | December 13, 2005 |
| EPIP-AD-07 | Emergency Notifications | September 16, 2005 |
| EPIPF-AD-07-01 | Event Notice Nuclear Accident Reporting System Form (NARS) | September 16, 2005 |
| EPIP-EOF-04 | Emergency Operations Facility Organization and Responsibilities | September 16, 2005 |
| EPIP-TSC-01 | Technical Support Center Organization and Responsibilities | September 16, 2005 |
| EPIPF-TSC-01-04 | TSC Director Checklist | March 30, 2006 |
| FR-S.1 | Response to Nuclear Power Generation / ATWS | April 20, 2006 |
| BKG FR-S.1 | Background Document for FR-S.1 | April 20, 2006 |
| CAPs | Title | Revision |
| 033463 | Wires in Cubicles 1-202 not Lifted Per Work Instruction on WO 06-5649 | May 2, 2006 |
| 033489 | Found Drawing and Wire Label Discrepancy in 5KV Breaker Cubicle 1-202 | May 2, 2006 |
| 033492 | Cables/1NI5O1O and 1NI5O12 Associated with Both Safety Trains | May 2, 2006 |
| Miscellaneous | | |
| | Title | Revision |
| | ABC's American Switchgear Type PSD (4160kV Breakers)-Lesson Plan for Plant Electricians | Revision C |
| | Westinghouse PSD-5VR Vacuum Element Replacement for Magnetic-Air Breakers Lesson Plan for Plant Electricians | Revision A |
| | Control Room Log | April 26, 2006, 17:05 through April 27, 2006, 06:46 |

LIST OF ACRONYMS USED

| | |
|---|---|
| AFW | Auxiliary Feedwater |
| ATWS | Anticipated Transient Without Scram |
| BOP | Balance of Plant |
| CAP | Corrective Action Program Document |
| CDT | Central Daylight Time |
| CE | Condition Evaluation |
| CFR | Code of Federal Regulations |
| DCR | Design Change Request |
| DRP | Division of Reactor Projects |
| ESF | Engineered Safety Features |
| Hg Abs. | Mercury Absolute |
| I&C | Instrument and Control |
| ICCMS | Inadequate Core Cooling Monitoring System |
| IEEE | Institute of Electrical and Electronics Engineers |
| IMC | Inspection Manual Chapter |
| kV | kilo-Volt |
| MD | Management Directive |
| MDAFWP | Motor-Driven Auxiliary Feedwater Pump |
| MFP | Main Feedwater Pump |
| MOC | Mechanically Operated Contact |
| MSR | Moisture Separator Reheater |
| NCV | Non-Cited Violation |
| NRC | Nuclear Regulatory Commission |
| OCC | Outage Control Center |
| OE | Operating Experience |
| OOS | Out-of-Service |
| PORV | Power-Operated Relief Valve |
| RCP | Reactor Coolant Pump |
| RCS | Reactor Coolant System |
| RPS | Reactor Protection System |
| SDP | Significance Determination Process |
| SPAR | Standardized Plant Analysis Risk |
| WO | Work Order |

April 28, 2006

MEMORANDUM TO: Gregory Gibbs, Resident Inspector, Point Beach

FROM: Mark A. Satorius, Director, Division of Reactor Projects
***/RA by S. West Acting for/***

SUBJECT: SPECIAL INSPECTION CHARTER FOR ALERT DECLARATION AT KEWAUNEE FOR ANTICIPATED TRANSIENT WITHOUT SCRAM (ATWS) AND MANUAL REACTOR TRIP WITH LOSS OF CONDENSER VACUUM, ON APRIL 26, 2006

On Wednesday, April 26, 2006, operators were shutting down the Kewaunee Power Station to allow for the repair of an unisolable leak from a service water pipe. At 8:42 p.m. (CDT), with the reactor at 34 percent power and the "B" main feed pump already secured as part of the shutdown, the "A" feed pump unexpectedly tripped when operators stopped the "B" condensate pump. The trip of the second feed pump should have caused a main turbine trip, followed by a reactor trip. However, for an as-of-yet unknown reason, the turbine did not trip. Reactor operators recognized the problem and manually tripped the reactor. A loss of condenser vacuum made the normal heat sink unavailable and operators used the atmospheric relief valves to control reactor temperature during the shutdown. After the failure of the turbine to trip, operators activated the station's Emergency Plan and declared an Alert, based on Chart F of the Plan, "Engineered Safety Feature Anomaly," which classified a failure of both reactor trip breakers to open upon receipt of a valid signal as an Alert. The station terminated Emergency Plan actions at 12:24 a.m. on Thursday, April 27.

The circumstances of the event were reviewed against the risk and deterministic criteria of Management Directive (MD) 8.3. Deterministically, the event met MD 8.3 criterion f, "Involved significant unexpected system interactions," and criterion h, "Involved questions or concerns pertaining to licensee operational performance. A Region III Senior Reactor Analyst completed a SPAR model event assessment using a transient initiating event and failing the main condenser. No change was made to RPS, because the failure of the turbine to trip did not result in an RPS reactor trip signal. The assessment resulted in an ICCDP value of 1E-7, which is not within the range for a special inspection. Notwithstanding, because of the extent of equipment problems that complicated the reactor trip, based on the deterministic criteria, and in consideration of Inspection Procedure 71153 and Regional Procedure, RP-1219, a Special Inspection will be conducted to review this event. Examples of these equipment problems included securing of the "B" condensate pump unexpectedly causing a trip of the "A" feed pump, the trip of the "A" feed pump should have caused a trip of the main turbine (and consequently, a reactor trip) but did not, and reactor coolant system cooldown being complicated by the loss of condenser vacuum.

CONTACT: Patrick L. Louden, DRP
630-829-9627

The Special Inspection Team will be led by you, and will include Carl Moore of Operating Licensing Branch and Zelig Falevits of Engineering Branch 3 (electrical engineering). Steve Burton, the Senior Resident Inspector, will assist your team as needed. An entrance meeting will be held Thursday afternoon, April 27, 2006. The specific charter for the Team is enclosed.

Enclosure: As stated

cc w/att: C. Moore, DRS, Operator Licensing
Z. Falevits, DRS, Electrical Engineering Branch
L. Raghavan, NRR - Projects
C. Pederson, DRS, Division Director
J. Caldwell, Regional Administrator, Region III
G. Grant, Deputy Regional Administrator, Region III
J. Dixon-Herrity, Region III EDO Coordinator

**KEWAUNEE SPECIAL INSPECTION (SI) CHARTER**

This Special Inspection Team is chartered to assess the circumstances surrounding the need for a manual trip of the Kewaunee reactor on April 26, 2006, during a controlled shutdown to repair a leaking service pipe. The Special Inspection will be conducted in accordance with Inspection Procedure 93812, "Special Inspection," and will include, but not be limited to, the items listed below.

2. Establish the sequence of events (a timeline) for the event, including the dates of any pertinent maintenance and surveillance activities.

3. Interview operators that were involved in the event to determine the actions taken by the crew, instruments monitored in the control room, procedures used in response to the event, and the decision-making associated with manual reactor trip and declaration of an "Alert" during the event.

4. Evaluate the licensee's event investigation activities. Include in your evaluation such items as: quarantine and troubleshooting plan used after the event, corrective actions put in place prior to start up from event, and the potential vulnerability for a repeat occurrence. Confirm whether or not a failure of the reactor protection system occurred.

5. Independent of the licensee's investigation, review design documents, maintenance and surveillance records, corrective action program documents, and pertinent procedures related to equipment that did not perform as expected.

5. Document the results of the inspection in inspection report 05000305/2006010.

Charter Approval

***/RA/*** P. L. Louden, Chief, Reactor Projects Branch 5

***/RA by Steve West Acting for/*** M. A. Satorius, Director, Division of Reactor Projects

**TIMELINE**

| Time | Event Description |
|---|---|
| April 26, 2006<br>5:05 p.m. | Procedure N–0-03, "Plant Operation Greater Than 35% Power," is in effect. Load reduction at ½ percent per minute to 30% power. |
| 5:23 | Completed 4-hour non-emergency notification to NRC regarding plant shutdown due to service water inoperability. Event Notification #42528. |
| 6:26 | Power reduction stopped to perform shift turnover. |
| 6:44 | Shift turnover completed. |
| 7:17 | Power reduction resumed at ½ percent per minute. |
| 7:42 | Manually stopped 'B' MFP per Procedure N-FW-05A. Operator in control room observes pump amps, flow, and pressure decrease to zero and 'B' MFP recirculation valve indicate open on main control board following shutdown of 'B' MFP. An in-plant operator reports the following abnormalities:<br>1) Discharge check valve (FW-1B) did not close.<br>2) Discharge valve (FW-2B) did not close.<br>3) 'B' MFP shaft was still rotating.<br>4) 'B' MFP recirculation valve (FW-101B) did not close.<br>Shift Manager contacts OCC and requests electrical department and instrumentation and control department assistance in troubleshooting observed abnormalities. |
| 8:06 | Load reduction stopped with reactor power at 34%. |
| 8:37 | Tag-Out placed to isolate 'B' MFP recirculation flow path. Operator verifies 'B' MFP is no longer rotating. |
| 8:40 | Shift Manager verifies 'B' MFP recirculation flow path is isolated and authorizes resumption of shutdown activities. |
| 8:42 | 'B' condensate pump manually shutdown. The 'A' MFP unexpectedly trips. |
| 8:42 | The reactor operator announces the trip of 'A' MFP to the control room. He states that both MFPs are off and that the turbine and reactor did not trip as expected. |
| 8:42 | Steam Flow > Feed Flow annunciators for both Steam Generators are received. |
| 8:42 | Unit supervisor orders the reactor operator to manually trip the Reactor based on no MFPs running and the turbine not tripping. |
| 8:43 | Steam Generator 'A' Low Low Level Reactor trip annunciator is received. |

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|---|---|
| 8:43 | Steam Generator ‘B’ Low Low Level Reactor trip annunciator is received. |
| 8:43 | Both MDAFWPs start on Low Low Steam Generator Level. |
| 8:46 | RCS temperature decreases below 540$^{\circ}$F due to reheater steam inlet valves (MW-201B1) failed closed. |
| 8:49 | Based on the fact that the turbine did not trip as expected when both MFPs were off, the Shift Manager declared an Alert in accordance with the Emergency Plan. Event Notification #42530. |
| 9:02 | State Warning Center and Kewaunee County responded to notification. |
| 9:03 | Plant announcement for Alert declaration made. |
| 9:05 | Safety Injection verified to NOT be required. Operating Crew transitions from Procedure E-0, “Reactor Trip or Safety Injection” to Procedure ES-0.1, “Reactor Trip Response.” |
| 9:06 | Personnel accountability initiated per Procedure EPIP-SEC-03, “Personnel Assembly and Accountability.” |
| 9:09 | Manitowoc County notified of Alert classification. |
| 9:19 | RCS temperature increases to > 540$^{\circ}$F following isolation of Reheater Steam Inlet valves (MW-201B1). Enters Hot Shutdown Mode. |
| 9:32 | Personnel accountability complete. |
| 9:37 | Emergency Operations Facility in Green Bay activated. |
| 9:38 | Low Condenser Pressure computer alarm received. Approximately 2.5" Hg Abs (Mercury Absolute). |
| 9:39 | NRC notified of plant status. |
| 9:40 | Technical Support Center (TSC) activated and Shift Manager relieved of Emergency Director duties. |
| 9:41 | Condenser Vacuum Low annunciator received at 5" Hg Abs. |
| 9:51 | Completed actions associated with Procedure ES-0.1, “Reactor Trip Response.” Entered normal Operating Procedure N–0-04, “35% Power to Hot Shutdown Condition.” |
| 10:25 | Computer alarm received for Low Condenser Pressure at 10.5" Hg Abs. |
| 10:39 | Quarantined ‘B’ MFP, ‘B’ condensate pump, and 4160-Volt Bus 2 for investigation of failure. |
| 10:41 | Procedure A-CD-03, “Abnormal Condensate System,” entered to address high hotwell level condition. |
| 10:53 | Use of hogging air ejector discussed to restore main condenser vacuum. |

| | |
|---|---|
| 11:51 | Control room brief performed by Shift Manager. |
| April 27, 2006<br>12:05 a.m. | Hogging air ejector started to restore main condenser vacuum. |
| 12:24 | Alert emergency classification terminated. |
| 12:41 | Condenser vacuum stabilized at approximately 6" Hg Abs. with hogging air ejector. |
| 12:49 | Entered Procedure N–0-05, “Plant Cooldown from Hot Shutdown to Cold Shutdown Conditions.” |